Monitoring devices

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Product range

Safety devices

- Safety switchgears
- Multifunction and modular safety systems
- Wireless safety systems
- Safety switches
- Safety interlocks
- Safety switch- and key interlock system

Monitoring devices

- Insulation monitors
- Equipment for insulation fault location
- Residual current monitors
- Measuring and monitoring relays
- Fault annunciators and fault annunciator systems
- SMS-Telecontrol module

Power electronics

- Semiconductors, relays/- contactors
- Reversing contactors
- Softstarters
- Motor brake relays
- Softstarters with DC-Brake
- Intelligents motor control units

Control devices

- CANopen field bus components
- CANopen PLC
- Interface and switching relays
- Interface relays with positive guided contacts

Timers

- Multifunction relays
- Time relays
  - operate delay
  - release delay
- Cyclic timers
- Flasher relays
- Fleeting action relays
- Pulse extender
- Star delta timers
- Safety time relays

Installation electronics

- Time switches
- Remote switches
- Specific installation electronics
- Time, control and monitoring relays

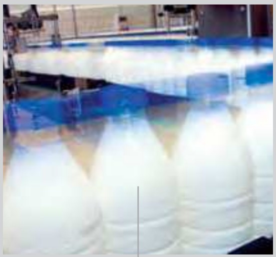
- Machinery and plant
- Power generation/distribution
- Oil and gas industry
- Automation
- Transport and material handling systems
- Rail technology
- Aviation/marine industry
- Paper and printing industry
- Food industry
- Rubber/plastics industry
- Heating and refrigeration
- Automotive
- Mining/metal working
- Chemical/pharmaceutical applications
- Medical technology
- Water/waste water treatment
- Cable cars/ski lifts

… and wherever safety has high priority.
We can cover your industrial applications as well!

DOLD –
Solutions for you










The DOLD philosophy, “Our experience. Your safety” constitutes our program: Offering solutions based on over 80 years of experience with a workforce of more than 400 employees, we manufacture high quality products using state-of-the-art production plant at our Furtwangen facility in Germany.

The comprehensive product range includes relay modules, safety relays with positively-driven contacts and electronic housings with virtually unparalleled production detail. The combination of know-how, innovation and experience makes us one of the leading worldwide manufacturers.

Apart from standard solutions, we are also the right partner when individual industrial solutions with that special touch are required.

Staying in close contact with our customers is very important to us. We listen, analyze and act by offering flexible, custom high-tech solutions, from a single source.

Thanks to our own development laboratory, highly automated production facilities with a modern tool & die shop in addition to injection moulding facility togehter with a well organized sales and marketing department, we guarantee high quality and short delivery times. Your benefits: Increased plant and machine availability, planning reliability and low production costs.

VARIMETER IMD
– Electrical safety for power supplies

An unplanned machine or system downtime due to insulation faults can have serious consequences. Through early recognition of such faults in ungrounded networks (IT networks), DOLD insulation monitors in the series VARIMETER IMD prevent failures in electric systems and guarantee a higher level of operational and system safety.

LK 5896

RN 5897

VARIMETER EDS
– Fault localization during ongoing operations

RR 5886

RR 5887

In large industrial facilities, localizing insulation faults can be both expensive and time consuming. The VARIMETER EDS insulation fault search system localizes insulation faults quickly and safely in complex, ungrounded AC/DC networks.

Custom-tailored measuring and monitoring solutions. from DOLD

Electrical Safety Solutions

DOLD offers a comprehensive selection of measuring and monitoring relays for your unique needs. The devices detect and provide early notification if critical limits of electrical variables such as current, voltage, power, insulation resistance, et cetera are violated. This allows dangers to people and machinery to be reliably avoided. In addition, the availability of your machines and systems will be increased and production outages will be minimized. DOLD's portfolio ranges from standard devices for the monitoring of individual variables to multifunctional devices to flexible error message systems.

In grounded networks, DOLD differential current monitors in the VARIMETER RCM series ensure reliable residual current monitoring. The differential current sensors can be used universally, as they can detect both direct and alternating current.

RN 5883

ND 5015/070

VARIMETER RCM
– Signalling instead of shutdown

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* Data sheet on request

Product selection

Insulation monitors for non-earthed systems VARIMETER IMD

Function	System type	Nominal Voltage [V]	Response value	With auxiliary voltage	Connection for indicator	Housing style	Width [mm]	Type	Page
Insulation monitor	mixed systems	1000	adjustable, 1 kΩ ... 2 MΩ	+		Distribution board	52.5	RN 5897/010	39
Insulation monitor	mixed systems	300	adjustable, 10 kΩ ... 1 MΩ	+		Distribution board	52.5	RN 5897/300	51
Insulation monitor	mixed systems	1000	adjustable, 1 kΩ ... 2 MΩ	+	+	Switch cabinet	90	LK 5896	59
Insulation monitor	mixed systems	1000	adjustable, 1 kΩ ... 2 MΩ	+		Switch cabinet	90	LK 5895	66
Insulation monitor	mixed systems	690	adjustable, 1 kΩ ... 2 MΩ	+		Switch cabinet	90	LK 5894	71
Insulation monitor	mixed systems	AC: 400 DC: 600	fixed, 10 kΩ ... 440 kΩ	+	+	Switch cabinet	45	UH 5892	77
Insulation monitor	AC; three-phase	500	adjustable, 5 kΩ ... 100 kΩ	+		Distribution board	35; 70	IL 5880, IP 5880, SL 5880, SP 5880	81
Insulation monitor	AC; three-phase	500	adjustable, 5 kΩ ... 100 kΩ	+		Switch cabinet	22,5; 45	MK 5880N, MH 5880	85
Insulation monitor	AC; three-phase	500	adjustable, 5 kΩ ... 5 MΩ	+	+	Distribution board	70	RP 5888	90
Insulation monitor for rooms used for medical purposes	AC; three-phase	500	adjustable, 50 kΩ ... 500 kΩ	+		Distribution board	52,5; 70	IN 5880/710, IN 5880/711, IP 5880/711	94
Insulation monitor	DC	280	adjustable, 5 kΩ ... 200 kΩ			Distribution board Switch cabinet	35 35	IL 5881, SL 5881	98

Following product are also available: AI 897, AI 898, EH 5878

The data sheets are available at **www.dold.com**

Product selection

Equipment for insulation fault location VARIMETER EDS

Function	Nominal voltage IT systems	Manual reset	Bus interface	Operating mode	Operating voltage	Width [mm]	Type	Page
Locating current injector	DC, AC, 3 AC 24...360 V	-	RS-485	Master / Slave	AC / DC 100 ... 230 V	105	RR 5886	102
Isolulation fault locator	DC, AC, 3 AC 24 ... 360 V	selectale by control terminal	RS-485	Slave	AC / DC 100 ... 230 V	105	RR 5887	106
Residual current transformer	-	-	-	-	-	-	ND 5015	122
Residual current transformer	-	-	-	-	-	-	ND 5016	116
Residual current transformer	-	-	-	-	-	-	ND 5017	110
Residual current transformer	-	-	-	-	-	-	ND 5018	123
Residual current transformer	-	-	-	-	-	-	ND 5019	117

Residual current monitors for earthed systems VARIMETER RCM

Function	Type of voltage	Adjustable measuring ranges [A]	Relay contacts / output	Adjustable operate delay	Test button	Reset button	Broken conductor detection	Housing style	Width [mm]	Type	Page
Residual current monitor, Type A	AC; DC pulsating	0.01 ... 10; 0.01 ... 30	+	+	+	+	+	Distribution board Switch cabinet	35 35	IL 5882, SL 5882	113
Residual current monitor, Type A, with forcibly guided indicator contacts	AC; DC; pulsating	0.01 ... 10	+	+	+	+	+	Distribution board	52.5	IP 5882.48	*
Residual current monitor, Type A, with integrated transformer	AC; DC; pulsating	0.01 ... 10; 0.01 ... 30	+	+	+	+	+	Distribution board	105	IR 5882	113
Residual current monitor, Type B	AC; DC; DC pulsating	0.01 ... 3	+	+	+	+	+	Distribution board	52.5	RN 5883	119

* Data sheet can be ordered

Product selection

Multifunctional relays VARIMETER PRO

Function	1-/3-phase	Standard measuring range	Measuring range max.	Contacts	Adjustable operate delay	Auxiliary voltage required	Housing Style	Width [mm]	Type	Page
Multifunctional measuring relay	1; 3	3 AC 24 ... 690 V	... 690 V	1 C/O; 2 x 1 C/O	+	+	Switch cabinet	22,5; 45	MK 9300N, MH 9300	126
Phase monitor with detection of under-/overvoltages, unbalance, phase failure, phase sequence	3	3 AC 400 V	690 V	2 C/O	+	+	Switch cabinet	45	BD 9080	141
Phase monitor with thermal motor protection, detection of under-/overvoltages, unbalance, phase failure, phase sequence	3	3/N AC 400/230 V	400 V	2 C/O			Distribution board Switch cabinet	35 35	IL 9086, SL 9086	144
Phase monitor with detection of under-/overvoltages, unbalance, phase failure, phase sequence	3	3/N AC 400/230 V	400 V	1 C/O; 2 C/O			Distribution board Switch cabinet	35 35	IL 9087, SL 9087	147
Traformer protection: Current and temperature monitoring	1	5 ... 50 A; >3,8 kΩ	50 A	2 x 2 C/O		+	Distribution board	70	IP 9111/107	*
Over-/undervoltage relay, optionally with unbalance and phase-sequence detection	3	AC 400 V	480 V	2 C/O; 4 C/O	+		Distribution board Switch cabinet	35; 70 35; 70	IL 9077, IP 9077, SL 9077, SP 9077	149

C/O = changeover contact

* Data sheet can be ordered

Product selection

Voltage monitoring VARIMETER

Function	1-/3-phase	Max. measuring range	Contacts	Operate delay	Auxiliary voltage required	Housing style	Width [mm]	Type	Page
Voltage relay	1	DC 250 V	1 C/O	+		Switch cabinet	35	RL 9836	152
Voltage relay	1	AC 300 V	1 C/O	+		Switch cabinet	35	RL 9854	156
Voltage relay, digital	1	AC/DC 300 V	1 C/O	+	+	Switch cabinet	22.5	MK 9064N	160
Voltage relay, digital	1	AC/DC 600 V	2 x 1 C/O	+	+	Switch cabinet	45	MH 9064	160
Voltage relay	1	AC/DC 1000 V	2 C/O	+	+	Switch cabinet	45	BA 9054, MK 9054N	166
Voltage relay	1	AC 660 V	1 C/O; 2 C/O	+		Switch cabinet	45	BA 9036	172
Voltage relay	1	AC 690 V	2 C/O	+		Switch cabinet	45	BA 9037	175
Voltage relay undervoltage, overvoltage, residual ripple	1	DC 24 V	1 C/O; 2 C/O	+		Distribution board	17.5	IK 9044, IK 9046	177
Overvoltage relay	3	AC 440 V	1 C/O; 2 C/O	+		Distribution board Switch cabinet	17.5 17.5	IK 9170, SK 9170	179
Overvoltage relay	1	AC 230 V	1 C/O; 2 C/O	+		Distribution board Switch cabinet	17.5 17.5	IK 9172, SK 9172	181
Over- and undervoltage relay	3	AC 480 V	2 C/O; 4 C/O	+		Distribution board Switch cabinet	35; 70 35; 70	IL 9077, IP 9077, SL 9077, SP 9077	149
Undervoltage relay	3	AC 690 V	2 C/O	+		Switch cabinet for front panel mounting	45	BA 9043, AA 9943	183
Undervoltage relay, detection of short-time phase failures	1	AC 230 V	1 C/O; 2 C/O	+		Switch cabinet	22.5	BC 9190N	186
Undervoltage relay	3	AC 500 V	1 C/O; 2 C/O	+		Distribution board Switch cabinet	17.5 35	IK 9171, IL 9171, SK 9171, SL 9171	188
Undervoltage relay	1	AC 400 V	1 C/O	+		Distribution board Switch cabinet	17.5 17.5	IK 9173, SK 9173	190
Undervoltage relay	3	AC 440 V	2 C/O	+		Distribution board Switch cabinet	35 35	IL 9071, SL 9071	192
Undervoltage relay	3	AC 400 V	1 C/O; 2 C/O			Distribution board	17.5	RK 9871	194
Undervoltage relay to detect auto-reclosing	3	AC 500 V	2 C/O	+		Distribution board Switch cabinet	35 17.5	IL 9079, SL 9079	199
Undervoltage relay for rooms used for medical purposes	1	AC 230 V	2 C/O	+		Distribution board	70	IP 9109.27/107	*
Undervoltage relay for rooms used for medical purposes	3	AC 400 V	1 NO, 2 NC	+		Distribution board	70	IP 9110/107	*
Undervoltage relay for rooms used for medical purposes	1	AC 230 V	2 NO, 2 NC	+		Distribution board	70	IP 9109.17/107	*
Battery symmetry monitor	1	0,12 ... 1,2 V DC	2 C/O	+	+	Switch cabinet	45	BA 9054/331 BA 9054/332	196

NO = normally open contact, NC = normally closed contact, C/O = changeover contact

Following product are also avaible: IL 9070 ; The data sheet are available at **www.dold.com**

* Data sheet can be ordered

Product selection

Current monitoring VARIMETER

Function	1-/3-phase	Max. measuring range	Contacts	Operate delay	Auxiliary voltage required	Housing style	Width [mm]	Type	Page
RL 9853	1	AC 230 V	1 C/O	+	+	Switch cabinet	35	RL 9853	202
Current relay	1	10 A	2 C/O	+	+	Switch cabinet	22.5	MK 9053N	206
Current relay	1	25 A	1 C/O / 2 C/O	+	+	Switch cabinet	45	BA 9053	206
Over-/undercurrent relay	1	15 A	2 C/O	+	+	Distribution board Switch cabinet	35 35	IL 9277, SL 9277	214
Over-/undercurrent relay	1	100 A	2 C/O	+	+	Switch cabinet	35	SL 9277CT	214
Over-/undercurrent relay	3	15 A	2 x 2 C/O	+	+	Distribution board Switch cabinet	70 70	IP 9277, SP 9277	214
Over-/undercurrent relay	3	100 A	2 x 2 C/O	+	+	Switch cabinet	70	SP 9277CT	214
Overcurrent relay	1	15 A	1 C/O	+	+	Distribution board Switch cabinet	17.5 17.5	IK 9270, SK 9270	220
Overcurrent relay	1	50 A	1 C/O / 2 C/O	+	+	Distribution board Switch cabinet	35 35	IL 9270, SL 9270	220
Overcurrent relay	3	15 A	2 C/O	+	+	Distribution board Switch cabinet	70 70	IP 9270, SP 9270	220
Overcurrent relay	3	100 A	2 C/O	+	+	Switch cabinet	35;70	SL 9270CT, SP 9270CT	220
Overcurrent relay	1	10 A	2 C/O	+	+	Distribution board Switch cabinet	17.5 17.5	IK 9272, SK 9272	226
Overcurrent relay	1	5 A	1 C/O	+	+	Distribution board	35	IL 5201/20007	229
Overcurrent relay	1	50 A	2 x 1 C/O	+	+	Switch cabinet	35	SL 5201/20007CT	229
Undercurrent relay	1	15 A	2 x 1 C/O	+	+	Distribution board Switch cabinet	17.5 17.5	IK 9271, SK 9271	231
Undercurrent relay	3	50 A	1 C/O	+	+	Distribution board Switch cabinet	35 35	IL 9271, SL 9271	231
Undercurrent relay	1	100 A	1 C/O / 2 C/O	+	+	Distribution board Switch cabinet	70 70	IP 9271, SP 9271	231
Undercurrent relay	1	15 A	2 C/O	+	+	Switch cabinet	35	SL 9271CT	231
Undercurrent relay	3	100 A	2 C/O	+	+	Switch cabinet	70	SP 9271CT	231
Undercurrent relay	1	100 A	2 C/O	+	+	Distribution board Switch cabinet	17.5 17.5	IK 9273 , SK 9273	237
Current monitor	1	10 A	1 C/O		+	Distribution board	17.5; 35	IK 8839, IL 8839	240
Current-assymmetry-relay	3	15 A	1 INV; 1 NO	+	+	Distribution board Switch cabinet	70 70	IP 9278, SP 9278	242
Current-assymmetry-relay	3	100 A	2 C/O	+	+	Switch cabinet	70	SP 9278CT	242

NO = normally open contact, C/O = change-over contac; / = optional

Following product are also available: ML 9701 ; The data sheet are available at **www.dold.com**

Product selection

Load monitoring VARIMETER

Function	1-/3-phase	Measuring range, max.	Output contacts max.	Operate delay	Auxiliary voltage required	Housing style	Width [mm]	Type	Page
Motor load monitor	3	12 A (8 kW)	1 C/O	+	+	Switch cabinet	22.5	MK 9397N	244
Motor load monitor	3	12 A (8 kW)	2 x 1 C/O	+	+	Switch cabinet	45	MH 9397	244
Motor load monitor	1; 3	40 A (37 kW)	2 x 1 C/O	+		Switch cabinet	45	BH 9097	248
Motor load transmitter	1; 3	40 A (37 kW)	0 ... 10 V/ ... 20 mA			Switch cabinet	45	BH 9098	254
Underlaod monitor (cos φ monitor)	1; 3	10 A	1 C/O / 1 C/O, 1 NO	+		Switch cabinet	45	BA 9065	261
Underlaod monitor (cos φ monitor)	1; 3	10 A	1 C/O + 1 C/O, 1 NO	+		Switch cabinet	22.5	MK 9065	265
Underlaod monitor (cos φ monitor)	1; 3	8 A	1 C/O	+		Switch cabinet Distribution board	17.5 17.5	IK 9065, SK 9065	268
Underlaod monitor (cos φ monitor)	1; 3	100 A	1 C/O	+		Switch cabinet	45	SL 9065CT	268
Reverse power monitoring	1; 3	40 A	2 C/O	+	+	Switch cabinet	45	BH 9140	272
Reverse power monitoring	1; 3	5 A	2 C/O	+	+	Distribution board	70	RP 9140	272

NO = normally open contact, C/O = change-over contact

Following product are also available : BA 9067 ; The data sheet are available at **www.dold.com**

Product selection

Mains monitoring VARIMETER

Function	1-/3-phase	Standard measuring range *	Max. measuring range	Contacts	Operate delay	Auxiliary voltage required	Housing style	Width [mm]	Type	Page
Undervoltage relay with test key	3	3/N AC 400/230 V	400 V	2 C/O			Distribution board	35	IL 9176	277
Phase monitor with detection of under-/overvoltages, unbalance, phase failure, phase sequence	3	3/N AC 400/230 V	400 V	1 C/O; 2 C/O			Distribution board Switch cabinet	35 35	IL 9087, SL 9087	147
Phase monitor with detection of under-/overvoltages, unbalance, phase failure, phase sequence	3	3AC 400 V	690 V	2 C/O	+	+	Switch cabinet	45	BD 9080	141
Phase monitor with thermal motor protection, detection of under-/overvoltages, unbalance, phase failure, phase sequence	3	3/N AC 400/230 V	400 V	2 C/O			Distribution board Switch cabinet	35 35	IL 9086, SL 9086	144
Phase indicator	3	3/N AC 400; 230 V	400 V				Distribution board Switch cabinet	17.5 17.5	IK 9168, SK 9168	279
Phase monitor	3	3 AC 80 ... 230 V/ 45 ... 130 V	230 V	1 C/O	+		Switch cabinet	35	RL 9877	134
Phase monitor	3	3 AC 175 ... 525 V/ 100 ... 300 V	525 V	1 C/O	+		Switch cabinet	52.5	RN 9877	134
Phase monitor	3	3/N AC 400; 230 V	400 V	1 C/O			Distribution board	17.5	RK 9872	281
Phase monitor	3	3/N AC 400; 230 V	400 V	1 C/O			Distribution board Switch cabinet	17.5 17.5	IK 9169, RK 9169, SK 9169	284
Phase sequence relay	3	AC 380 ... 690 V	690 V	1 C/O			Installationsverteiler Schaltschrank	35 35	IL 9059, SL 9059	286
Phase sequence relay	3	AC 380 ... 690 V	690 V	1 NC			Motor terminal box	62	OA 9059	286
Phase sequence relay	3	3 AC 400 V	550 V	1 C/O; 2 C/O			Switch cabinet	45	BA 9041, AI 941N	289
Phase sequence relay	3	3 AC 380 ... 500 V	500 V	2 C/O			Switch cabinet	22.5	MK 9056N	291
Phase sequence indicator	3	3 AC 400 V	3 AC 400 V				Distribution board Switch cabinet	17.5 17.5	IK 9178, SK 9178	293
Phase sequence monitor (Phase sequence relay)	3	3 AC 400 V	3 AC 400 V	1 C/O			Distribution board Switch cabinet	17.5 17.5	IK 9179, RK 9179 SK 9179	295
Asymmetry relay	3	3 AC 400 V	3 AC 690 V	2 C/O	+		Switch cabinet	75	AK 9840	297
Asymmetry relay	3	3 AC 400 V	3 AC 690 V	2 C/O	+		Switch cabinet	22.5; 45	BA 9040, MK 9040N	299
Asymmetry relay	3	3AC 400 V	3 AC 400 V	2 C/O			Switch cabinet	45	BA 9042, AI 942	302
Frequency relay	1	30 ... 90 Hz	600 Hz	1 C/O; 2 C/O	+	+	Switch cabinet	45	BA 9837, AA 9837, AA 9838	304
Frequency relay	1	5 ... 200 Hz	300 Hz	1 C/O; 2 C/O	+	+	Distribution board Switch cabinet	35 35	IL 9837, SL 9837	308
Neutral monitor	3	3/N AC 400; 230 V	415 V	2 C/O	+		Distribution board Switch cabinet	35 35	IL 9069, SL 9069	311

NC = normally closed contact, C/O = change-over contact

* Other measuring ranges on request

Product selection

Mains monitoring VARIMETER

Function	1-/3-phase	Standard measuring range *	Max. measuring range	Contacts	Operate delay	Auxiliary voltage required	Housing style	Width [mm]	Type	Page
Fuse monitor	1; 3	3 AC 110/64 V	3 AC 110 V	1 C/O	+		Switch cabinet	35	RL 9075	313
Fuse monitor	1; 3	3 AC 400/230 V 3 AC 230/130 V	3 AC 400 V	1 C/O	+		Switch cabinet	52.5	RN 9075	313
Fuse monitor	3	3 AC 380 ... 415 V	690 V	2 C/O			Distribution board Switch cabinet	35 35	IL 9075, IP 9075, SL 9075, SP 9075	316
Fuse monitor	3	3 AC 110 ... 400 V	3 AC 400V	2 C/O	+		Switch cabinet	22.5	UG 9075	320
Frequency relay	1	50; 60 Hz	50/60 Hz	1 C/O	+	+	Distribution board Switch cabinet	17.5 17.5	IK 9143, SK 9143	323
Frequency relay	1	1,5 ... 600 Hz	600 Hz	2 C/O		+	Switch cabinet	22.5; 45	MK 9837N, MH 9837	325
Frequency relay	1	1,5 ... 600 Hz	600 V	2 C/O	+	+	Switch cabinet	22.5; 45	MK 9837N/ 5_0, MH 9837/ 5_0	330
Mains frequency relay	1	50; 60 Hz	50/60 Hz	2 C/O; 4 C/O	+	+	Switch cabinet	22.5; 45	MK 9143N, MH 9143	335

NC = normally closed contact, C/O = change-over contact

* Other measuring ranges on request

Product selection

Measuring relays for special applications VARIMETER

Function	1-/3-phase	Standard measuring range	Contacts	Adjustable operate delay	Auxiliary voltage required	Housing style	Width [mm]	Type	Page
Voltage and frequency monitor for generator sets on public grid	3	50 Hz; AC 230 V	2 C/O	+		Distribution board	70	RP 9800	341
Voltage and frequency monitor for generator sets on public grid acc. to VDE-AR-N 4105	3	50 Hz; AC 400 / 230 V	3 C/O	+		Distribution board	70	RP 9810	344
Voltage and frequency monitor for generator sets on public grid international	3	AC 400 / 230 V	3 NO	+	+	Distribution board	70	RP 9811	349
Mains frequency monitor for self-production plant	1	50 / 60 Hz	2 C/O; 4 C/O	+	+	Switch cabinet	22.5; 45	MK 9143N, MH 9143	335
Undervoltage relay, f. med.areas acc. to DIN VDE 0100-710	3	AC 230 V	2 NO + 2 NC	+		Distribution board	70	IP 9109.27/107	*
Undervoltage relay, f. med.areas acc. to DIN VDE 0100-710	3	AC 400 V	2 NO + 2 NC	+		Distribution board	70	IP 9109.17/107	*
Undervoltage relay, f. med.areas acc. to DIN VDE 0100-710	3	AC 400 V	1 NO + 2 NC	+		Distribution board	70	IP 9110/107	*
Over- and undervoltage relay as option with unbalance- and phase sequence detection for self-production plant	1	50 ... 500 kΩ	2 C/O		+	Distribution board	52.5; 70	IN 5880/710, IN 5880/711	94
Battery symmetry monitor	1	0,12 ... 1,2 V DC	2 C/O	+	+	Switch cabinet	45	BA 9054/331, BA9054/332	196
Valve monitor: current and broken conductor monitoring	1	< 0,7A	1 C/O		+	Distribution board Switch cabinet	17.5 17.5	IK 9076, SK 9076	364
Transformer protection: Current and temperarure monitoring f. med.areas acc. to DIN VDE 0100-710	1	5 ... 50 A; > 3.8 kΩ	2 x 2 C/O		+	Distribution board	70	IP 9111/107	*

NO = normally open contact, NC = normally closed contact, C/O = change-over contac

Following product are also available: AI 940 ; The data sheet are available at **www.dold.com**

* Data sheet can be ordered

Product selection

Monitoring physical values VARIMETER

Function	Measuring range, max.	Contacts	Operate delay	Housing style	Width [mm]	Type	Page
Stand-still monitor		2 NO, 2 NC		Switch cabinet	45	BD 5936	366
Stand-still monitor	300000 IPM	1 C/O	+	Distribution board	17.5; 35	IK 9144, IL 9144 SK 9144; SL 9144	368
Speed monitor	10000 IPM	1 C/O	+	Switch cabinet	45	BA 9055, AA 9050	372
Speed monitor	600000 IPM	1 C/O	+	Distribution board Switch cabinet	17.5; 35 17.5; 35	IK 9055, IL 9055, SK 9055, SL 9055	375
Speed monitor	120000 IPM	2 C/O		Distribution board	22.5; 45	MK 9055N, MH 9055	381
Speed monitor	120000 IPM	2 C/O		Distribution board	22.5; 45	MK 9055N/5_0, MH 9055/5_0	*
Level sensing relay	450 kΩ	2 x 1 C/O	+	Distribution board Switch cabinet	35 22.5; 45	IL 9151, SL 9151, MK 9151N	387
Temperature relay	600 °C	1 C/O, 1 NO		Switch cabinet	35	BA 9094	391
Temperature relay	300 °C	1 C/O		Distribution board Switch cabinet	17.5; 35 17.5; 35	IK 9094, IL 9094, SK 9094, SL 9094	393
Thermistor motor protection relay	> 3.8 kΩ	2 C/O		Switch cabinet	45	BA 9038, AI 938	397
Thermistor motor protection relay	> 3.8 kΩ	2 C/O		Distribution board Switch cabinet	35 35	IL 9163, SL 9163	399
Thermistor motor protection relay	> 3.8 kΩ	2 C/O		Switch cabinet	22.5	MK 9163N, MK 9163N-ATEX	401
Thermistor motor protection relay	> 3.1 kΩ	2 C/O		Switch cabinet	22.5	MK 9003-ATEX	405
Transformer protection: Current and temperature monitoring	5 ... 50 A; > 3.8 kΩ	2 x 2 C/O		Distribution board	70	IP 9111/107	*
Valve monitor: current and broken conductor monitoring	< 0.7A	1 C/O		Distribution board Switch cabinet	17.5 17.5	IK 9076, SK 9076	364

NO = normally open contact, C/O = change-over contact

* Data sheet can be ordered

Accessories for measuring relays

Function	3-phase	Nominal voltage U_N max. without PE connectoin	Nominal voltage U_N max. with PE connectoin	Housing style	Width [mm]	Depth [mm]	Type	Page
Noise filter	+	3 AC 1000 V	3/N AC 860 / 500 V	Switch cabinet	22.5	97 121	MK 5130N, LG 5130	409

Product selection

Fault annunciator systems INFOMASTER, accessories

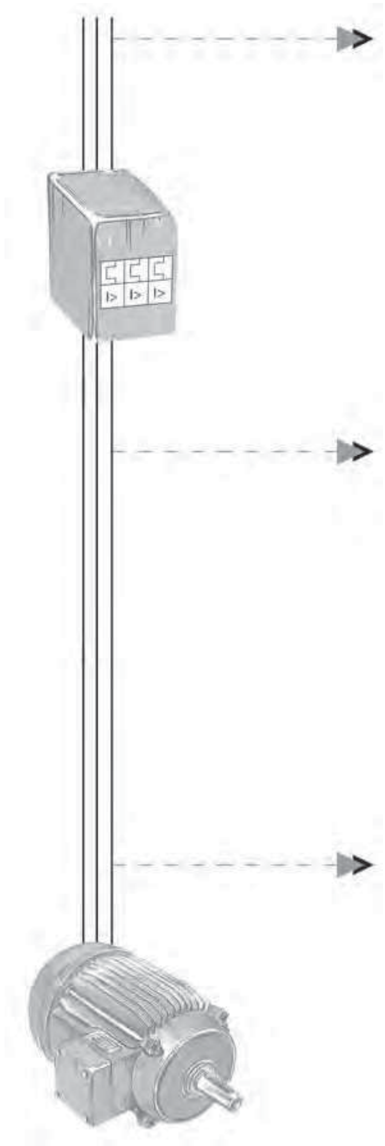
Function	Alarm inputs	Alarm inputs, extendable up to	Operate delay	Operating principle: Energized-on trip (A)/ de-energized-on-trip (R) de repos (R)	Visual indication	Acoustic indication	Special features	Housing style	Width [mm]	Type	Page
Fault annunciator system	6	8		R	LED	Output for horn		Front panel mounting	96 x 96	EH 9997	411
Fault annunciator system	12			A		Output for horn		Switch cabinet	45	AD 5960	413
Fault annunciator system	4	160	1; 3; 10 NO	A / R	LED	Output for horn		Distribution board Switch cabinet	35 35	IL 5990, IL 5991, SL 5990, SL 5991	415
Common alarm annunciator	8	88	0 ... 10 NO	A / R	LED		configurable; bus-compatible	Distribution board Switch cabinet	70 70	RP 5990, RP 5991	421
New- / First- / Common signal annunciator	8	88	0 ... 10 NO	A / R	LED		configurable; bus-compatible	Distribution board Switch cabinet	70 70	RP 5994, RP 5995	426
Indications panel for fault annunciator system					LED		configurable; bus-compatible	Front panel mounting	96 x 96	EH 5990, EH 5991	421
Indications panel for new-value and first-up annunciator					LED		configurable; bus-compatible	Front panel mounting	96 x 96	EH 5994, EH 5995	426
Text display unit for New-value and first-up annunciator system					LED		configurable; bus-compatible	Front panel mounting	96 x 96	EH 5996	431
Fault annunciator system	16	160	1; 3; 10 NO	A / R	LED	Output for horn		Front panel mounting	72; 144	EP 5966, EP 5967	434
Fault annunciator system	3; 6	303		A	Output for signal lamp	Output for horn		Switch cabinet	45	AD 5998, AD 5992	437
GSM-Module busconnection					LED		configurable; bus-compatible	Distribution board	70	RP 5810	*
SMS-Telecontrol module					LED			Distribution board	70	RP 5812	440
Accessories for fault annunciators: Lamp tester					LED			Distribution board Switch cabinet	17.5 17.5	MK 9994, MK 9995	444

NO = normally open contact

Following product are also available : AI 990, AI 991, AI 992, AI 998, UP 5864

Monitoring hardware

DOLD's monitoring relays such as insulation monitors, differential-current monitors and measuring relays reliably monitor electrical quantities such as current, voltage, power, resistance, etc. and annunciate fault conditions and disturbances. Thus, these products protect also complex systems and ensure an optimal production flow. LEDs on the front provide visual status indications. Output contacts or interfaces for bus systems allow a further transmission of information from these devices, e.g. to fault annunciators.



Monitoring electrical quantities : **System**

Phase

- Voltage
- Phase failure / Asymmetrie
- Broken neutral wire
- Frequency
- Insulation failures

- Undervoltage and overvoltage relays, voltage monitors, single- and trhee-phase
- Phase-sequence relays, phase monitors, phase indicators
- Unbalance relays
- Neutral monitors
- Frequency relays
- Insulation / differential-current monitors

Monitoring electrical quantities: **Load**

Load

- Current
- cos φ
- Effective power

- Current relays
- Underpower monitors
- Load monitors, overload monitors, load transformers

Monitoring physical quantities : **Processes**

Installations

- Speed
- Temperature
- Level

- Speed / zero-speed relays
- Tempetature relays, thermistor motor protection relays
- Neutral monitor
- Level sensing relays

Monitoring of multiple quantities **/ special applications**

- Multifunctional relays
- Measuring relays for specific applications

Insulation monitor

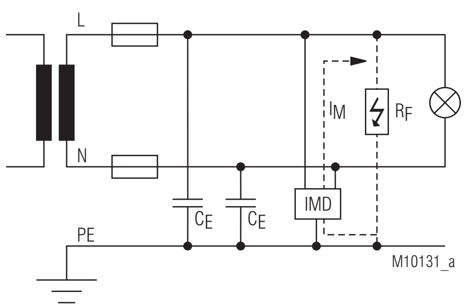
Non-earthed (IT) systems

Insulation monitor

Insulation monitors are used in non-earthed systems (IT systems). They measure the insulation resistance against earth of the system to be monitored. Such systems are protected by insulation monitors the use of them in IT systems is required by law by the norm “Safety of Machinery” DIN EN 60204-1 or DIN VDE 0100-410.
Thanks to the deliberately kept simple functionality of insulation monitors from DOLD customers benefit from a considerable cost advantage combined with the high quality standard accustomed from DOLD. Insulation monitors are used to avoid accidents and downtimes in the case of insulation failures and to protect against fire and accidents.
For insulation monitoring in earthed systems, differential-current monitors are used.

Problem:

- The standards DIN VDE 0100-410 and DIN EN 60204-1 require the use of an insulation monitor in non-earthed systems. Our objective is to meet this standard as cost-effective as possible.
- Ensure protection againstfire and accidents by early detection of earth fault currents and slowly evolving insulation faults, e.g. safeguarding fire/explosion-prone areas
- Prevent unscheduled downtimes due to earth faults in medical areas.



R_F : Fault resistance
I_F : Fault current
C_E : Earth capacitance
IW : Insulation monitor

Solution:

DOLD insulation monitors are available for d.c. and three-phase systems, a.c. systems and mixed systems. Further, our insulation monitors can be used to monitor switched off loads, mobile power supply units, d.c. systems and rooms used for medical applications.

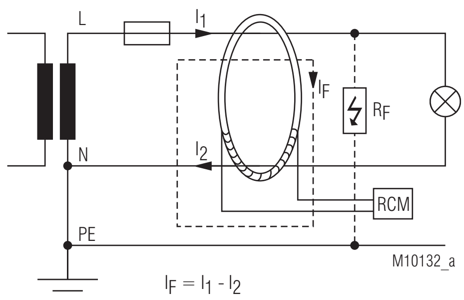
Earthed (TN) systems

Differential-current monitors

Differential-current monitors are used in earthed systems (TN systems). They monitor the fault current on the basis of the differential-current measurement and are mainly used to prevent expensive downtimes and fire risk that is latently present due to evolving insulation faults. They guarantee an increased safety of operating and installations.
For insulation monitoring in non-earthed systems, insulation monitors are used.

Problem:

- Avoid the risk offire and accidents due to slowly evolving insulation faults: High-resistance faults to exposed conductive parts and to earth are present if the conductive connection of the fault location includes resistances. There is just a risk of fire when the power loss on the fault location is 60 W. This corresponds to a fault current of 260 mA at 230 VAC. Overcurrent devices would not operate in this case.
- Avoid costly downtimes, get an information lead to ensure high operational reliability between maintenance intervals



R_F : Fault resistance (insulation fault)
I_F : Fault current
DW : Differential-current monitor
W : Energy consumption on the fault location

Solution:

In their standard variant, DOLD differential-current monitors can be used for d.c. systems or pulsating d.c. systems, and a universal-current-sensitive variant is available for mixed systems.

Basics of monitoring technology in low voltage systems

What means asymmetry (unbalance) in three-phase systems?

The most common system is the 400 V three-phase system (fig. 1) formed from three alternating voltages that are displaced in time by 120° el. (fig. 2). Between the phases L1, L2, and L3, there are 3 phase-to-phase voltages U_{L1-L2}, U_{L2-L3}, U_{L3-L1} that are also referred to as line-to-line voltages. Graphically represented in a phasor diagram, these voltages result in an isosceles triangle (fig. 3). This type of representation is common in electrical engineering to easily illustrate sinusoidal alternating quantities. The 3 voltages against the neutral N of the transformer are the star voltages (phase-to-neutral voltages) U_{L1-N}, U_{L2-N}, U_{L3-N} which can also be drawn in the isosceles triangle.

Under normal conditions in a three-phase system, all voltages are equal in their magnitude and all angles are 120° el. An deviation from this is called asymmetry (unbalance). How this affects connected loads is described below.

There are two types of asymmetry:

Case 1: Given a stiff system, i.e. the phase-to-phase voltages are constant, the phase-to-neutral voltages on the load (measuring point A) can change without changing the outer symmetry (fig. 4). This is the case with asymmetric loads in star connections and interrupted neutral conductor, i.e. with open neutral (star) point.

Case 2: However, if the phase-to-phase voltages change, this will always cause a change of the phase-to-neutral voltages too. This occurs with motive-power loads when one phase fails (fig. 1b). The motor windings U and V induce a voltage in the disconnected winding W, which does no longer correspond to the original system voltage. Therefore, the three-phase system downstream of the fuses on the measuring point B now became asymmetric. This is referred to as reverse power.

To detect an asymmetry in a system, for the 1st case, the 3 phase-to-phase voltages against the star point (neutral conductor N) must be measured and compared to each other. Even the smallest voltage differences cause an asymmetry. It can be calculated by

$$\text{Asymmetry (Unbalance)} = \left(\frac{\text{Highest voltage}}{\text{Lowest voltage}} - 1\right) * 100 \text{ in (\%)} \qquad \text{Eq.(1)}$$

In the second case it is enough to compare the magnitude of the phase-to-phase voltages and to determine the asymmetry (unbalance) with equation (1).

Consequences of asymmetry (unbalance) in three-phase systems

1. Neutral conductor interruption

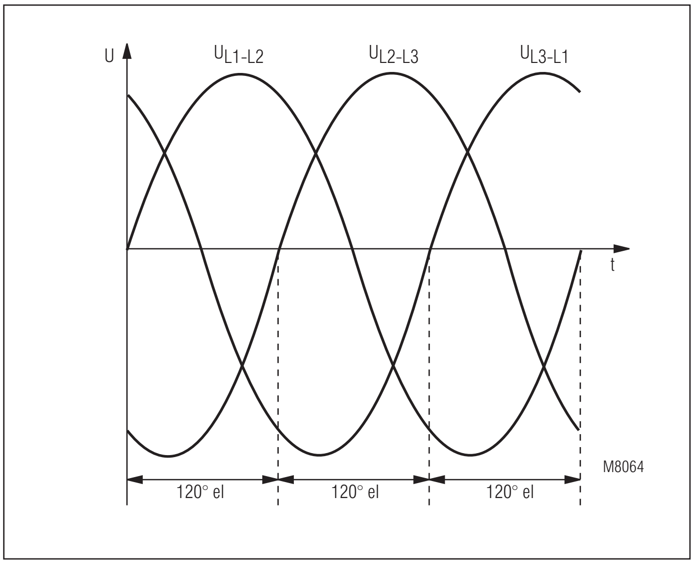


Fig. 2:
Sinusoidal time characteristic

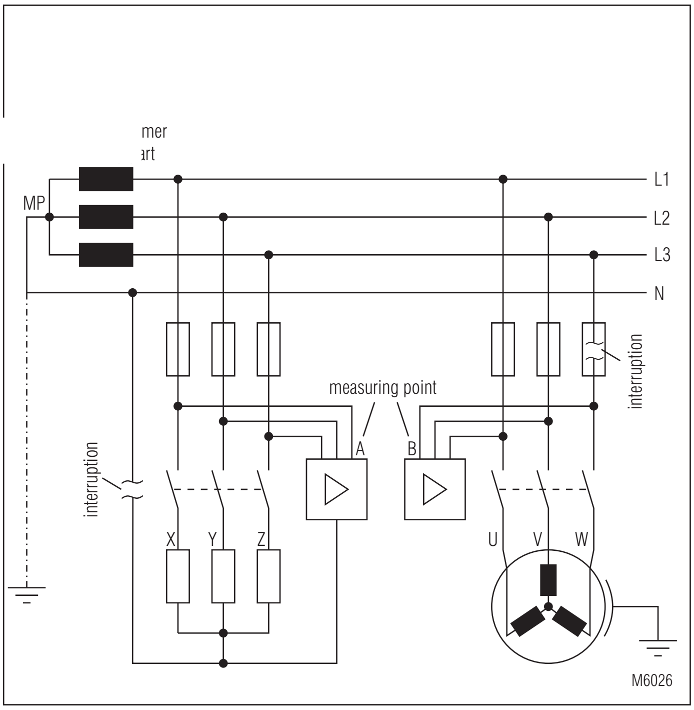


Fig. 1a:
Ohmic load

Fig. 1b:
Motive-power load

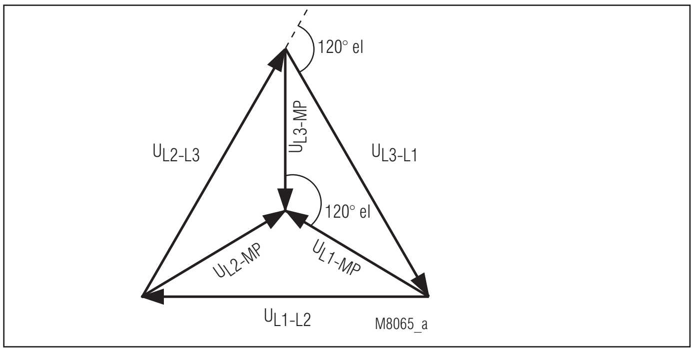


Fig. 3: Phasor diagram

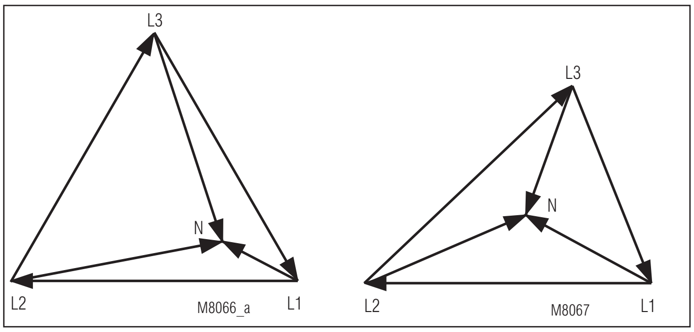


Fig. 4:
Asymmetrical star voltages

Fig. 5:
Asymmetrical phase-to-phase voltages

At first, the case of a broken neutral conductor is considered. As shown in fig. 4, the phase-to-neutral voltages can reach dangerously high values, up to the magnitude of the phase-to-phase voltage in extreme cases. It is clear that this would damage or destroy connected loads. Such overvoltages are a consequence of a severe unbalance as is encountered frequently in private or commercial systems. This is due to the fact that the electrical devices used there are mainly single-phase consumers with different power consumptions.

Although attention is paid in building installations to symmetrically distribute loads to all 3 phases unsymmetrical loading cannot be avoided in the daily use of electric equipment. An example for a highly unsymmetrical loading may be a washing machine (2000 W) on phase L1, bulbs (100 W) on phase L2 and a radio (20W) on phase L3 (fig. 6b).

In normal system operation, the correct system voltage (230 V) is applied to all loads. However, if the neutral conductor is inadvertently not reconnected after work on the installation, for example, and the system is reconnected, the voltage on small loads can reach very high values. In our example, the radio would be at a high risk (power pack would be damaged) and the bulbs would burn out.

It should be the objective to signal even the smallest unbalances by means of measuring relays and to disconnect loads if required before dangerous conditions can evolve. Conventional over/undervoltage relays are not suited for an early detection. To detect an asymmetry of 5 %, for example, according to equation (1) only by the use of voltage relays they had to be set to a value of 2.5 % overvoltage or undervoltage. However, this would be not useful as there is no need to disconnect at an undervoltage of only 2.5 %.

Therefore, DOLD's neutral monitor IL 9069 would be a suited measuring device for this case because it detects an asymmetry of the phase-to-neutral voltages. As the phase-to-neutral voltages can reach high values in case of a fault, as mentioned above, the measuring relay must be rated for this to prevent it from being damaged. Figure 6a shows an example how the neutral monitor IL 9069 can protect an installation against overvoltage.

2. Reverse voltage

Reverse voltage, often also called reverse feeding, becomes an issue whenever a conductor is interrupted in the electrical installation. Such an interruption can be caused by a blown fuse, a broken conductor or a contact failure in a switching device, for example (Fig. 1b). However, a reverse voltage only occurs when a three-phase motor or transformer is present. Because motors running on two phases due to an interruption have the characteristic to regenerate the missing system phase by themselves. However, magnitude and angle of this voltage do not match with the original system voltage. Therefore, the three-phase system became asymmetrical downstream of the interruption point (measuring B, Fig. 1b). The extent of asymmetry depends on the type, size and loading of the motor.

In the past, the above behaviour was deliberately used to generate a three-phase system from an existing single-phase system. Today, in the age of power electronics, this is no longer necessary. In our case, it would be even detrimental when a phase fails in systems with electrical drives. The problem is that a single-phase operation cannot be immediately detected because the drives continue to operate without changes for the moment. Only when the operating condition is deliberately changed it would be detected, but then it may be too late. Three-phase motors cannot start on a single-phase system, for example.

Also a reversal of the rotational direction by plugging is no longer possible because the motor would continue to run in its original direction even after plugging. This may be dangerous if a reversal is needed for safety reasons such as with presses and calenders. Also motors for elevators and cranes would start in the opposite direction due to the pulling load.

Again, asymmetry (unbalance) relays can be used to prevent conditions of this type. But in this case, devices are needed that compare the three phase-to-phase voltages and evaluate them according to equation 1. As described for the neutral conductor, smallest amounts of asymmetry are detected, which cannot be detected by normal voltage relays.

Figure 7 represents the correct connection of a motor feeder, as an example. The undervoltage relay with integrated unbalance detection IL 9071/011 is used here. Please note that the section between asymmetry relay and motor is not monitored. If this is required for safety reasons, the undercurrent relay IP 9271 must be additionally looped in the motor feeder. With this measure, the whole drive is then optimally protected against phase failure and broken conductor.

Note: For the detection of asymmetry, also the BA 9040 would be suitable, and the broken conductor relay AI 940 for undercurrent detection. However, devices from the I range have been selected for reasons of uniformity.

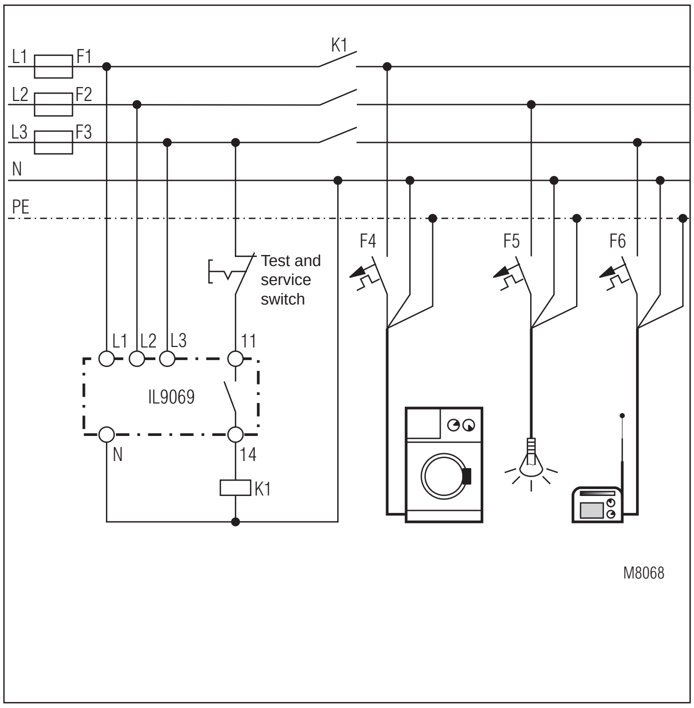


Figure 6a
Neutral monitor

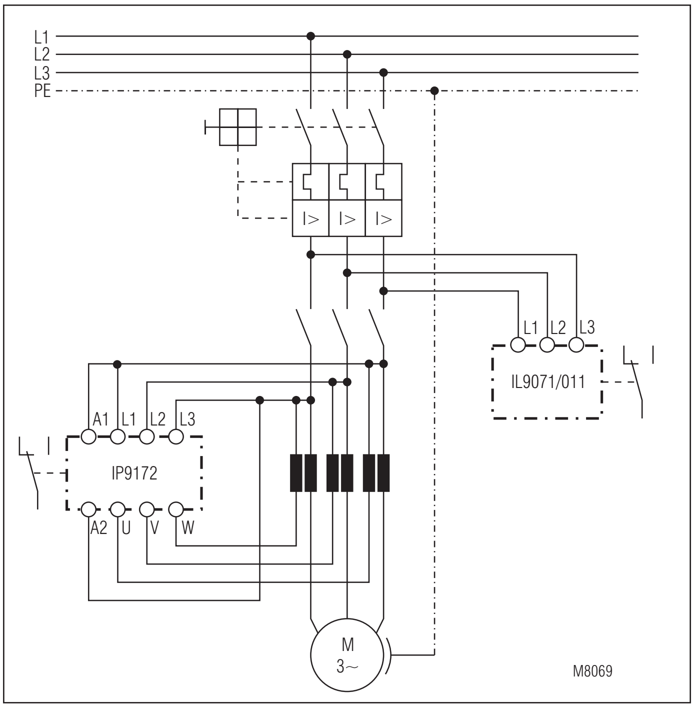


Fig. 7:
Monitoring for broken conductor and unbalance

Measuring relays

Monitoring of electrical systems for undervoltage and overvoltage

1. Function principle of voltage measuring relays

The considerations below are not only restricted to voltage monitoring but also apply correspondingly to the monitoring of current, cos φ, power, temperature, frequency, etc.

Once we have discussed above a special case of under/overvoltage, namely asymmetry (unbalance), we now deal with the normal case, i.e. the monitoring of electrical systems for under/overvoltage.

In sytems where reverse feeding is not to be expected a standard voltage measuring relay is sufficient for monitoring. All DOLD measuring relays and in particular the voltage measuring relays work on the basis of the same principle, no matter whether they operate with or without auxiliary voltage U_H. In the following, the function principle is described in more detail on the example of an undervoltage relay.

With the use of an undervoltage relay, the user wants to detect a downward deviation from the nominal voltage, which underruns the permissible tolerance, e.g. 20 %. Given a 230 V AC system, this is an undervoltage of 184 V.

The device has two switching points, an upper and a lower. To prevent confusing we speak of upper and lower switching points below.

In a three-phase measuring relay, the upper switching point must **at first exceeded in all three phases at the same time** in order to enable the device with the undervoltage feature to go to the „good state". That means in our example that the upper switching point must be set to approx. 228 V to allow the device to pick up at a system voltage of 230 V.

If then the voltage drops to a value just under 228 V, the device will not respond to it for the moment. Only when the lower switching point is underrun the relay reports a fault. For this, it is enough that **only one of the three voltages** drops under the lower switching point.

The difference between both switching points is called hysteresis and is specified either as an absolute value in Volt or relatively in percent (%) related to the threshold. In the example above, the device must have the lower switching point at 184 V resulting in a hysteresis of 44 V or 19.3 %. Figure 8 shows the connections described above in graphical form.

Measuring relays may have two different response principles when the measured value has over/underrun a switching point. In the open-circuit principle, the signal relay in the output only picks up when the fault, e.g. overvoltage occurs. With the closed-circuit principle, the output relay is permanently picked up (energized) in the "good range" of the measured quantity and will only drop out in case of a fault.

To prevent short-time voltage dips from causing an undesired alarm the output relay can be operated with a time delay. If the system voltage reaches again its original value within the delay time t_1 the output relay will not operate. Likewise, a time delay t_1 can be realized when the measured voltage returns to the „good range" (refer to Fig. 8).

Due to the measurement principle used, namely the arithmetic averaging, a system-specific delay time t_0 results in the measuring input. At each variation of the measured voltage, small capacitances in the device are caused to charge and discharge. Depending on the amount of the voltage jump, it takes between 100 ms and 1 s before the new measurement internally tunes in.

Now, the five most important parameters are known that can be set together or individually on a voltage measuring relay by the user or are fixed set in the factory These parameters include:

Upper switching point, lower switching point, response principle, delay time t_1, and delay time t_2. In a block diagram, figure 9 shows the general working principle of a voltage measuring relay.

The considerations above do not only apply to three-phase system but can be also translated to single-phase and direct current systems. It is clear that there is an abundance of design variants for such devices alone from the above mentioned combination options. This wealth of variants can be arbitrarily extended by fitting the devices with further extra functions such as unbalance detection, phase angle measurement, etc.

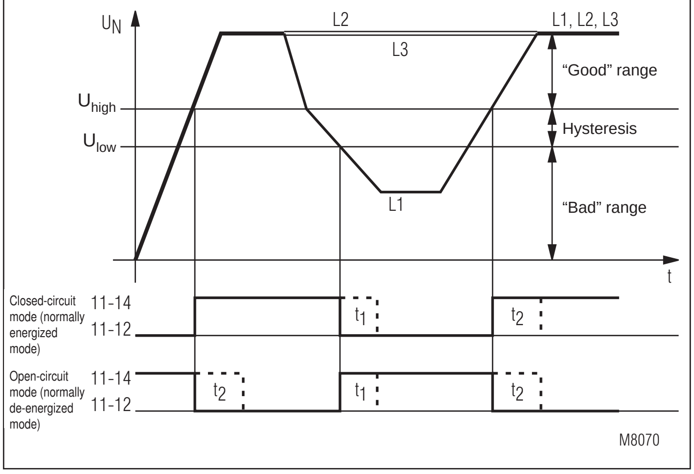


Fig. 8:
Function diagram for undervoltage relay with auxiliary supply

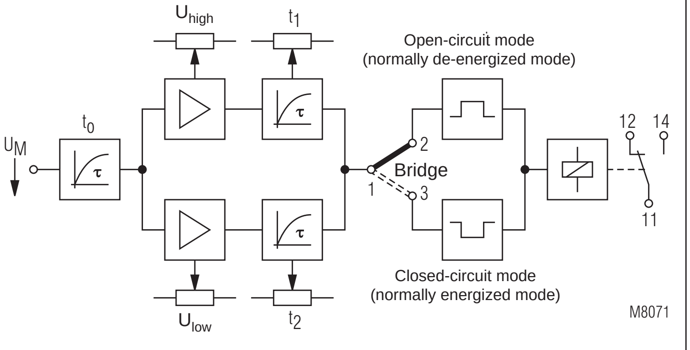


Fig. 9:
Simplified block diagram of a voltage measuring relay

2. Practical application of voltage measuring relays

After the theoretical preliminary consideration, we now come to the applications of measuring devices in practice. In particular, discrete devices shall be selected from the general case (figure 9).

In principle, it would be possible to combine all conceivable functions and options, e.g. over/undervoltage, unbalance, phase sequence, current, overload, time delays, etc. in a single device. However, this is not useful in practice as such a device would be too expensive on the one hand and difficult to handle on the other hand because all making conditions would have to be met at the same time to allow the device to report a faultless state at all.

Therefore, form the abundance of measuring and evaluation options, only those are selected that are really required and useful for a certain monitoring task. From these specifications, a device with specific features is then created.

IK 9171 (or alternatively BA 9043)

In the first example, following device features are required: three-phase undervoltage measurement, nominal voltage 400 V, N connection option, lower switching point 0.85 U_N and closed-circuit principle. The solution is our standard type:
IK 9171/200 3AC 400/230 V 0,85 U_N

What can this device do?

Once the system voltage is applied it goes to the “good condition” and the output contact closes. When the system voltage in only one of the phases drops under the lower switching point the output relay drops out (figure 10) and thus it signals the fault condition (closed-circuit principle). When the system voltage increases above the upper switching point again the device detects this and the output contact closes without time delay.

What’s this device for?

It is suited for simple monitoring tasks to detect undervoltage in particular in control voltage systems. Also, it is approved for applications according to VDE 0108 (emergency power supply).

Variant

Now, we add the time delay t_2 to the above device and change the switching point to 0.7 U_N. All remaining specifications remain the same. So, you get the device IK 9171/240.

What can this device do?

Same functionality as above. The only difference is that the output contact only closes after the time t_2 (figure 11) adjustable between 5 and 15 minutes when the voltage exceeds the upper switching point and the device detects this.

What’s this device for?

The above device, in particular the single-phase model IK 9173/240, was designed for applications in southern (warmer) countries. The majority of houses there are equipped with air-conditioning systems. In the case of power failures, that occur frequently due to weak and unreliable systems, the cooling compressors must not restart immediately after restoration of supply. This is because the refrigerant must be allowed to return in the compressor firstly, and secondly, it must be prevented that all air-conditioning units start at the same time on the weak system, which would cause a new collapse. They must be started in a coordinated (time-staggered) manner by differently set delay times.

IL 9071

For the second example, there are following requirements: Three-phase undervoltage measurement, nominal voltage 400 V, N connection option, lower switching point 0.85 U_N, and unbalance detection. This leads to the IL 9071/010.

What can this device do?

In principle, it has all features as the IK 9171/200 plus unbalance detection (figure 11).

What’s this device for?

It can not only be used for simple undervoltage detection but also for phase failure detection. Thanks to the built in unbalance detection, it can reliably detect a phase failure also in systems with motive-power load as the phenomenon of reverse voltage is considered.

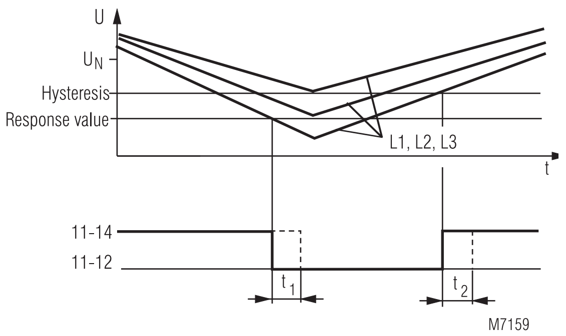


Fig. 10:
Function diagram for undervoltage relay IK 9171

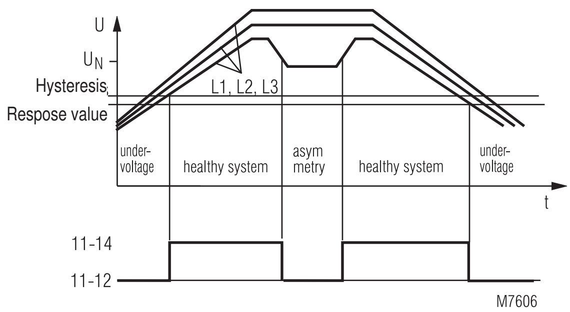


Fig. 11:
Function diagram for undervoltage relay IL 9071

IL 9079

For the third example, we opt for following features: three-phase undervoltage measurement, very short response time t_0, time delay t_2 and closed-circuit principle for the device IL 9079.

What can this device do?

Once the system voltage is applied it goes to the “good condition” and the output contact closes (closed-circuit principle). When the system voltage drops under the lower switching point the device immediately responds within t_0 = 20 ms and the output contact drops out. When the system voltage recovers the output contact only closes after a time that is adjustable between 0.2 and 2 sec. (figure 12).

What’s this device for?

The IL 9079 was designed for the detection of automatic reclosings in three-phase systems. As such rapid auto-reclosures have a duration of only approx. 100 ms a very short response time t_0 of the device matters. These rapid auto-reclosures can confuse contactor control systems. Using the IL 9079 the control system is shut down and restarted in a controlled way. With a connection trick it is possible to configure the device with reclosing lockout (figure 13).

The three examples above should be enough to demonstrate what an abundance of devices and variants are possible in the field of voltage measurement - only by smart combination of individual functionalities.

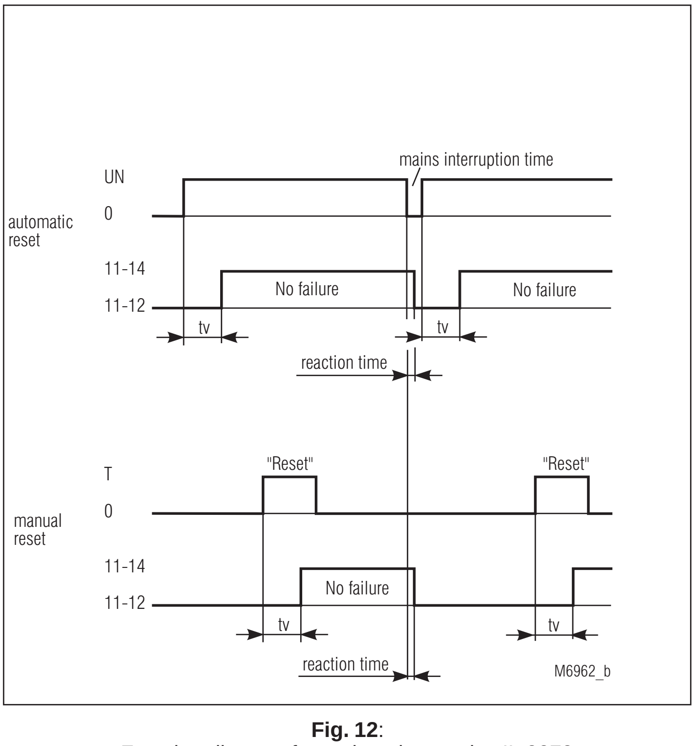


Fig. 12:
Function diagram for undervoltage relay IL 9079

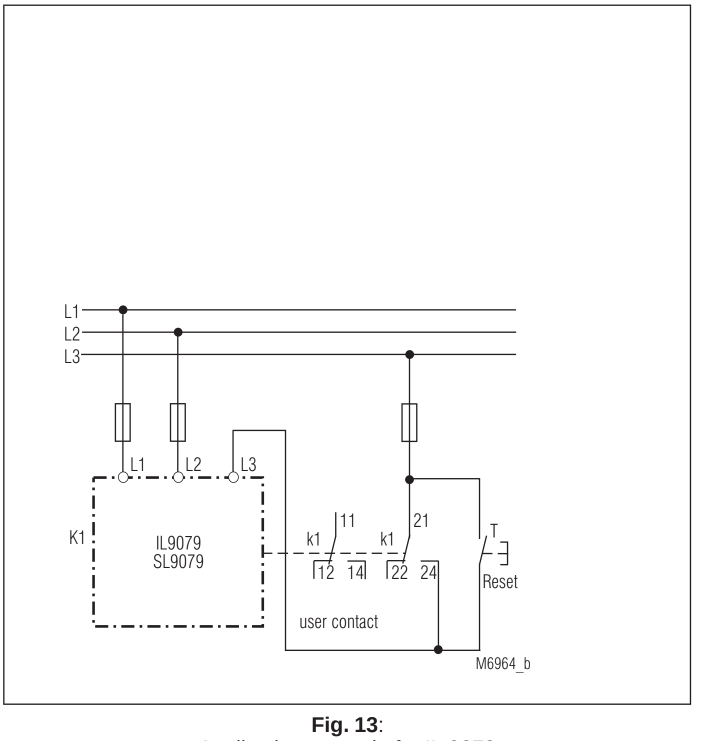


Fig. 13:
Application example for IL 9079

3. General

The last section of the preface deals with general recurring issues with respect of measuring relay use.

Neutral connection

When to use the devices with and without neutral conductor? The basic principle is: If a 4-wire system with neutral conductor is available, you should use a measuring relay that has an N-connection, even when a three-phase connection would be enough. Because such devices are able to measure and compare all 3 phase voltages against N they are more accurate and sensitive than devices with only 3 terminals which use one phase as reference phase and can only measure and compare 2 voltages.

Phase terminals

Basically, three-phase devices with N terminal can also be connected to a single-phase system by bridging all 3 terminals for the phases with each other.

Response principle

In principle, the measuring relays can be designed for open-circuit or closed-circuit mode on the user's request. However, a fitting with open-circuit mode is not useful for an undervoltage relay without auxiliary voltage supply. Because the output relay must be energized in case of a fault (undervoltage) owing to the response principle. But when the voltage drops under the permissible tolerance or a total power failure occurs the output relay can no longer pick up because there is no more energy. Therefore, the closed-circuit principle is the only correct selection for such an application.

Protection of measuring circuits by fuses

One recurring question is how to correctly connect measuring relays with respect to their protection against short-circuits. The standard DIN VDE 0100 Part 430 provide information on this. Section 6.4.3 says that protective devices are not necessary when (1) the conductor or cable is made so that the risk of a short-circuit is reduced to a minimum and (2) the conductor or cable is not located close to combustible materials. Generally, this is called short-circuit-proof installation.

What does this mean in practice?
To connect a voltage relay to a busbar, for example, considerably smaller conductor cross sections are allowed. But this is only allowed when they are laid separately, equipped with reinforced insulation and shorter than 3 m. The purpose of this is to prevent any contact to each other and thus to prevent a short-circuit. If it happens against expectation, the line must be additionally routed so that it can burn out without danger.

If the user does not want to take care of the above regulations, he must install a protection device directly at the loaction of cross section transition (busbar to measuring conductor) as is required by the cross section and conductor laying. Then, a short-circuit on the supply conductor is cut out by the fuse without any risk. The user does not need to consider the measuring relay in this respect because a short-circuit occuring there is automatically interrupted. It goes without saying that the device can no longer be used after this.

4. Further applications

4.1. Reverse-power protection relay IR 9140

If reverse power to the system is to be prevented, the reverse-power protection relay IR 9140 can be used. It monitors the direction of energy transport in an electrical system. This can be required at connection points to the power grid or industrial systems, for the operation of emergency power units, for generator operation of driving motors, etc.

4.2. Small power stations

An example of the use of different DOLD measuring relays can be encountered in small power stations. Here, over/undervolgage relays with unbalance detection, frequency relays, reverse-power protection relays and speed relays or level sensing relays are used. For a more detailed application description for these devices please refer to our project folder P1 “Small power stations operated in parallel with the system”.

4.3. Hospitals

A further application of our measuring relays is the voltage switching and monitoring of the IT system in rooms used for medical applications. Here, undervoltage relays, insulation monitors, current and temperature monitors are used. For more information please refer to our associated project folder P1 “Rooms used for medical applications”.

Fault annunciators

Systems and installations become more and more complex due to increased automation, rationalization and growing use of control electronics in machinery and plants. Maintenance expenditures increase and human intervention becomes more and more difficult. So, not only the safety but also the service life of such installations is of major importance.

Avoiding failures by preventive maintenance or safely correcting failures within a short period of time helps to reduce costs. The use of fault annunciators pays off evermore because lost production time can hardly be recovered.

Requirements and field of application

In the course of time, changes have taken place just with respect to detection and processing of faults. In the past, single components from relays, auxiliary contactors and interval time-delay relays were used besides pushbuttons for acknowledgement, horn and indicator lamps to process fault signals. Today, a single module is enough to fulfill this task.

In the meantime, function and annunciating sequences have been standardized by the standard DIN 19 235. Apart from simple electrical group fault, new-value and first-up annunciators, electronic clear text fault annunciating systems are available for complex applications.

Precisely, when using PLC or control system technology it is indispensable to install a fault alarm acquisition independent of the process level to keep control when the plant control fails and thus a damage may occur.

Typical application fields for fault annunciators include:

Industry:
Monitoring of production sequences and processes, monitoring of the production plant, monitoring of machine functions such as V-belt breaking, filter blocking, dry-running of pumps, etc. and the specification of maintenance intervals for preventive maintenance.

Buildings:
Monitoring of heating, ventilation and air-condition systems, doors, gates and windows as well as monitoring of transport and conveying systems.

Environment:
Monitoring of sewage treatment plants, waste incineration plants and power stations.

Group fault, new-value and firt-up annunciators have normally acoustic and visual indicators and are designed for DIN rail mounting or for front panel mounting.

Group fault annunciators are availabel for 6 or 12 (extendable) signals that energize a relay when a fault signal occurs. Such a relay can be de-energized by an acknowledging key. A visual (flash lamp) or an acoustic (horn) transducer is connected to this relay output.

New-value and first-up annunciators are used where the chronology of fault signals is essential.

The **new-value annunciator** highlights those alarms among a number of alarms the status of which has changed after the last acknowledgement. New-value annunciations are indicated by a flash lamp and after acknowldgement as permanent light until the fault is cleared.

The **first-up annunciator** highlights that alarm among a number of alarms the status of which has changed first after the last acknowledgement. The first occurred fault is indicated by a flashing lamp and consequential faults by permanent light.

Text fault annunciator systems

Text annunciator systems echo the correct sequence of the arrived fault signals. Stored alarms can be called up and viewed on the display. Text fault annunciator systems can be operated as new-value and also as first-up annunciators.

Text fault annunciators have outputs for group annunciation, horn and system readiness. Inputs and outputs are metallically isolated and thus ensure a maximum of interference immunity.

A printer can be used for **logging**, i.e. for printing out the fault date, time and text.

With an appropriate **programming software** also other settings such as closed-circuit and open-circuit principle as well as time delay of inputs can be defined apart from the message texts.

A decentralized fault alarm acquisition in complex installations can be configured with up to 30 modules with 8, 16, 24 or 32 inputs each. Via a separate module, these modules are connected to a two-wire line which is connected to the central fault annunciator. A maximum of 255 fault alarms can be acquired with this. Additional remote control stations complete the system.

VARIMETER IMD
Insulation monitor
RN 5897/010

DOLD

0274875

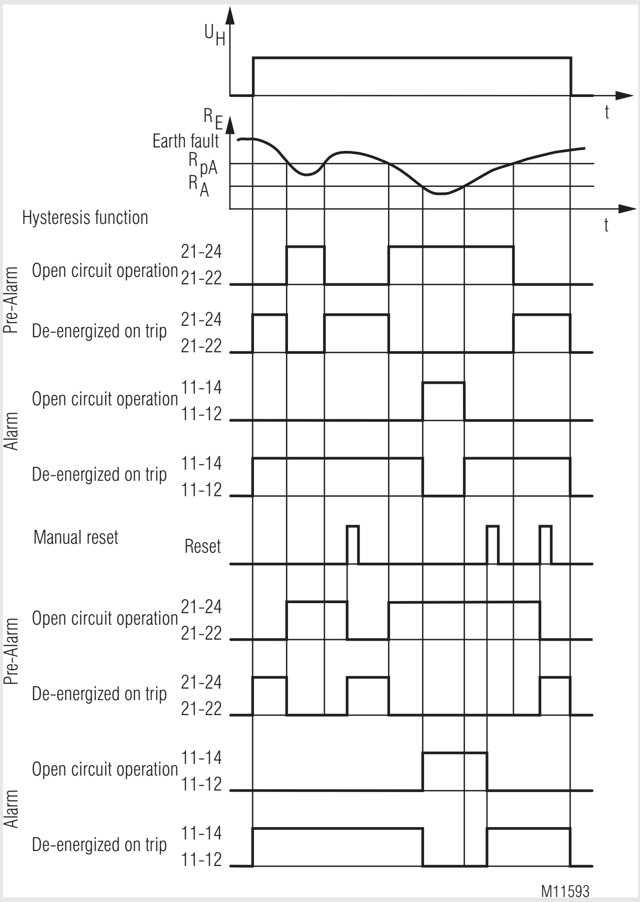
RN 5897/010

RP 5898

Product Description

The insulation monitor RN 5897/010 of the VARIMETER IMD family provides best and up to date insulation monitoring of modern IT systems in an optimum and state of the art way fulfilling the relevant standards. The device can be used in the most flexible way for AC, DC and AC/DC systems even with large leakage capacity to earth (PE). The adjustment of the setting values is simple and user friendly done on 2 rotary switches on the front of the device. Via display and LEDs the measured value, device parameters and device status are indicated easy to read. With a sealable transparent cover the device is protectet against manipulation.

Function Diagram



Your Advantages
- Preventivefire and system protection
- Detection of symmetric and asymmetric insulation faults
- Quick fault localisation through selective earth fault detection to L+ and L-
- Universal application in non-earthed AC, DC, AC/DC networks with up to 300 V nominal voltage
- Easy adjustment of response values and setting parameter via rotational switch and menu display
- Suitable for large leakage capacitances up to 1000µF
- Optimised reaction time for large leakage capacitances
- Monitoring also with voltage-free mains
- Measuring circuit L(+)/L(-) with broken wire detection (can be switched off)
- Protective conductor PE1/PE2 with broken wire detection (can't be switched off)

Features
- Insulation monitoring according to IEC/EN 61557-8
- With connection facility of an external coupling device RP 5898 for voltages up to 1000 V
- Trigger output for insulation fault locating system
- 2 separate adjustable response thresholds (using e.g. for pre-Alarm and Alarm)
- Setting range of 1st response value (Pre-Alarm): 20 kΩ … 2 MΩ
- Setting range of 2nd response value (Alarm): 1 kΩ … 250 kΩ
- 2 changeover contacts für insulation failures-Pre-Alarm and -Alarm
- Energized or de-energized on trip can be selected for indicator relay
- Display for indication of measured value, device parameters and device status
- Setting the maximum leakage capacitance to shorten the response time
- Automatic and manual device self-test
- Alarm storage selectable
- Protection against manipulation by sealable transparent cover
- External control input for combined Test-/Reset-button
- 3 wide voltage input for auxiliary voltage
- Width 52.5 mm

Approvals and Markings

CE	AC/DC

Applications

Insulation monitoring of:
- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Networks with frequency inverters
- Battery networks
- Networks with direct current drives
- Hybrid and battery-powered vehicles
- Mobile generator sets

Function

The device is supplied with DC auxiliary voltage via terminals A1(+) / A2. Switching on the auxiliary voltage (Power-On) is followed by an internal self-test for 10 sec (see „Device test functions"). The test process is visible in the display. After this, measurement of the insulation resistance in the measuring circuits begins and the the colour of the backlight changes into green.

Measuring circuit
(Insulation measurement between terminals L(+) / L(-) and PE1/PE2)
The insulation monitor RN 5897 can be operated either with or without coupling device. Max. mains voltage and connection diagrams have to be observed!
If the insulation monitor is operated without coupling device the terminals L(+) and L(-) have to be connected directly to the voltage system to be monitored. and the terminals VSG1/L(+) and VSG2/L(-) each have to be bridged (see also operation with coupling device).
A broken wire detection that can be disabled provides a fault signal if both terminals L(+) and L(-) are not linked by the connected network.
The type of network (AC, DC, 3NAC) has to be selected.
Also the terminals PE1 and PE2 have to be connected with 2 separate wires to the protective earth. An interruption of a wire also causes a fault signal (see section "Behavior on faulty connection"). The monitoring of the PE connection cannot be de-activated.
To measure the insulation resistance an active measuring voltage with changing polarity is connected between L(+)/L(-) and PE1/PE2.The momentary polarity of the measuring cycle is shown on the display by 2 curser segments („MP+" for positive phase and „MP-" for negative phase). The duration of the positive and negative measuring phase depends on the setting of the max. leakage capacity („CE[µF]" in programming mode), the actual leakage capacity of the monitored system and in DC systems also on the level and duration of possible voltage variations. This allows a correct and fast measurement in different network conditions.
At the end of a measuring cycle the actual insulation resistance is produced and indicated. The actual value is shown on the display. The relays for alarm K1 and pre-alarm K2 switch when dropping under the adjusted response values. In addition the backlight of the display changes to orange color on pre-alarm or to red color on alarm. An asymmetric earth fault either to „+" or „-" is also indicated on the display (only in DC- systems, or with a fault on the DC-side of a system).

Manual reset of fault message
Using the display menu in programming mode, the manual reset function for insulation failures can be selected. If manual reset is activated the insulation fault signals of the measuring circuit are stored when dropping under the adjusted response values also if the insulation resistance goes back to healthy state. The minimum value is stored and can be shown on the display. Pressing the „Reset" button on the front side, the alarm signal and the stored minimum value are reset if the actual insulation resistance is in healthy state.

Indicator relay for insulation fault signal
For the indicator relays K1 (contacts 11-12-14, for alarm) and K2 (contacts 21-22-24, for pre-alarm) the function can be set in programming mode to energized on trip or de-energized on trip when the insulation resistance drops below the adjusted response value.
The status of the indicator relays is shown on the display with the two cursor segments "K1" and "K2". When the relay is energized, the corresponding curser lights up.

Trigger output for insulation fault locating system
There is an additional trigger output for an insulation fault detection system on the insulation monitor RN 5897/010.
This trigger output (Y1-Y2) can be coupled with the trigger input Y1-Y2 of RR 5886 to initiate automatic fault location with the insulation fault locating system, consisting of RR 5886 and RR 5887. The trigger output is activated when the measuring value drops under the alarm response value (R_E < R_A). As long as it stays under the response value or an alarm is stored, the trigger output Y1-Y2 remains active.

Function

Broken wire detection
As described in section "Measuring circut", the measuring circuits L(+)/L(-) and the protective conductors PE1/PE2 are constantly monitored for wire breaks – not only at Power-On or a manual or occasional automatic test. The response time of monitoring is only a few seconds. Broken wire detection between L(+) and L(-) is performed via coupled alternating voltage. This alternating voltage is short-circuited if the terminals are connected to the connected mains at low-resistance. The device detects that the mains to be monitored is properly connected.
Since this broken wire detection is carried out with alternating voltage, large capacitances should be avoided between L(+) and L(-), since the capacitive reactance of these capacitances also short-circuits this alternating voltage. The device would no longer detect a connection fault on L(+)/L(-). Especially parallel lines should be prevented over larger distances.
If larger capacitances between L(+)/L(-) cannot be avoided or if the coupled alternating voltage interferes with the system, the broken wire detection can be de-activated using the display menu in programming mode. Monitoring deactivated, monitoring only during device test or continuous monitoring (every 2 minutes for 10 sec) are the possible options. If the broken wire detection on L(+)/L(-) is de-activated no AC voltage is injected.
The broken wire detection on PE1/PE2 cannot be de-activated.

Device test functions
Principally, 2 different test functions are implemented: The "self-test" and the "expanded test":
The self-test of the device is performed automatically after Power-On and every full operating hours. It can also be triggered manually at any time by pressing the "Test" button at the device front for 2 sec.
With the self-test, contrary to the expanded test, the status of the Indicator relays is not affected; the sequence is as follows:
The display backlight colour changes into orange. For approx.. 2 s all pixels and segments of the LCD are shown. After that the text "Test1" comes up and the measuring pulse is switched for approx. 4 s to negative test phase. The polarity of the test voltage is also indicated on the display by curser segments. Within these 4 s the internal measuring circuit is checked for failures. Then the measuring pulse is switched for approx.. 4 s to positive test phase and more internal tests take place. If no failures turned up and had been recognized, the measurement continuous. The extended test procedure is started when during or at the end of the above described self-test the test button is pressed again for 2 s.
The sequence is similar to the self-test (2 measuring phases of 4 s each) but in addition the output relays go in alarm stated. The display shows "Test2". The test phases of the extended test will be repeated continuously. Pressing the reset button again for 2 s will stop the extended test immediately. The device starts the insulation measurement again.

Behaviour with internal device faults
If internal device faults were detected during the test function, the display backlight changes into red and an error messages (failure code: „Int.1") is indicated. The indicator relays K1 and K2 switch to the alarm state.

Behavior on faulty connection
When detecting broken wire on terminals L(+)/L(-), the measurement is disabled. The reaction time could be up to 2 min. The monitoring relays K1 and K2 go in alarm state, the backlight changes to red. The display shows the fault message „L+/L-". After removing the interruption the fault is automatically reset (max. reaction time up to 2 min) and the measurement of the insulation resistance is continued.
Stored alarm values remain stored. An interruption of the protective earth connections PE1/PE2 causes the same reaction as interrupting the measuring circuit, only the display shows „PE1-PE2".

External control input
To terminals X1/X2 an external combined Test-/Reset button can be connected. If the terminals X1/X2 are bridged for approx.. 1 s the test mode is started. This has the same function as pressing the internal test button. When bridging X1/X2 for > 3 s, a stored alarm will be reset. This has the same function as pressing the internal reset button.

Function

Connection of an external coupling device

An external coupling device RP 5898 can be connected to extend the input voltage range of the monitored voltage system on RN 5897/010. The terminals with the same legend of the insulation monitor and the coupling device (VSG1, VSG2, L(+), L(-)) are connected together. The network to be monitored is connected to terminals L1(+) und L2(-) on the coupling device. Using the display menu in programming mode the connection of the coupling device has to be selected and activated. The broken wire detection is active on the terminals L1(+)/L2(-) on the coupling device. A broken wire between coupling device and insulation monitor cannot be detected immediately but the measured values on interruption of 1 or 2 wires between coupling device and insulation monitor are much lower as the real values, which will cause an early response of the device.

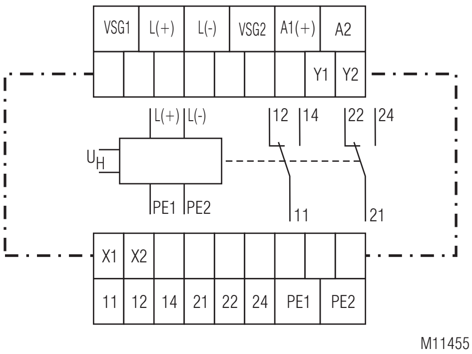
Programming/setting of parameters/set-up of the insulation monitor

The response values for alarm and pre-alarm can be adjusted via 2 rotary switches „R_A“ and „R_{pA}“ on the front of the device. New setting are immediately active and do not require a restart of the unit. More settings can be done with the 3 buttons and the display menu in programming mode. To start the programming mode, the button „Set/ESC“ has to be pressed for approx. 2 s. To avoid unauthorized manipulation, this button as well as the rotary switches „R_A“ and „R_{pA}“ are located behind a sealable transparent cover. When the device changes to programming mode, the measurement is stopped, the display back light changes to orange color and the first parameter is displayed. To scroll the different parameters, the button „Set/ESC“ has to be pressed short. With the 2 scroll buttons (Scroll-Up „▲“ and Scroll-Down „▼“) the settings can be modified.
The first parameter is the broken wire detection in the measuring circuit „BrWiD“. Possible setting are continuously on („on“), continuously off („oFF“) or only active during self-test. The default is „on“.
The second parameter is alarm memory „Mem.“. Here are 2 options available manual reset („on“) und auto reset („oFF“). The default value is „oFF“.
The third parameter is the relay operation principle „Rel.“ Settings are: de-energized on trip („n.c.“) and energized on trip („n.o.“). The default value is „n.c.“.
The fourth parameter is the type of network connection „Net“. Selection are AC Network(„Ac“),DC-Network („dc“) or 3NAC-Network („3nAc“). The default value is „Ac“.
The fifth parameter ist the setting oft the maximum leakage capacity („CE[µF]“). This can be adjusted to 30 µF („30“), 100 µF („100“), 300 µF („300“) and 1000 µF („1000“). The default value is „30“.
The device allow the connection of a coupling device, the sixth parameter activates („on“) or de-activates („oFF“) the coupling device.
The leave the programming mode the button „Set/ESC“ has to be pressed for 2 s. The settings will be activated and stored permanently. After that the device makes a restart similar to power on.

Default-Setting of Parameters

Nr.	Parameter	Default-Set
1	Broken wire detect in measuring circuit “Broken Wire Detect”	on
2	Storing insulation fault message “Memory”	off
3	Switching mode of output relays “Relay”	n.c. (normally closed) de-energized on trip
4	Power supply type “Net”	AC
5	Max. line capacitance “CE[µF]”	30
6	Ext. coupling device “VSG”	off

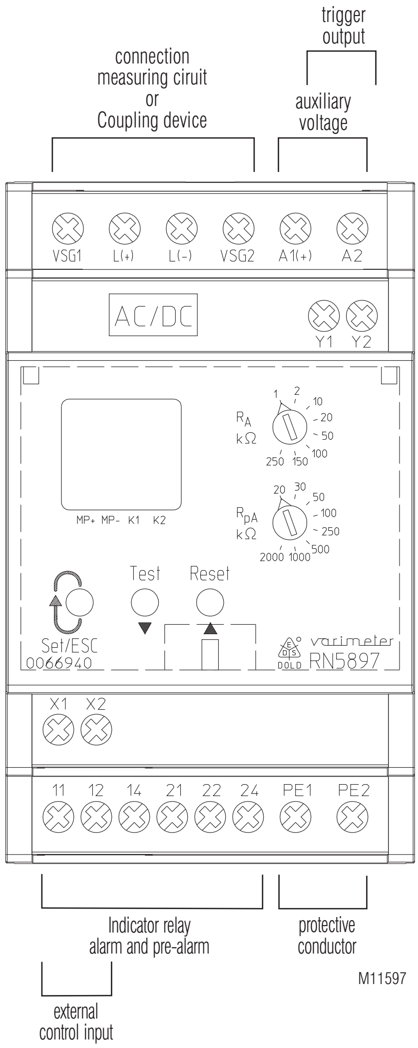
Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
A1(+), A2	Auxiliarx voltage AC or DC
L(+), L(-), VSG1, VSG2	Connection for measuring ciruit or Connection for coupling device
PE1, PE2	Connection for protective conductor
X1, X2	Control input (combined external Test- and Reset-input)
Y1, Y2	Alarm trigger output for insulation fault locating system
11, 12, 13	Alarm signal relay K1(1 changeover contact)
21, 22, 23	Prewarning signal relay K2 (1 changeover contact)

Indicators



RN 5897/010

Indicators

The colour of the backlight indicates the operating status of the device.

Off: No auxiliary voltage connected
Green: Normal operation (Insulation resistance in healthy state)
Red: Alarm (measured value below alarm response value, device failure, connection failure)
Orange: Warning (measured value below pre-alarm response value, test mode, Parameter set-up mode)

Actual value display
The actual insulation resistance „R_E [kΩ]“ is displayed. If the actual value is R_E < 10 kohm, the value in kohm is displayed with 1 decimal place. With values 10 kOhm ≤ R_E < 500 kOhm the display shows the value without decimal place, with values 500 kOhm ≤ R_E < 1 MOhm the value is rounded to 10 kOhm. Insulation resistance values 1 MOhm ≤ R_E < 2 MOhm are displayed in MOhm with one decimal place. If the resistance is R_E > 2 MOHm the display indicates ---- showing the value is higher the 2 MOhm.
In a DC Network an asymmetric insulation resistance to „+“ or „-“ is indicated by displaying „R_E+[kΩ]“ or „R_E-[kΩ]“
By pressing the scroll buttons (Scroll-Up „▲“ und Scroll-Down „▼“) more measured values can be shown. Another value is the mains voltage on L(+)/L(-).This is indicated with „U_N [V_{AC}]“ or „U_N [V_{DC}]“ in V depending on the type of network and voltage. If the unit is connected single pole to a 3NAC network the mains voltage cannot be measured. With this setting the voltage value is not displayed. When manual reset is selected, the display shows the minimum stored value of the resistance „R_M [MΩ]“ or „R_M [kΩ]“ after the value dropped below the response value also when the value goes back to healthy state. The stored minimum value will only be reset when acknowledging the stored Alarm signal (with the reset button). Also the firmware version can be displayed.

Positive measurement phase active (MP+)

Pre-Alarm monitoring relay K2 energized

Negative measurement phase active (MP-)

Alarm monitoring relay K1 energized

Indicators

Display-Indication	Measuring- resp. display value
 	Insulating resistance in kΩ resp. MΩ („----“ complies RE ≥ 2 MΩ)
 	Asymmetrical insulating resistance in kΩ against L+ or L- at DC-mains
 	Measured mains voltage in V at AC- or DC-mains
	Stored min. insulating resistance in kΩ resp. MΩ
	Latest firmware-version

Display-Indication	Test function
	Display-Test
	Selftesting (measuring switching, measuring voltage, internal tests)
	Advanced Test (additional control of indicator relay)

Error Indication

Display-Indication	Failure cause	Failure recovery
	Broken wire detection on L(+)/L(-).	Check measuring circuit L(+) and L (-)
	Broken wire detection on PE1/PE2.	Check protective conductor connections PE1 and PE2
	Internal failure detected in test mode	Press test button again or restart the unit by interrupting the auxiliary supply temporarily. If the fault remains permanent, send device back to manufacturer for examination.
	Faulty calibration values detected in device memory.	Send device back to manufacturer for recalobration and examination.

Notes

In one voltage system only one insulation monitor can be used. This has to be observed when interconnecting two separate systems.

Device terminals PE1 and PE2 must always be connected via separate lines to different terminal points of the protective-conductor system.

The main measuring circuit can be connected with its terminals L(+) and L(-) both to the DC and also AC side of a mixed network; it is done most practically where the primary incoming power supply takes place e.g. with battery networks with connected inverters on the DC side, with Generators/ Transformers with connected Rectifiers or inverters on the AC-side. To monitor a 3NAC system the device can be connected single pole, (L(+) and L(-) are bridged, to the neutral of the 3p4w system. The 3 phases have a low-ohmic (approx. 3 – 5 Ohm) connection via the transformer windings so also insulation failures of the not directly connected phases are detected. Via the display menu in programming mode the correct type of network needs to be selected (see „Connection Examples“).

The measuring circuit of the RN 5897/010 are designed for leakage capacities up to 1000 µF. The measurement of the insulation resistance will not be influenced but for the measuring phases longer time periods are necessary as with smaller capacities. If the max. possible leakage capacity is known, the device can be adjusted to the required lower level, which will reduce the response time and measurement time.

Please do not connect external voltage to terminals X1/X2. The control must only be made by bridging X1 and X2.

The trigger output Y1/Y2 at RN 5897/010 is galvanic separated from the rest of the circuit. It determined to be connected to a DOLD insulation fault location system RR5886 and RR5887. Please do not connect external voltages.

ATTENTION !

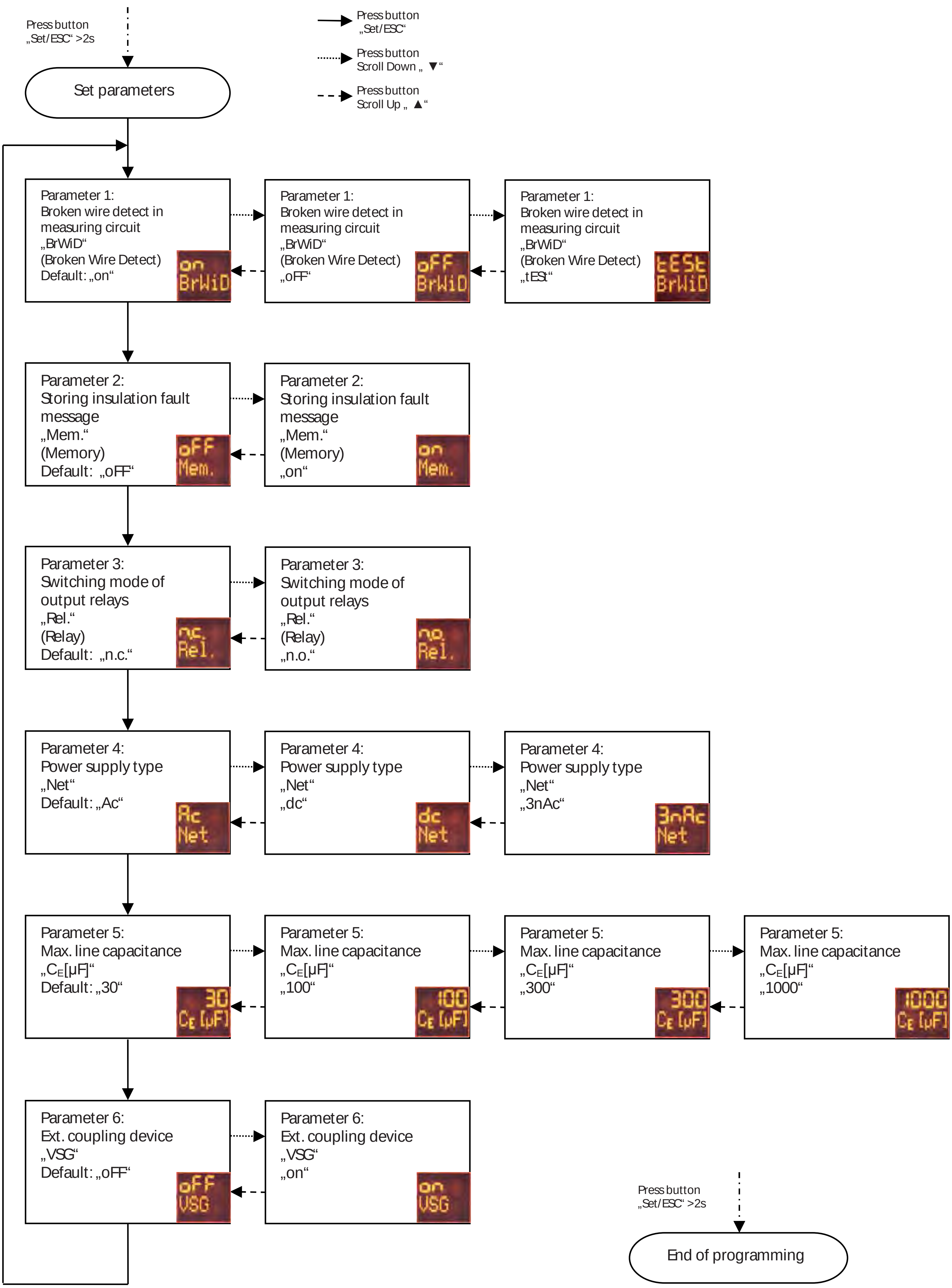
The device must not be operated without PE1/PE2 connection!

Before checking insulation and voltage, disconnect the monitoring device RN 5897 from the power source!

WARNING

The device monitors HIGH-VOLTAGE!
Caution High-Voltage when working on the device!
Disconnect all power supplies before servicing equipment!

Running chart



Technical Data

Measuring ciruit L(+)/L(-) to PE1/PE2 (without coupling device)

Voltage range U_N: DC 0 ... max. 300 V; AC 0 ... max. 250 V
Frequency range: DC or 16 ... 1000 Hz
Max. line capacitance: 1000 µF
Internal resistance (AC / DC): > 90 kΩ
Measuring voltage: approx. ± 90 V
Max. mesured current (R_E = 0): < 1,10 mA
Response inaccuracy: ± 15 % ± 1.5 kΩ IEC 61557-8
Response value hysteresis: approx. + 25 %; min. + 1 kΩ
On delay
at C_E = 1µF,
R_E of ∞ to 0,5 * response value: < 30 s
Measuring time:
At C_E = 1 … 1000 µF,
R_E from ∞ to 1000 kΩ,
R_E from ∞ to 100 kΩ,
R_E from ∞ to 1 kΩ: see characteristics

Response values

Pre-warning („R_{pA}“):

kΩ:	20	30	50	100	250	500	1000	2000

Alarm („R_A“)

kΩ:	1	2	10	20	50	100	150	250

each adjustable via rotational switches

Response value broken wire detection L(+)/L(-): > approx. 90 kΩ
Response value broken-wire detection PE1/PE2: > approx. 0.5 kΩ

Measuring ciruit L1(+)/L2(-) to PE1/PE2 (with coupling device RP 5898)

Voltage range U_N: DC 0 ... max. 1000 V; AC 0 ... max. 760 V
Frequency range: DC or 16 ... 1000 Hz
Max. line capacitance: 1000 µF
Innenwiderstand (AC / DC): > 240 kΩ
Messspannung: approx. ± 90 V
Max. mesured current (R_E = 0): < 0,40 mA
Response inaccuracy: ± 15 % ± 1.5 kΩ IEC 61557-8
Response value hysteresis: approx. + 25 %; min. + 1 kΩ
On delay
at C_E = 1µF,
R_E of ∞ to 0,5 * response value: < 30 s
Measuring time:
At C_E = 1 … 1000 µF,
R_E from ∞ to 1000 kΩ,
R_E from ∞ to 100 kΩ,
R_E from ∞ to 1 kΩ: see characteristics

Response values

Pre-warning („R_{pA}“):

kΩ:	20	30	50	100	250	500	1000	2000

Alarm („R_A“)

kΩ:	1	2	10	20	50	100	150	250

each adjustable via rotational switches

Response value broken wire detection L1(+)/L2(-): > approx. 500 kΩ
Response value broken wire detection PE1/PE2: > approx. 0.5 kΩ
Max. wire length between insulation monitor and coupling device: < 0,5 m

Auxiliary voltage input A1(+)/A2

Nom. Voltage	Voltage range	Frequency range
AC/DC 24 ... 60 V	AC 19 ... 68 V	45 … 400 Hz; DC 48 % W*)
	DC 16 ... 96 V	W*) ≤ 5 %
AC/DC 85 ... 230 V	AC 68 ... 276 V	45 … 400 Hz; DC 48 % W*)
	DC 65 ... 300 V	W*) ≤ 5 %
DC 12 ... 24 V	DC 9.6 ... 30 V	W*) ≤ 5 %

*) W = permitted residual ripple of auxiliary supply

Technical Data

Nominal consumption:
DC 12 V, 24 V, 48 V: max. 3 W
AC 230 V: max. 3.5 VA

Control input X1/X2 for external kombinierte Test-/Reset-Taste

Current flow: approx. 3 mA
No-load operation voltage X1 to X2: ca. 12 V
Permissible wire length: < 50 m
Activation time for test signal: approx. 1 s
Activation time for reset signal: > 3 s

Outputs

Indicator contact: 2 x 1 changeover contact for Alarm (K1) and Pre-Alarm (K2)
energized or de-energized on trip (programmable)
Thermal current I_{th}: 4 A
Switching capacity
to AC 15:
NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: 2 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
at 5 A, AC 230 V: 1 x 10^5 switching cycles
Short circuit strength max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: 50 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 30 ... + 60 °C
(at range 0 … -30 °C limited function of the LCD displaye)
Storage: - 30 ... + 70 °C
Altitude: < 2.000 m IEC 60 664-1
Clearance and creepage distances
Rated insulation voltage: 300 V
Overvoltage category: III
rated impuls voltage / pollution degree: IEC 60 664-1
measuring circuit L(+)/L(-) to auxiliary voltage A1(+)/A2 and indicator relay contacts K1, K2 and trigger output Y1/Y2: 4 kV / 2
auxiliary voltage A1(+)/A2 to indicator relay contacts K1, K2 und trigger output Y1/Y2: 4 kV / 2
indicator relay contact K1 to indicator relay contacts K2: 4 kV / 2
trigger output Y1/Y2 to indicator relay contacts K1, K2: 4 kV / 2
Insulation test voltage
Routine test: AC 2,5 kV; 1 s
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61000-4-2
HF irradiation:
80 MHz … 1 GHz: 20 V / m IEC/EN 61000-4-3
1 GHz … 2.7 GHz: 10 V / m IEC/EN 61000-4-3
Fast transients: 2 kV IEC/EN 61000-4-4
Surge voltage
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 20 V IEC/EN 61000-4-6
Interference suppression: Limit value classe B EN 55011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermpolastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm, Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 30 / 060 / 04 IEC/EN 60 068-1

Technical Data

Terminal designation: EN 50 005
Wire connection DIN 46 228-1/-2/-3/-4
Cross section: 0.5 ... 4 mm² (AWG 20 - 10) solid or
0.5 ... 4 mm² (AWG 20 - 10)
stranded wire without ferrules
0,5 ... 2,5 mm² (AWG 20 - 10)
stranded wire with ferrules
Stripping length: 6.5 mm
Wire fixing: Cross-head screw / M3 box terminals
Fixing torque: 0.5 Nm
Mounting: DIN rail IEC/EN 60715
Weight: approx. 205 g

Dimensions

Width x height x depth: 52.2 x 90 x 71 mm

Standard Types

RN 5897.12 DC 12 ... 24 V
Article number: 0067251
- Auxiliary voltage: DC 12 ... 24 V

RN 5897.12 AC/DC 24 … 60 V
Article number: 0066940
- Auxiliary voltage: AC/DC 24 … 60 V

RN 5897.12 AC/DC 85 … 230 V
Article number: 0066941
- Auxiliary voltage: AC/DC 85 … 230 V

- Outputs: 1 changeover contact for pre-warning
  1 changeover contact for alarm
- Setting range pre-warning: 20 kΩ … 2 MΩ
- Setting range alarm: 1 kΩ … 250 kΩ
- Trigger output for insulation fault locating system
- With connection facility of a coupling device RP 5898
- Adjustable line capacitance
- Energized or de-energized on trip
- Selection of type of network
- Width: 52.5 mm

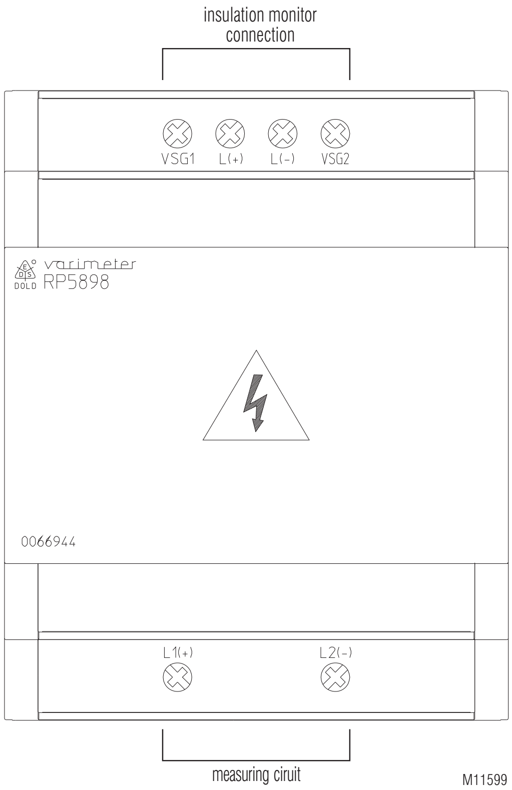
Ordering Example for variants

RN 5897 .12 /_ _ _ AC/DC 24 … 60 V 20 kΩ … 2 MΩ 1 kΩ … 250 kΩ

Setting range alarm
Setting range Pre-warning
Auxiliary voltage
Variant, if required
Contacts
Type

Accessories

RP5898:
Article number: 0066944
- Coupling device for RN 5897.12/010
- Extension of nominal voltage range U_N to DC max. 1000 V, AC max. 760 V
- Weight: approx. 110 g
- Dimensions
  - Width x height x depth: 70 x 90 x 71 mm

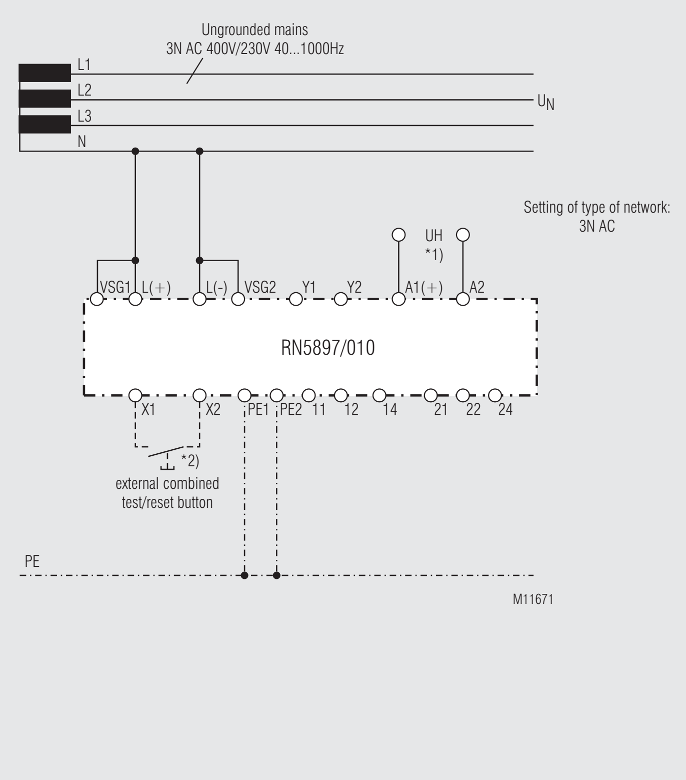


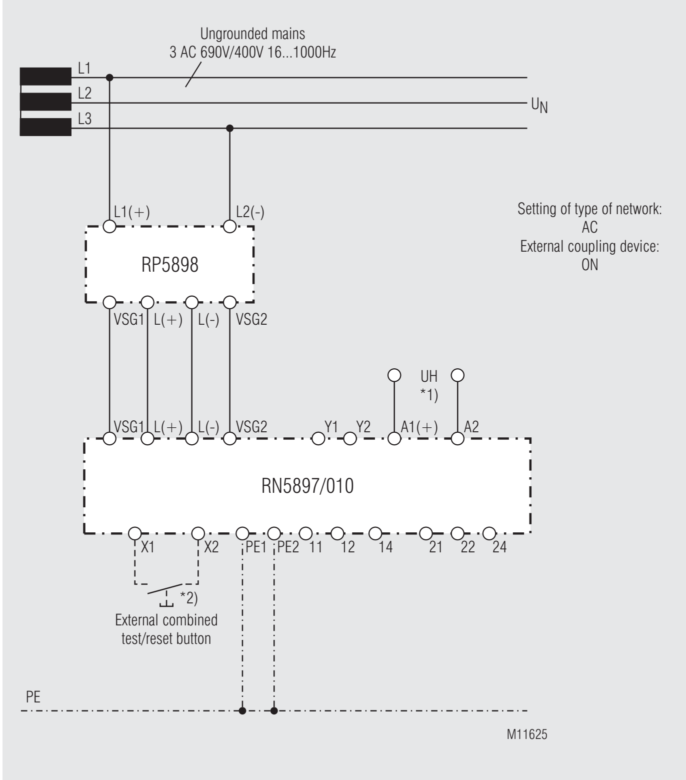
Connection Example

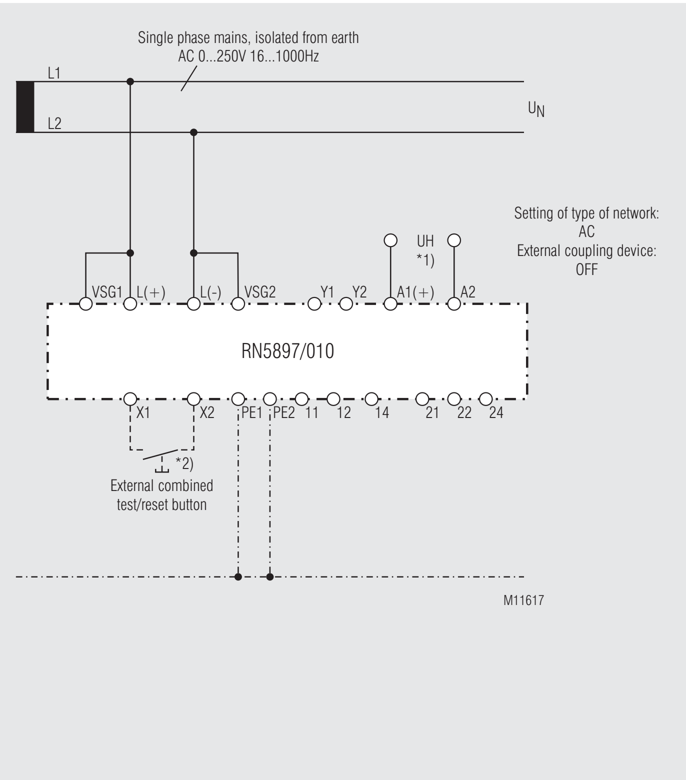
*1) Auxiliary voltage U_H (A1(+)/A2)) can also be sourced from the monitored voltage system. The voltage range of the auxiliary supply has to be taken into account.

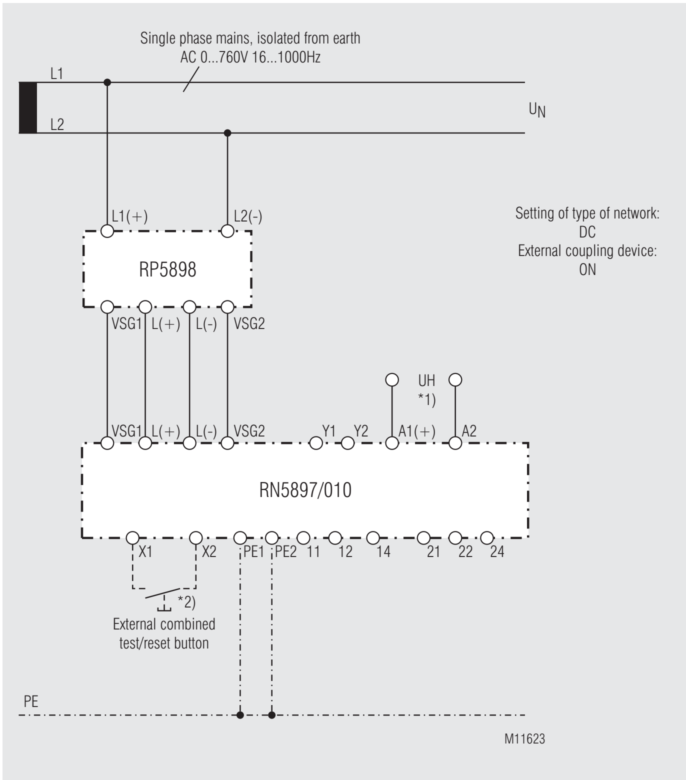
*2) Control input X1/X2 for external combined Test-/Reset-button:
- Control approx. 1 s: Test function
- Control > 3 s: Reset function

Connection Example









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The voltage range of the auxiliary supply has to be taken into account.

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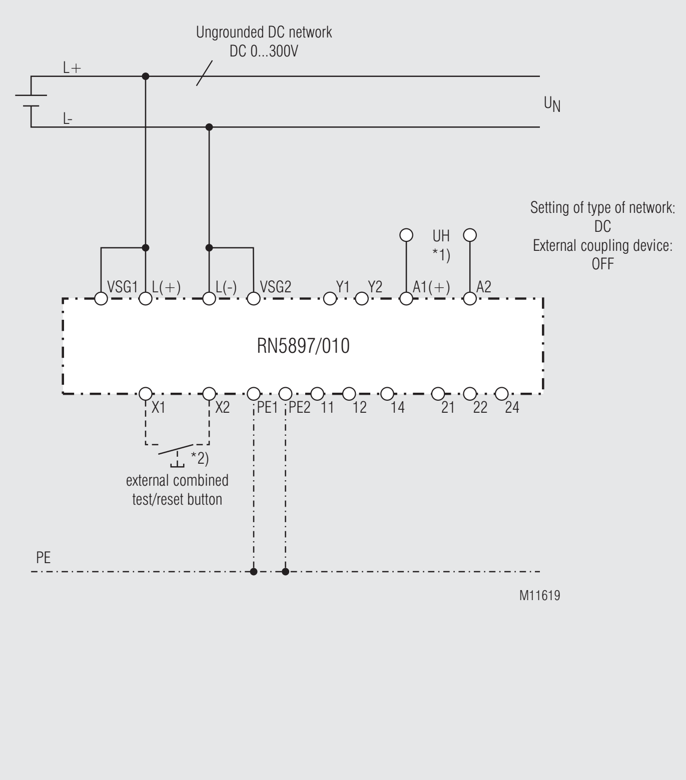
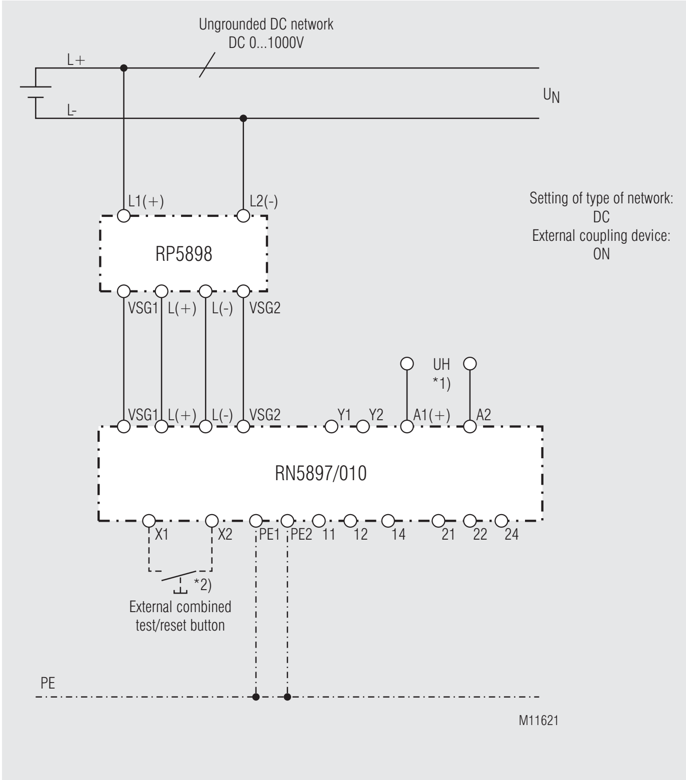
Connection Example





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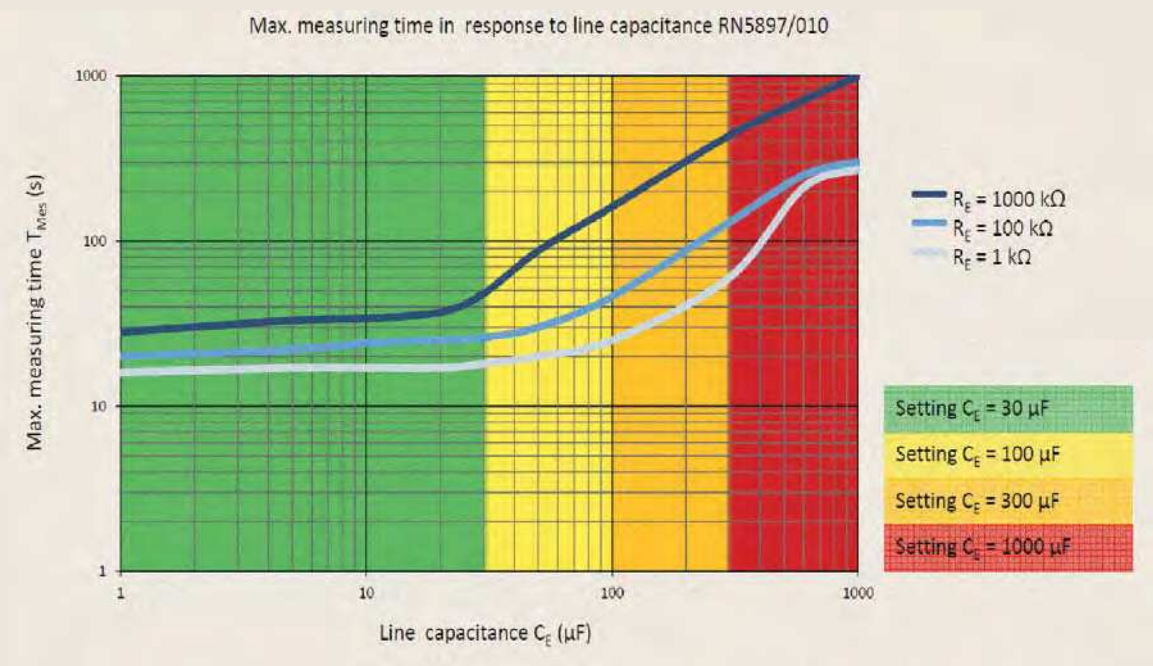


Max. measuring time in response to line capacitance RN5897/010
Max. measuring time T_{Mes} (s)
1000
100
10
1
1
10
100
1000
Line capacitance C_E (µF)
R_E = 1000 kΩ
R_E = 100 kΩ
R_E = 1 kΩ
Setting C_E = 30 µF
Setting C_E = 100 µF
Setting C_E = 300 µF
Setting C_E = 1000 µF

M11605

VARIMETER IMD
Insulation monitor
RN 5897/300

DOLD

0274214

Product Description

The insulation monitor RN 5897/300 of the VARIMETER IMD family provides best and up to date insulation monitoring of modern IT systems in an optimum and state of the art way fulfilling the relevant standards. The device can be used in the most flexible way for AC, DC and AC/DC systems. The adjustment of the setting values is simple and user friendly done on 3 rotary switches on the front of the device. Via multicolor LED the device status is indicated easy to read. With a sealable transparent cover the device is protectet against manipulation.

Your Advantages
- Preventivefire and system protection
- Detection of symmetric and asymmetric insulation faults
- Universal application in non-earthed AC, DC, AC/DC networks with up to 300 V nominal voltage
- Easy adjustment of response values and setting parameter via rotational switch
- Suitable for large leakage capacitances up to 30μF
- Monitoring also with voltage-free mains
- Measuring circuit L(+)/L(-) with broken wire detection (can be switched off)
- Protective conductor PE1/PE2 with broken wire detection (can't be switched off)
- No additional coupling device required

Features
- Insulation monitoring according to IEC/EN 61557-8
- 2 separate adjustable response thresholds (using e.g. for pre-Alarm and Alarm)
- Setting range of 1st response value (Pre-Alarm): 20 kΩ … 1 MΩ:
- Setting range of 2nd response value (Alarm): 10 kΩ … 250 kΩ
- 2 changeover contacts für insulation failures-Pre-Alarm and -Alarm
- Energized or de-energized on trip can be selected for indicator relay
- LED for status indication
- Automatic and manual device self-test
- Alarm storage selectable
- Protection against manipulation by sealable transparent cover
- External control input for combined Test-/Reset-button
- 3 wide voltage input for auxiliary voltage
- Width 52.5 mm

Approvals and Markings

CE	AC/DC

Applications

Insulation monitoring of:
- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Networks with frequency inverters
- Battery networks
- Networks with direct current drives
- Hybrid and battery-powered vehicles
- Mobile generator sets

Function

The device is supplied with DC auxiliary voltage via terminals A1(+) / A2. Switching on the auxiliary voltage (Power-On) is followed by an internal self-test for 10 sec (see „Device test functions“). The test process is visible in the status LED. After this, measurement of the insulation resistance in the measuring circuits begins and the the colour of the status LED changes to green.

Measuring circuit
(Insulation measurement between terminals L(+) / L(-) and PE1/PE2)
The terminals L(+) and L(-) are connected directly to the voltage system to be monitored. A broken wire detection creates a fault signal if there is no low-ohmic connection between both terminals.
The type of network (AC, DC, 3NAC) has to be selected.
Also the terminals PE1 and PE2 have to be connected with 2 separate wires to the protective earth. An interruption of a wire also causes a fault signal (see section "Behavior on faulty connection"). The monitoring of the PE connection cannot be de-activated.
To measure the insulation resistance an active measuring voltage with changing polarity is connected between L(+)/L(-) and PE1/PE2.
The duration of the positive and negative measuring phase depends on the actual leakage capacity of the monitored system and in DC systems also on the level and duration of possible voltage variations. This allows a correct and fast measurement in different network conditions.
At the end of a measuring cycle the actual insulation resistance is produced and indicated. The relays for alarm K1 and pre-alarm K2 switch when dropping under the adjusted response values. In addition the LED changes to orange color on pre-alarm or to red color on alarm.

Manual reset of fault message
The rotary switch "UN" is devided in 2 sections. So additional to the type of voltage system also manual or autoreset can be selected. (Alarm storing: manual reset, no alarm storing: auto reset).
If manual reset is activated the insulation fault signals of the measuring circuit are stored when dropping under the adjusted response values also if the insulation resistance goes back to healthy state. Pressing the „Reset“ button on the front side for 2 s, the alarm signal are reset if the actual insulation resistance is in healthy state.

Indicator relay for insulation fault signal
For the indicator relays K1 (contacts 11-12-14, for alarm) and K2 (contacts 21-22-24, for pre-alarm) the function energized on trip or de-energized on trip can be set via pre-alarm rotational switch "R_{pA}" when the insulation resistance drops below the adjusted response value.

Broken wire detection
As described in section "Measuring circut", the measuring circuits L(+)/L(-) and the protective conductors PE1/PE2 are constantly monitored for wire breaks – not only at Power-On or a manual or occasional automatic test. The response time of monitoring is only a few seconds. Broken wire detection between L(+) and L(-) is performed via coupled alternating voltage. This alternating voltage is short-circuited if the terminals are connected to the connected mains at low-resistance. The device detects that the mains to be monitored is properly connected.
Since this broken wire detection is carried out with alternating voltage, large capacitances should be avoided between L(+) and L(-), since the capacitive reactance of these capacitances also short-circuits this alternating voltage. The device would no longer detect a connection fault on L(+)/L(-).
Especially parallel lines should be avoided over larger distances.
If larger capacitances between L(+)/L(-) cannot be avoided or if the coupled alternating voltage interferes with the system, the broken wire detection can be de-activated using alarm rotary switch "R_A". Monitoring deactivated or continuous monitoring (every 2 minutes for 10 sec) are the possible options. If the broken wire detection on L(+)/L(-) is de-activated no AC voltage is injected.
The broken wire detection on PE1/PE2 cannot be de-activated.

Function

Device test functions
Principally, 2 different test functions are implemented: The "self-test" and the "expanded test":
The self-test of the device is performed automatically after Power-On and every full operating hours. It can also be triggered manually at any time by pressing the "Test" button at the device front for 2 sec.
With the self-test, contrary to the expanded test, the status of the Indicator relays is not affected; the sequence is as follows:
The self-test is indicated via LED with orange flash code 1. For approx. 4 s to negative test phase. Within these 4 s the internal measuring circuit is checked for failures. Then the measuring pulse is switched for approx.. 4 s to positive test phase and more internal tests take place. If no failures turned up and had been recognized, the measurement continuous. The extended test procedure is started when during or at the end of the above described self-test the test button is pressed again for 2 s.
The sequence is similar to the self-test (2 measuring phases of 4 s each) but in addition the output relays go in alarm stated. The LED shows orange flash code 2. The test phases of the extended test will be repeated continuously. Pressing the reset button again for 2 s will stop the extended test immediately. The device starts the insulation measurement again.

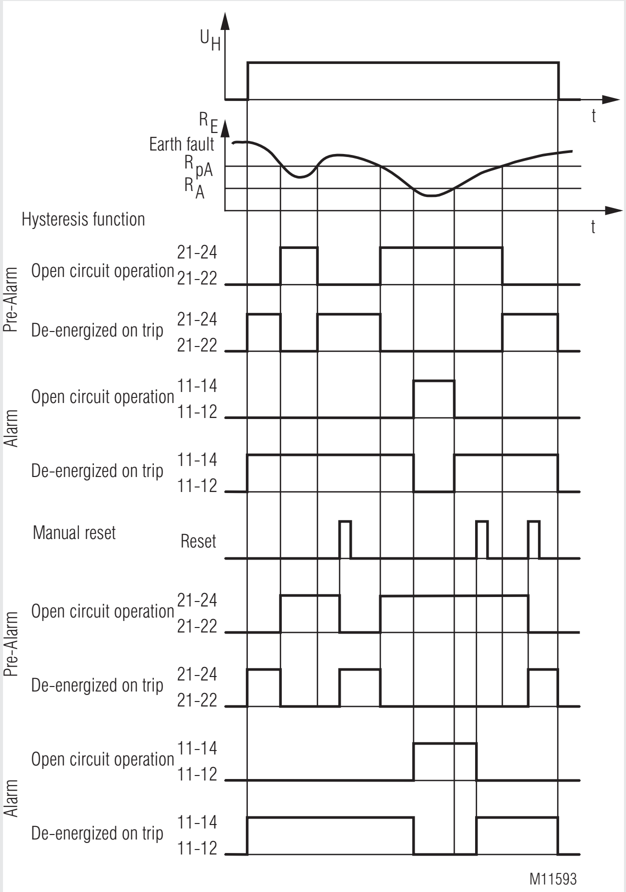
Behaviour with internal device faults
If internal device faults were detected during the test function, the LED flashes continuously red. The indicator relays K1 and K2 switch to the alarm state.

Behavior on faulty connection
When detecting broken wire on terminals L(+)/L(-), the measurement is disabled. The reaction time could be up to 2 min. The monitoring relays K1 and K2 go in alarm state, the LED indicates the red flash code 1. After removing the interruption the fault is automatically reset (max. reaction time up to 2 min) and the measurement of the insulation resistance is continued. Stored alarm values remain stored. An interruption of the protective earth connections PE1/PE2 causes the same reaction as interrupting the measuring circuit, only the LED indicate the red flash code 2.

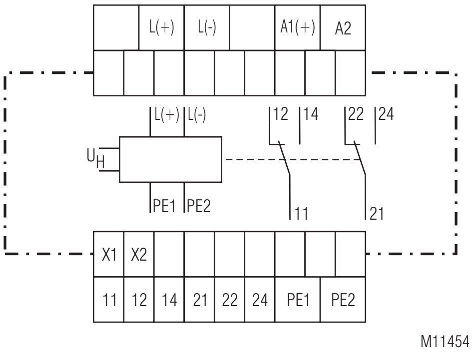
External control input
To terminals X1/X2 an external combined Test-/Reset button can be connected. If the terminals X1/X2 are bridged for approx.. 1 s the test mode is started. This has the same function as pressing the internal test button. When bridging X1/X2 for > 3 s, a stored alarm will be reset. This has the same function as pressing the internal reset button.

Programming/setting of parameters/set-up of the insulation monitor
All setting are done with 3 rotary switches on the front of the unit. To avoid unauthorized manipulation of the settings, all 3 switches are located behind a sealable transparent cover. The first rotary switch “R_A” sets the response value for alarm. In addition it is divided in 2 sections. If the setting position is in the first section the broken wire detection is permanent enabled, if the setting position is in the second section the broken wire detection is permanent disabled. The second rotary switch “R_{pA}” sets the response value for pre-alarm. In addition it is also divided in 2 sections. If the setting position is in the first section, the relay output function is de-energized on trip, if the setting position is in the second section, the relay output function is energized on trip.
The third rotary switch “UN” selects the type of network connection. It is also divided in 2 sections. If the setting position is in the first section, the unit is on auto reset, if the setting position is in the second section, the unit is on manual reset.
New settings are accepted without restart of the device.

Function Diagram



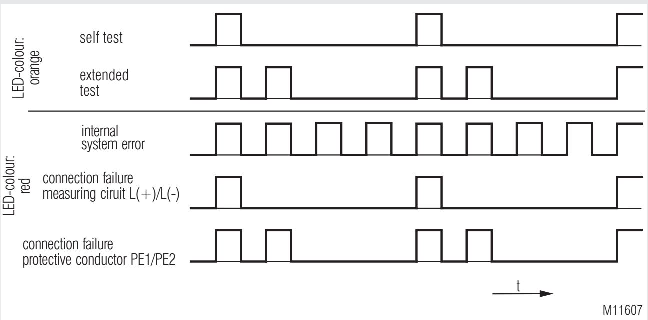
Circuit Diagram



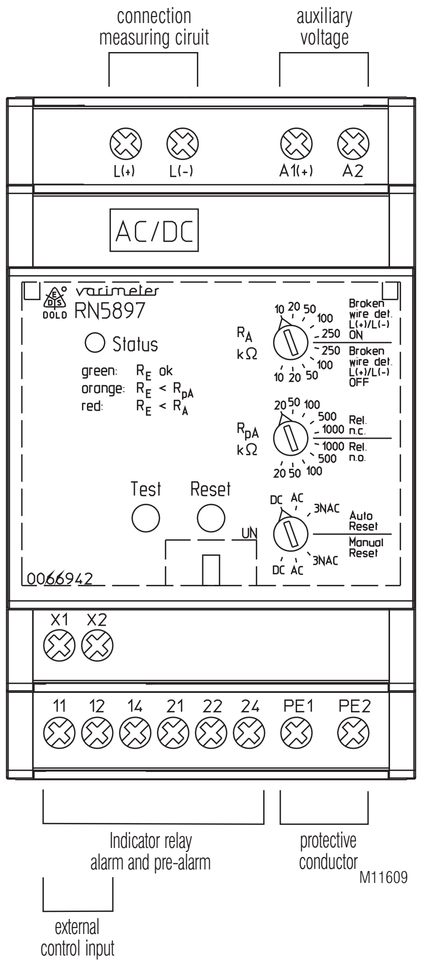
Connection Terminals

Terminal designation	Signal designation
A1(+), A2	Auxiliarx voltage AC or DC
L(+), L(-)	Connection for measuring ciruit
PE1, PE2	Connection for protective conductor
X1, X2	Control input (combined external Test- and Reset-input)
11, 12, 13	Alarm signal relay K1 (1 changeover contact)
21, 22, 23	Prewarning signal relay K2 (1 changeover contact)

Flashing Codes LED "ERR"



Indicators



Error Indication

Flash code red Status-LED	Failure cause	Failure recovery
1	Broken wire detection on L(+)/L(-).	Check measuring circuit L(+) and L (-)
2	Broken wire detection on PE1/PE2.	Check protective earth connections PE1 and PE2
continously flashing	Internal failure detected in test mode	Press test button again or restart the unit by interrupting the auxiliary supply temporarily. If the fault remains permanent, send device back to manufacturer for examination.
continously flashing	Faulty calibration values detected in device memory.	Send device back to manufacturer for recalobration and examination.

Indicators

The operational status of the device is indicated on a 3-colour LED:

Off:	No auxiliary voltage connected
Green:	Normal operation (Insulation resistance in healthy state)
Red:	Alarm (measured value below alarm response value)
orange:	Warning (measured value below pre-alarm response value)
orange flashing:	Test mode procedure (see flashing code diagramm)
red flashing:	Failure code (see flashing code diagramm)

Flash code orange Status-LED	Description
1	Selftest (measuring circuit, measuring voltage, internal tests)
2	Advanced Test (additional control of indicator relays)

Notes

In one voltage system only one insulation monitor can be used. This has to be observed when interconnecting two separate systems.

Device terminals PE1 and PE2 must always be connected via separate lines to different terminal points of the protective-conductor system.

The main measuring circuit can be connected with its terminals L(+) and L(-) both to the DC and also AC side of a mixed network; it is done most practically where the primary incoming power supply takes place e.g. battery networks with connected inverters on the DC side, with Generators/ Transformers with connected Rectifiers or inverters on the AC-side. To monitor a 3NAC system the device can be connected single pole, (L(+) and L(-) are bridged, to the neutral of the 3p4w system. The 3 phases have a low-ohmic (approx. 3 – 5 Ohm) connection via the transformer windings so also insulation failures of the not directly connected phases are detected. Via the rotational switch "UN" the correct type of network needs to be selected (see „Connection Examples").

Please do not connect external voltage to terminals X1/X2. The control must only be made by bridging X1 and X2.

ATTENTION !

The device must not be operated without PE1/PE2 connection!

Before checking insulation and voltage, disconnect the monitoring device RN 5897 from the power source!

WARNING

The device monitors HIGH-VOLTAGE!
Caution High-Voltage when working on the device!
Disconnect all power supplies before servicing equip-ment!

Technical Data

Measuring ciruit L(+) / L(-) to PE1 / PE2

Voltage range U_N:	DC 0 ... max. 300 V; AC 0 ... max. 300 V
Frequency range:	DC or 40 ... 1000 Hz
Max. line capacitance:	30 µF
Internal resistance (AC / DC):	> 120 kΩ
Measuring voltage:	approx. ± 90 V
Max. mesured current (R_E = 0):	< 0,80 mA
Response inaccuracy:	± 15 % ± 1.5 kΩ IEC 61557-8
Response value hysteresis:	approx. + 25 %; min. + 1 kΩ

On delay
at C_E = 1µF,
R_E of ∞ to 0.5 * response value: ≤ 1 s (at setting 3N AC)
< 5 s (at setting AC, DC)

Measuring time:
At C_E = 1 … 30 µF,
R_E from ∞ to 1000 kΩ,
R_E from ∞ to 100 kΩ,
R_E from ∞ to 1 kΩ: see characteristics

Response values:

Pre-warning („R_{pA}“):

kΩ:	20	50	100	500	1000

Alarm („R_A“)

kΩ:	10	20	50	100	250

each adjustable via rotational switches

Response value broken wire detection L(+)/L(-): > approx. 30 kΩ
Response value broken wire detection PE1/PE2: > approx. 0,5 kΩ

Auxiliary voltage input A1(+)/A2

Nom. Voltage	Voltage range	Frequency range
AC/DC 24 ... 60 V	AC 19 ... 68 V	45 … 400 Hz; DC 48 % W*)
	DC 16 ... 96 V	W*) ≤ 5 %
AC/DC 85 ... 230 V	AC 68 ... 276 V	45 … 400 Hz; DC 48 % W*)
	DC 65 ... 300 V	W*) ≤ 5 %
DC 12 ... 24 V	DC 9,6 ... 30 V	W*) ≤ 5 %

*) W = permitted residual ripple of auxiliary supply

Nominal consumption:
DC 24 V, 48 V: max. 3 W
AC 230 V: max. 3.5 VA

Control input X1/X2 for external kombinierte Test-/Reset-Taste

Current flow: approx. 3 mA
No-load operation voltage X1 to X2: ca. 12 V
Permissible wire length: < 50 m
Activation time for test signal: approx. 1 s
Activation time for reset signal: > 3 s

Outputs

Indicator contact: 2 x 1 changeover contact for Alarm (K1) and Pre-Alarm (K2)
energized or de-energized on trip (programmable)
Thermal current I_{th}: 4 A
Switching capacity
to AC 15:
NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: 2 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
at 5 A, AC 230 V: 1 x 10^5 switching cycles
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: 50 x 10^6 switching cycles

Technical Data

General Data

Operating mode: Continuous operation
Temperature range:
Operation: - 40 ... + 70 °C
Altitude: < 2.000 m IEC 60 664-1
Clearance and creepage distances
Rated insulation voltage: 300 V
Overvoltage category: III
rated impuls voltage / pollution degree: IEC 60 664-1
measuring circuit L(+)/L(-) to auxiliary voltage A1(+)/A2 and indicator relay contacts K1, K2: 4 kV / 2
auxiliary voltage A1(+)/A2 to indicator relay contacts K1, K2: 4 kV / 2
indicator relay contact K1 to indicator relay contacts K2: 4 kV / 2
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61000-4-2
HF irradiation:
80 MHz … 1 GHz: 20 V / m IEC/EN 61000-4-3
1 GHz … 2.7 GHz: 10 V / m IEC/EN 61000-4-3
Fast transients: 2 kV IEC/EN 61000-4-4
Surge voltage between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 20 V IEC/EN 61000-4-6
Interference suppression: Limit value classe B EN 55011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermpolastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm, Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 40 / 070 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection
Cross section: solid/stranded 0.5 ... 4 mm²
Stranded ferruled: 0.5 ... 2.5 mm²
Multiple wire connection: 0.5 ... 1.5 mm² (2 wires with same cross section)
Stripping length: 6.5 mm
max. fixing torque: 0.5 Nm
Wire fixing: box terminal with cross recess screw
Mounting: DIN rail IEC/EN 60715
Weight: approx. 200 g

Dimensions

Width x height x depth: 52.2 x 90 x 71 mm

Classification to DIN EN 50155

Vibration and shock resistance: Category 1, Class B IEC/EN 61 373
Protective coating of the PCB: No

Standard Types

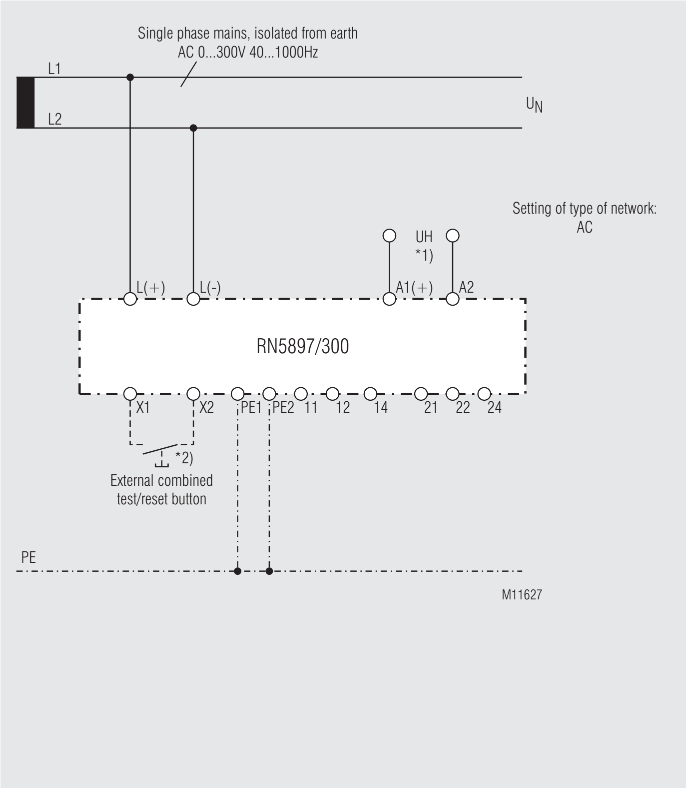
RN 5897.12/300 AC/DC 24 … 60 V
Article number: 0066942

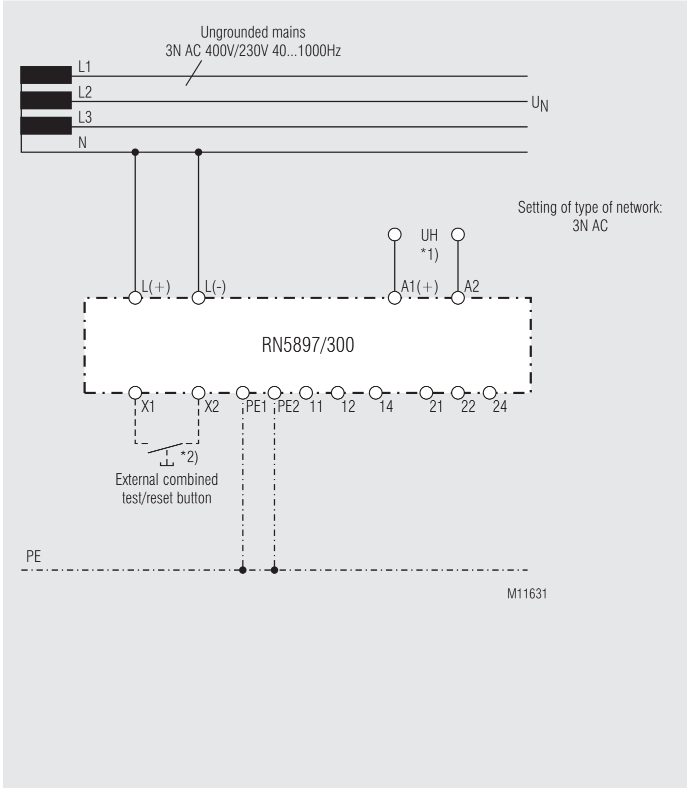
- Auxiliary voltage: AC/DC 24 … 60 V
- Outputs: 1 changeover contact for pre-warning
  1 changeover contact for alarm
- Setting range pre-warning: 20 kΩ … 1 MΩ
- Setting range alarm: 10 kΩ … 250 kΩ
- Max. line capacitance: 30 µF
- Energized or de-energized on trip
- Selection of type of network
- Width: 52.5 mm

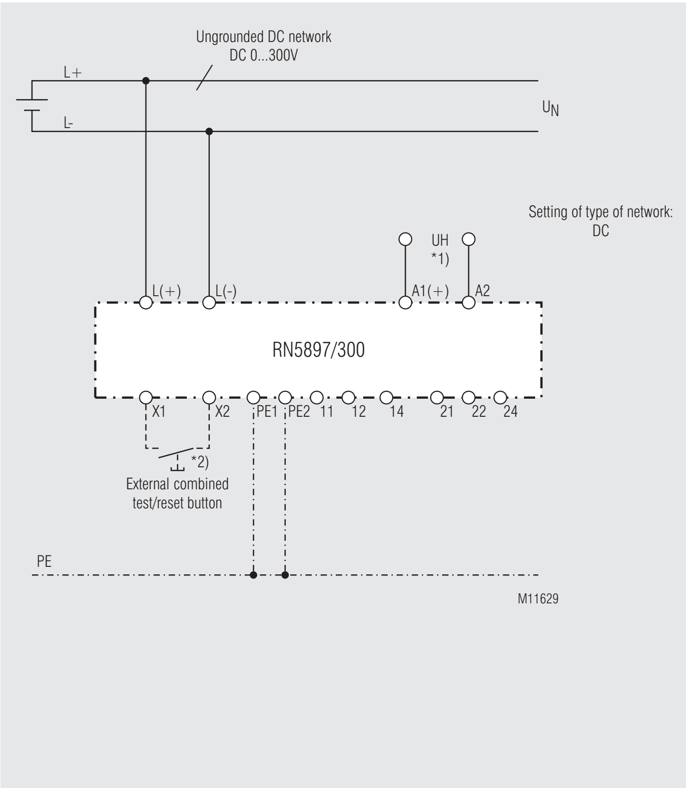
RN 5897.12/300 AC/DC 85 … 230 V
Article number: 0066943

- Auxiliary voltage: AC/DC 85 … 230 V
- Outputs: 1 Wechsler für Pre-Alarm
  1 Wechsler für Alarm
- Setting range pre-warning: 20 kΩ … 1 MΩ
- Setting range alarm: 10 kΩ … 250 kΩ
- Max. line capacitance: 30 µF
- Energized or de-energized on trip
- Selection of type of network
- Width: 52.5 mm

Connection Examples

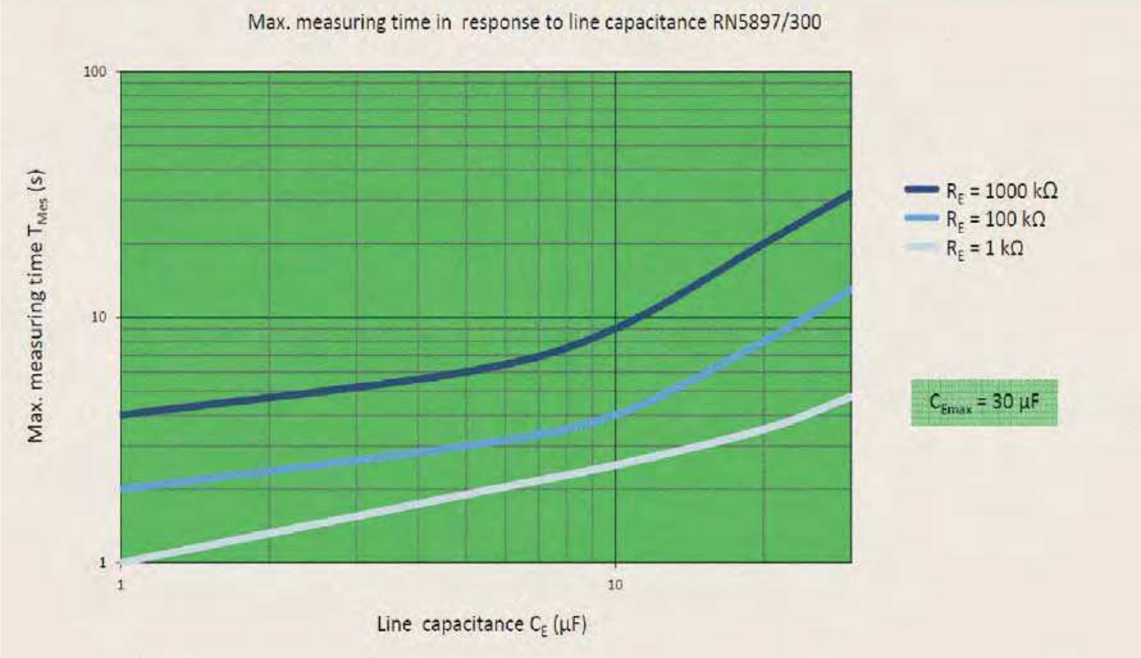






*1) Auxiliary voltage U_H (A1(+)/A2)) can also be sourced from the monitored voltage system.
The voltage range of the auxiliary supply has to be taken into account.

*2) Control input X1/X2 for external combined Test-/Reset-button:
- Control approx. 1 s: Test function
- Control > 3 s: Reset function


Max. measuring time in response to line capacitance RN5897/300
Max. measuring time T_{Mes} (s)
100
10
1
1
10
Line capacitance C_E (µF)
R_E = 1000 kΩ
R_E = 100 kΩ
R_E = 1 kΩ
C_{Emax} = 30 µF

M11611

VARIMETER IMD
Insulation monitor
LK 5896

DOLD

0269338

Product Description

The insulation monitor LK 5896 of the varimeter IMD family provides best and up to date insulation monitoring of modern IT systems in an optimum and state of the art way, fulfilling the relevant standards. The device can be used in the most flexible way for AC, DC and AC/DC systems even with large leakage capacity to earth (PE). The adjustment of the setting values is simple and user friendly done on 2 rotary switches on the front of the device. Via LEDs the measured value, device parameters and device status are indicated easy to read. The unit has 3 relay contacts to signal Insulation and device failures. The analogue output provides a voltage and current signal proportional to the actual insulation resistance, which can be connected to a superior control (plc), another system or external display unit. In addition the LK 5896 provides a second measuring circuit that can be used to monitor an inverter on the AC side also when the inverter is disconnected.

Your Advantages
- Preventivefire and system protection
- Quick fault localisation through selective earth fault detection to L+ and L-
- Universal application in non-earthed AC, DC, AC/DC networks with up to 1000 V nominal voltage
- Suitable for large leakage capacitances up to 3000µF
- Simplest setting via engaging rotary switches
- For monitoring photovoltaic system, also with thinfilm technology
- Optimised measuring times - normally shorter than with known methods
- Monitoring also with voltage-free mains
- Additional measuring circuit allows AC output monitoring even with the inverter switched off, e.g. with hybrid vehicles
- Measuring circuit with broken wire detection
- No additional coupling device required
- Trigger output for insulation fault locating system
- Analogue output for value of the insulation resistance: 0 ... 10 V / 0 ... 20 mA (2 ... 10 V / 4 ... 20 mA)

Features
- Insulation monitoring according to IEC/EN 61557-8
- Detection of symmetric and asymmetric insulation faults
- Measuring circuits can be disconnected via control terminals, e.g. for mains couplings
- 1 changeover contact each for prewarning and alarm
- 3. output relay for signalling wire break and device faults
- Prewarning threshold setting range: 20 kΩ ... 2 MΩ
- Alarm threshold setting range: 1 kΩ ... 250 kΩ
- Energized or de-energized on trip can be selected for output relay
- Setting the maximum leakage capacitance to shorten the response time
- Simple, clearly arranged adjustment of the device with screwdriver
- LED chain to indicate the current insulation resistance
- Display of active measuring circuits
- Automatic and manual device self-test
- Alarm storage selectable
- External test and reset pushbutton can be connected
- Width: 90 mm

Connection Terminals

Terminal designation	Signal designation
A1+, A2	DC-Auxiliary voltage
L(+), L(-)	Connection for main measuring circuit
U, V	Connection for auxiliary measuring circuit
KE, PE	Connection for protective conductor
G, R	Control input (manual/auto reset) G/R not bridged: manual reset G/R bridged: auto reset
G, T	Control input (External test input) connection option for external device test pushbutton
G, HM	Control input (main measuring circuit deactivation) G/HM not bridged: : Main measuring circuit activated G/HM bridged: Main measuring circuit deactivated
G, ZM	Control input (aux. measuring circuit deactivation) G/ZM not bridged: aux. measuring circuit deactivated G/ZM bridged: aux. measuring circuit activated
XA, GA, IA, UA	Analogue output XA/GA not bridged: UA-GA 0 ... 10V; IA-GA 0 ... 20mA XA/GA bridged: UA-GA 2 ... 10V; IA-GA 4 ... 20mA
Y1, Y2	Alarm trigger output for insulation fault locating system
11, 12, 14	Alarm signal relay (1 changeover contact)
21, 22, 24	Prewarning signal relay (1 changeover contact)
31, 32, 34	Device fault signal relay (1 changeover contact)

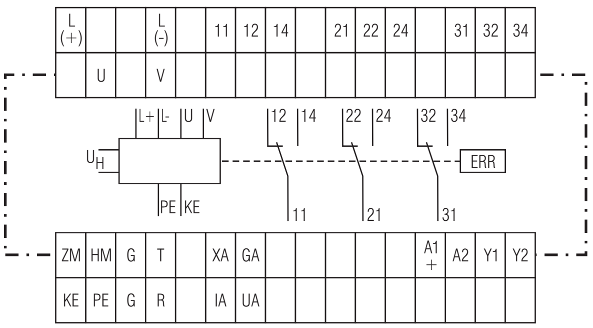
Approvals and Markings

CE	AC/DC	PV

Applications

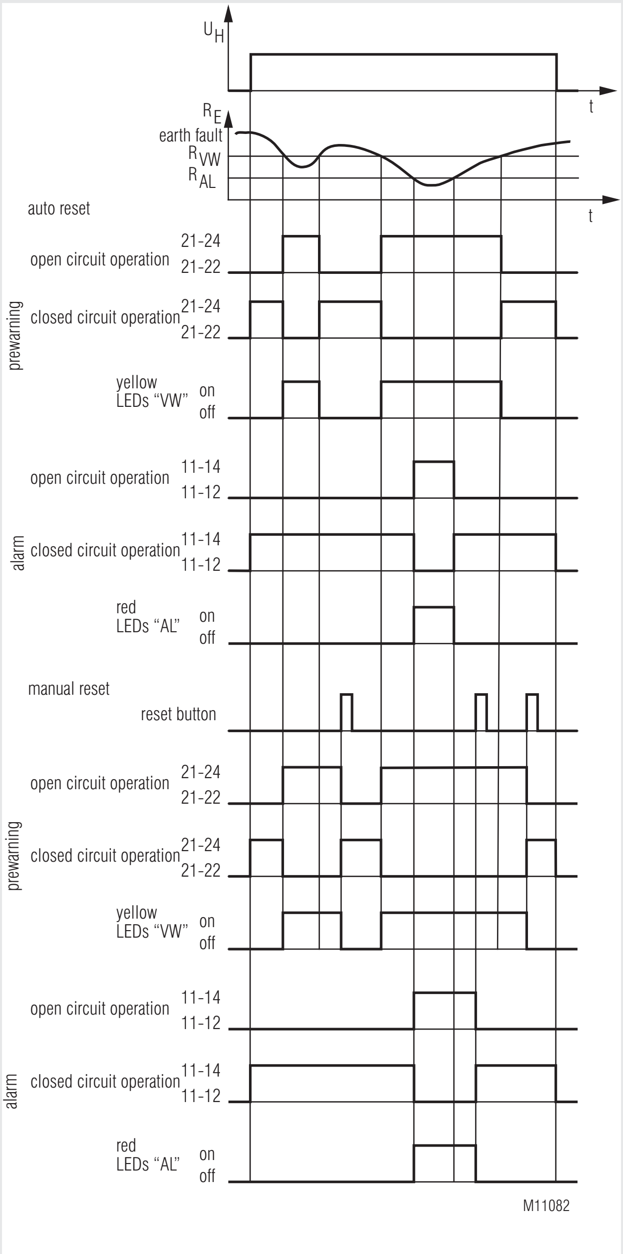
Insulation monitoring of:
- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Networks with frequency inverters
- Battery networks
- Networks with direct current drives
- Photovoltaic systems
- Hybrid and battery-powered vehicles

Circuit Diagrams

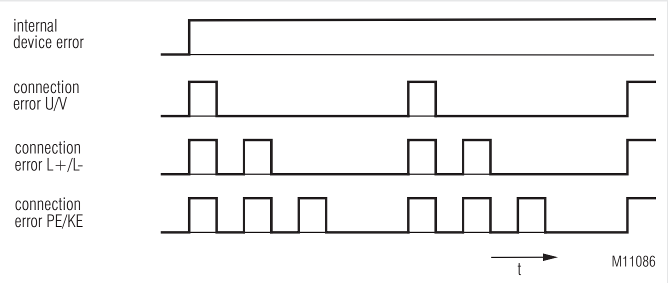


M10832_b

Function Diagram



Flashing Codes LED "ERR"



Function

The device is supplied with DC auxiliary voltage via terminals A1+ / A2; a green "PWR" LED comes on. Switching on the auxiliary voltage is followed by an internal self-test for 10 sec, where the LEDs of the indicator string light up in sequence. After this, measurement of the insulation resistance in the measuring circuits begins.

Main measuring circuit
(Insulation measurement between terminals L(+) / L(-) and PE / KE)
Terminals L(+) and L(-) are connected to the mains to be monitored. Broken wire detection, constantly effective during operation, generates an error messages if both terminals are not connected with low resistance through the mains.
In addition, the two terminals PE and KE must be connected to the protective conductor system via separate lines. An error message is given here as well if a line is interrupted (see section "Actions in case of connection faults").
If the main measuring circuit is activated (terminal HM open), an active measuring voltage with alternating polarity is applied between L(+) / L(-) and PE / KE to measure the insulation resistance. During the measuring phase with positive polarity, the "HM" LED flashes with a long On-phase and with negative polarity with a short On-phase.
The "HM" LEDs goes off when the main measuring circuit is switched off through bridges of terminals HM-G. Measurement is suspended and no more measuring voltage reaches the measuring circuit, so that in case of coupling to a network where another insulation monitor is already active, no interference can occur.
The length of the positive and negative measuring phases depends on the settings on the rotary switch "CE/µF", the actual leakage capacitance of the monitored network and with DC networks, on the level and duration of possible mains voltage fluctuations. Correct and preferably quick measurement is thus given with different mains conditions. In the event of particularly adverse conditions and major interferences, the measuring analysis can be steadied and delayed in addition with rotary switch "tv" if necessary.
The current insulation resistance is determined and analysed at the end of each measuring phase. The LED-chain and the analogue output show the resistance determined, and the output relays for prewarning "VW" and alarm "AL" switch according to the respective response values set. If the response thresholds have been undercut, the LEDs "VW" or "AL" light according to the insulation fault location: "+", "-" or "+" and "-" simultaneously for AC faults or symmetric insulation faults.

Auxiliary measuring circuit
(Insulation measurement between terminals U / V and PE / KE)
The main measuring circuit is connected at the DC side for photovoltaic systems and hybrid vehicles. The AC side is disconnected as long as the inverter is switched off and can therefore not be monitored by the main measuring circuit for insulation faults. However, it is useful to monitor the AC side already before activating the inverter for insulation faults to PE for the inverter not to be even activated in the output circuit in case of insulation faults. For this reason, the insulation monitor LK5896 is equipped with an auxiliary measuring circuit determining the insulation resistance of the AC side to PE / KE. To this end, terminals U and V are connected to any phase preferred on the AC side. Broken wire detection is effective here as well and generates an error message if terminals U / V are not connected at low resistance, e.g. via load resistors, transformer or motor windings.
The auxiliary measuring circuit is activated by bridging the device terminals ZM-G, for example, by the break contact of the (released) contactor that activates the inverter. The "ZM" LED lights when the auxiliary measuring circuit is activated.
The auxiliary measuring circuits monitors for the same response values as the main measuring circuit. The current insulation resistance in the auxiliary measuring circuit does not affect the analogue input but is displayed at values < approx. 1.7 MΩ on the LED-chain through corresponding LEDs, which are selected here in flashing function to distinguish from the main measuring circuit. The "ZM" LED flashes here at the same clock frequency. The LEDs of "VW" or "AL" flash if the respectively set response value is undercut only in the auxiliary measuring circuit.

Function

Storing insulation fault message
If terminal R is open, the insulation fault messages from the main and auxiliary measuring circuit are stored when the respective response value is undercut, but also when the insulation resistance returns to the OK-range. In addition, the temporary minimum values of the insulation resistance are indicated on the LED-chain through dimmed LEDs.
If the "Reset" button on the device front is pressed or terminal R is connected with G, the stored insulation fault messages are reset when the insulation resistance is again in the OK-range.

Output relay for insulation fault messages
The rotary switch "CE/µF Rel." allows selecting the operating current (A) or standby current (R) principle for the output relays "AL" (contacts 11-12-14) and "VW" (contacts 21-22-24).
With the operating current principle, the relays respond when the response values are undercut, with the standby current principle they release when the response values are undercut.
If 2 different response values are not needed, "VW" and "AL" can be set to the same value. The output relays switch together in this case.

Analogue output
The LK 5896 features a universal analogue output to display the current insulation resistance in the main measuring circuit: Terminal UA-GA: 0 ... 10 V and terminal IA-GA: 0 ... 20 mA. By bridging terminals XA-GA, the output can be switched to 2 ... 10 V and 4 ... 20 mA.

Trigger output for insulation fault locating system
This trigger output (Y1-Y2) can be coupled with the trigger input Y1-Y2 of RR 5886 to initiate automatic fault location with the insulation fault locating system, consisting of RR 5886 and RR 5887. The trigger output is activated when the measuring value drops under the Alarm response value (AL). As long as it stays under the response value or an alarm is stored, the trigger output Y1-Y2 remains active. To prevent insulation monitor LK 5896 from affecting insulation fault locating, RR 5886 generates the deactivation signal for LK 5896 at its terminals H-G. It is applied to terminals HM-G of LK 5896 and deactivates its measuring circuit.

Broken wire detection
As mentioned above, both the main measuring circuit and the auxiliary measuring circuit are constantly monitored for wire breaks – not only at Power-On or a manual or occasional automatic test. The response time of monitoring is only a few seconds. Broken wire detection between L(+) and L(-) is performed via coupled alternating voltage. This alternating voltage is short-circuited if the terminals are connected to the connected mains at low-resistance. The device detects that the mains to be monitored is properly connected.
Since this broken wire detection is carried out with alternating voltage, large capacitances should be avoided between L(+) and L(-), since the capacitive reactance of these capacitances also short-circuits this alternating voltage. The device would no longer detect a connection fault on L(+)/L(-).
Especially parallel lines should be prevented over larger distances.
If larger capacitances between L(+)/L(-) cannot be avoided or if the coupled alternating voltage interferes with the system, version LK 5896.13/101 (without broken wire detection on L(+)/L(-)) shall be used.

Device test functions
Principally, 2 different test functions are implemented: The "self-test" and the "expanded test":
The self-test of the device is performed automatically after Power-On and every 4 operating hours. It can also be triggered manually at any time by pressing the "Test" button at the device front or with an external pushbutton connected between terminals T and G.
With the self-test, contrary to the expanded test, the status of the output relays and the analogue output are not affected; the sequence is as follows:
Switching to the negative measuring phase is performed for 4 sec. The "HM" LED flashes here with a brief On-phase. The LEDs of the LED-chain are selected in sequence and the internal circuit is checked. After this, switching to the positive measuring phase is performed for 4 sec. The "HM" LED flashes here with a long On-phase. The LED-chain cycles again and additional internal tests are performed. Insulation measurement continues normally after a pause of 2 sec if no faults have occurred.

Function

The expanded test is started when the internal or external "Test" button is pressed (or is still held) at the end of the 8 sec self-test, described above. The sequence is the same as with the self-test (2 measuring phases at 4 sec + 2 sec pause); however, the output relays "AL" and "VW" as well as the associated LEDs switch to the alarm state and the analogue output proceeds to its lowest value.
If the Reset button is pressed during the 8 sec or terminals R-G are connected, the expanded test is terminated after these 8 sec. Otherwise, the phases of the expanded test are constantly repeated, where, in addition, the "ERR" LED and the fault signalling relay (contacts 31-32-34) constantly receive current. However, the expanded test is terminated as soon as the Reset button is pressed. The device switches to the OK-state and restarts insulation measurement.

Behaviour with internal device faults
If internal device faults were detected during the test function, the "ERR" LED is lit continuously and the fault signalling relay (31-32-34) responds. The main measuring circuit is deactivated internally ("HM" LED goes off). The output relays "AL" and "VW" as well as the associated LEDs switch to the alarm state. The analogue output proceeds to its lowest value and all LEDs of the LED-chain extinguish.

Behaviour with connection faults
IIf the auxiliary measuring circuit is activated by bridging terminals ZM-G, broken wire detection in the auxiliary measuring circuit at U / V is signalled by the "ERR" LED flashing with "Error code 1" and the fault signalling relay responds. Measurement and analysis for the main measuring circuit continue normally.
Measurement is suspended if a line interruption is detected at terminals L(+) / L(-); the "HM" LED goes off. The state of the output relays "AL" / "VW" and associated LEDs, the display of the LED-chain and the analogue output are "frozen". This Broken wire detection is signalled by the "ERR" LED flashing with "Error code 2" and the fault signalling relay responds. Measurement of the connection insulation resistance restarts after the connection interruption has been corrected. However, stored alarm messages are preserved. If the connections PE / KE to the protective-conductor system are interrupted, the same responses take place as with an interruption at terminals L(+) / L(-), only that the "ERR" LED indicates "Error code 3".

Indicators

green LED „PWR“:	on when auxiliary supply connected	
red LED „ERR“:	permanent on:	at system error
	flashing:	at connection failure
green LED „HM“:	flashing:	at active main measuring ciruit,
	ON-OFF-ratio per measurement phase:	long ON period during measurement phase with positiv polarity short ON period during measurement phase with negative polarity
green LED „ZM“:	permanent on:	at active auxiliary measuring circuit,
	flashing:	ar RE < 2 MΩ
yellow LED-chain:	8 LEDs indicate the actual insulating resistance (≤ 10 kΩ ... ≥ 2 MΩ)	
	flashing:	for auxiliary measuring circuit
yellow LED „VW +“:	permanent on:	RE lower then prewarning value to + potential
	flashing:	for auxiliary measuring circuit
yellow LED „VW -“:	permanent on:	RE lower then prewarning value to - potential
	flashing:	for auxiliary measuring circuit
yellow LEDs „VW +“ and „VW -“ simultaneity:	permanent on:	AC-fault / symmetric fault
	flashing:	for auxiliary measuring circuit
red LED „AL +“:	permanent on:	tRE lower then tripping value to + potential
	flashing:	for auxiliary measuring circuit
red LED „AL -“:	permanent on:	RE lower then tripping value to - potential
	flashing:	for auxiliary measuring circuit
red LEDs „AL +“ And „AL -“ simultaneity:	permanent on:	AC-fault / symmetric fault
	flashing:	for auxiliary measuring circuit

Notes

Device terminals PE and KE must always be connected via separate lines to different terminal points of the protective-conductor system. The main measuring circuit can be connected with its terminals L(+) and L(-) both to the DC and also AC side of a mixed network; it is done most practically where the primary incoming power supply takes place. Selector switch "tv / UN" should be set accordingly. For photovoltaic systems and hybrid vehicles, the main measuring circuit of the LK 5896 is connected on the DC side; the auxiliary measuring circuit can then be used to monitor the (deactivated) AC side.

For the main measuring circuit, the nominal voltage range for DC is specified with 1000 V; however, absolute values up to max. DC 1500 V are permissible.

Only one insulation monitor may be active in a network to be monitored, since the devices would otherwise influence each other. When coupling several networks or incoming feed sections, where each of them is equipped with its own insulation monitor, all of them must be deactivated except for one insulation monitor. Such deactivation can be beneficially handled via the HM-G control terminals with the LK 5896. The main measuring circuit is designed for large leakage capacitances up to 3000 μF. The selection switch "CE/μF" must be set accordingly. Measurement of the insulation resistances is not falsified by this; however, longer periods are required for the measuring phases than with small capacitances. If the maximum approximate leakage capacitance is known, the selector switch "CE/μF" can possibly be set to smaller values, which reduces the response time further.

The measuring circuit should not be connected via longer parallel guided wires, as this may interfere with the broken wire detection. Also large capacities between L(+) und L(-) have to be avoided.

No external potentials may be connected to control terminals "ZM", "HM", "T" and "R". The associated reference potential is "G" (identical with PE), and the connection of the terminals is made via bridges to "G".

The analogue output and trigger output Y1-Y2 are electrically separated from the rest of the circuitry. The trigger output is intended for connection to the DOLD insulation fault locator system, consisting of RR 5886 and RR 5887. No external voltages may be applied.

Attention !

The device must not be operated without KE/PE connection.

Before making insulation and voltage tests, the monitor LK 5896 has to be disconnected. !

The voltage of the monitored voltage system is connected to terminals L(+) / L(-). Please observe sufficient distance to terminals of neighbour devices and to the grounded metal cabinet or box (min 0.5 cm).

WARNING

The device monitors HIGH-VOLTAGE
Caution High-Voltage when working on the device!
Disconnect all power supplies before servicing equipment!

Technical Data

Main measuring ciruit L(+) / L(-) to PE / KE

Nominal voltage U_N: DC 0 ... 1000 V; AC 0 ... 1000 V
Voltage range: DC max. 1500 V; AC max. 1100 V
Frequency range: DC or 16 ... 1000 Hz
Max. line capacitance: 3000 µF
Internal resistance (AC / DC): > 280 kΩ
Measuring voltage: approx. ± 95 V
Max. mesured current (R_E = 0): < 0.35 mA

Auxiliary measuring circuit U / V to PE / KE

Nominal voltage U_N: AC 0 ... 690 V
Voltage range: 0 ... 1.1 U_N
Frequency range: 16 ... 1000 Hz
Max. line capacitance: 10 µF
Internal resistance (AC / DC): approx. 2 MΩ
Measuring voltage: approx. 12 V
Max. mesured current (R_E = 0): approx. 6 µA

Response values R_E

Pre-warning („VW“):

kΩ:	20	30	50	70	100	150	250	500	1000	2000

Alarm („AL“)

kΩ:	1	2	10	20	30	50	70	100	150	250

each adjustable via rotational switches

Response inaccuracy: ± 15 % + 1.5 kΩ IEC 61557-8
Schaltpunkt-Hysterese
at range 10 kΩ ... 700 kΩ: approx. 25 %
out of range: approx. 40 % + 0.5 kΩ
On delay
at C_E = 1µF,
R_E of ∞ to 0,5 * response value: < 10 s
Measuring time: siehe Kennlinie

Input auxiliary voltage

DC-Input (A1+ /A2)
Nominal voltage U_H: DC 24 V
Voltage range: DC 20 ... 30 V
Nominal consumption: max. 5 W

Control input (between ZM, HM, T, R and G)

Current flow: approx. 3 mA
No-load voltage to G: approx. 12 V
Permissible wire length: < 50 m
Min. activation time: 0.5 s

Output

Contacts: 3 x 1 changeover contacts for VW, AL and ERR
Thermal current I_{th}: 4 A
Switching capacity
to AC 15:
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
at 8 A, AC 250 V: 1 x 10^4 switching cycles
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: 10 x 10^6 switching cycles

Analogue output

for actual insulating value, galvanic separation
Terminals IA(+) / GA: 0 ... 20 mA (bridge XA-GA: 4 ... 20 mA); max. burden 500 Ω
Terminals UA(+) / GA: 0 ... 10 V (bridge XA–GA: 2 ... 10 V); max. current 10 mA
Scaling
lower analogue value: R_E = 0;
upper analogue value: R_E = ∞
Middle of range: R_E = 289 kΩ
Formula example
for 0-10V: RE = 289 kΩ / (10V / UA – 1)
for 2-10V: RE = 289 kΩ / (8V / (UA-2V) – 1)

Technical Data

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 25 ... + 60 °C (device mounted away from heat generation components)
- 25 ... + 45 °C (device mounted without distance heated by devices with same load)
Storage: - 40 ... + 70 °C
Relative air humidity: 93 % bei 40 °C
Atmospheric pressure: 860 ... 1600 mbar (86 ... 106 kPa)
Altitude: < 4.000 m IEC 60 664-1
Clearance and creepage distances
rated impulse voltage / pollution degree IEC 60 664-1
Main measuring ciruit L(+) / L(-) to auxiliary voltage DC and relay contacts VW, AL, ERR and analogue output IA, UA, GA and trigger output Y1-Y2: 8 kV / 2
auxiliary measuring circuit U / V to auxiliary voltage DC and relay contacts VW, AL, ERR and analogue output IA, UA, GA and trigger output Y1-Y2: 8 kV / 2
auxiliary voltage DC and trigger output Y1-Y2 to relay contacts VW, AL, ERR and analogue output IA, UA, GA: 8 kV / 2
relay contact VW to relay contact AL to relay contact ERR: 4 kV / 2
analogue output IA, UA, GA to relay contacts VW, AL, ERR and trigger output Y1-Y2: 4 kV / 2
trigger output Y1-Y2 to relay contacts VW, AL, ERR: 4 kV / 2
Insulation test voltage
Routine test: AC 5 kV; 1 s
AC 2,5 kV; 1 s

EMC
Electrostatic discharge (ESD): 8 kV (air) IEC / EN 61000-4-2
HF irradiation:
80 MHz ... 2.7 GHz: 10 V / m IEC / EN 61000-4-3
Fast transients: 4 kV IEC / EN 61000-4-4
Surge voltages
between A1 - A2: 1 kV IEC/EN 61000-4-5
between L(+) - L(-): 2 kV IEC/EN 61000-4-5
between A1, A2 - PE and L(+), L(-) - PE: 4 kV IEC/EN 61000-4-5
between control line: 0,5 kV IEC/EN 61000-4-5
between control line and earth: 1 kV IEC/EN 61000-4-5
HF-wire guided 10V IEC / EN 61000-4-6
Interference suppression: Limit value class A*)
*) The device is designed for the usage under industrial conditions (Class A, EN 55011).
When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermpolastic with V0 behaviour according to UL subject 94
Vibration resistance: IEC/EN 60 068-2-6
Amplitude 0.35 mm
frequency 10 ... 55 Hz
Amplitude ± 1mm, frequency 2 ... 13.2 Hz
13.2 ... 100 Hz, acceleration ± 0.7 g_n
Shock resistance: 10 g_n / 11 ms, 3 pulses IEC/EN 60068-2-27
Climate resistance: 25 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005

Technical Data

Wire connection DIN 46 228-1/-2/-3/-4

Screw terminals (fixed): 1 x 4 mm² solid or
1 x 2,5 mm² stranded ferruled (isolated)
or
2 x 1,5 mm² stranded ferruled (isolated)
DIN 46228-1/-2/-3-4
or
2 x 2,5 mm² stranded ferruled (isolated)
DIN 46228-1/-2/-3

Insulation of wires or sleeve length: 8 mm

Wire fixing: Plus-minus terminal screws M3,5 terminal with wire protection

Fixing torque: 0.8 Nm

Mounting: DIN rail IEC / EN 60715

Weight: approx. 584 g

Dimensions

Width x height x depth: 90 x 90 x 121 mm

Standard Type

LK 5896.13/100 DC 20 ... 30 V

Article number: 0065131

- Outputs: 1 changeover contact for pre-warning
  1 changeover contact for alarm
  1 changeover contact for connection- / system error
- Auxiliary measuring circuit for inverter output
- Auxiliary voltage: DC 20 ... 30 V
- Setting range pre-warning: 20 kΩ ... 2 MΩ
- Setting range alarm: 1 kΩ ... 250 kΩ
- Adjustable line capacitance
- Open- / or closed circuit operation
- Adjustable time delay / selection of AC or DC connection
- Analogue output: 0 ... 20 mA / 4 ... 20 mA; 0 ... 10 V / 2 ... 10 V
- Trigger output for insulation fault locating system
- Width: 90 mm

Variant

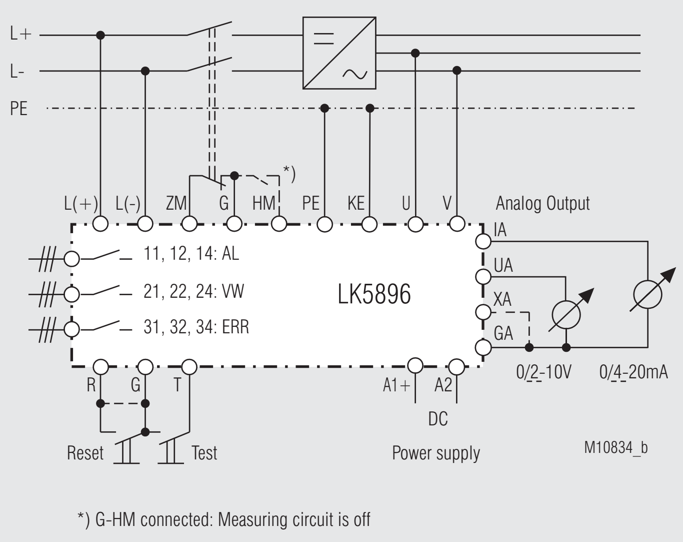
LK 5896.13/101: without wire-break detection at L(+)/L(-)

Accessories

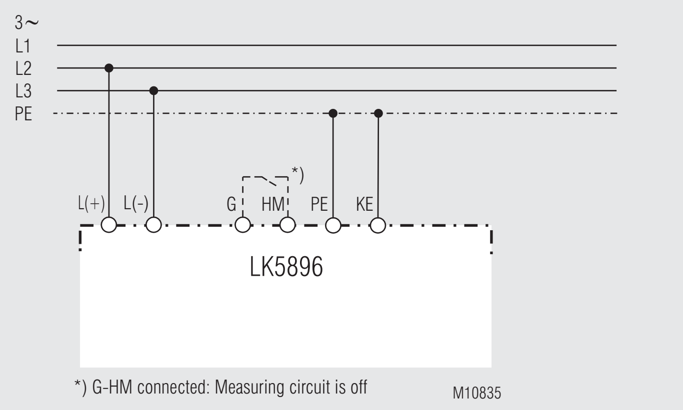
EH 5861/005: Indicating instrument,
degree of protection: IP 52
Article number: 0067516

The indicating device EH 5861 is externally connected to the insulation monitor on terminals UA / GA (0 - 10 V) and shows the actual insulation resistance of the voltage system to ground.
Dimensions:
Width x heigth x depth
96 x 96 x 52 mm

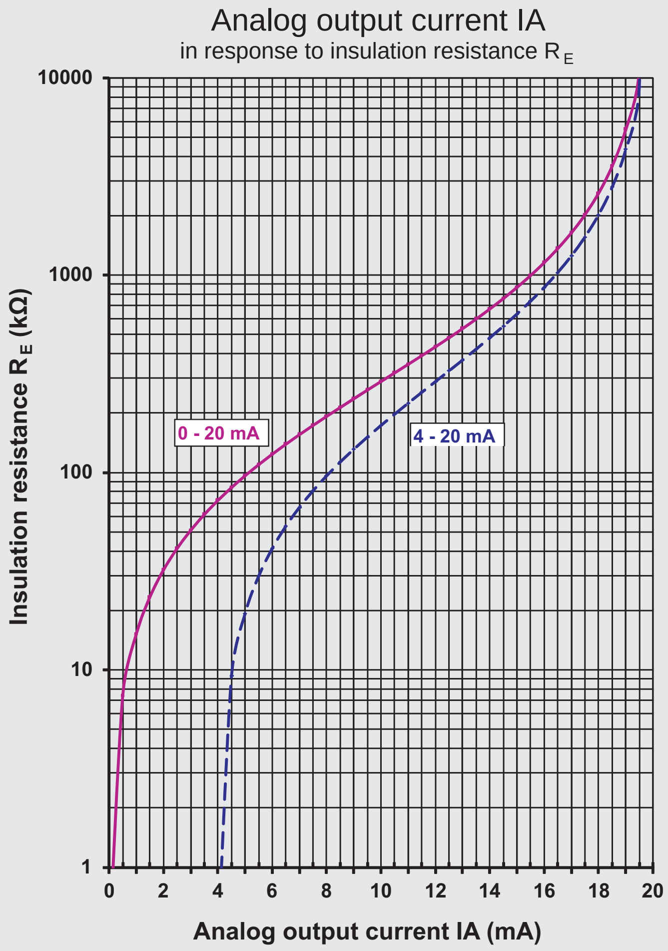
Connection Examples

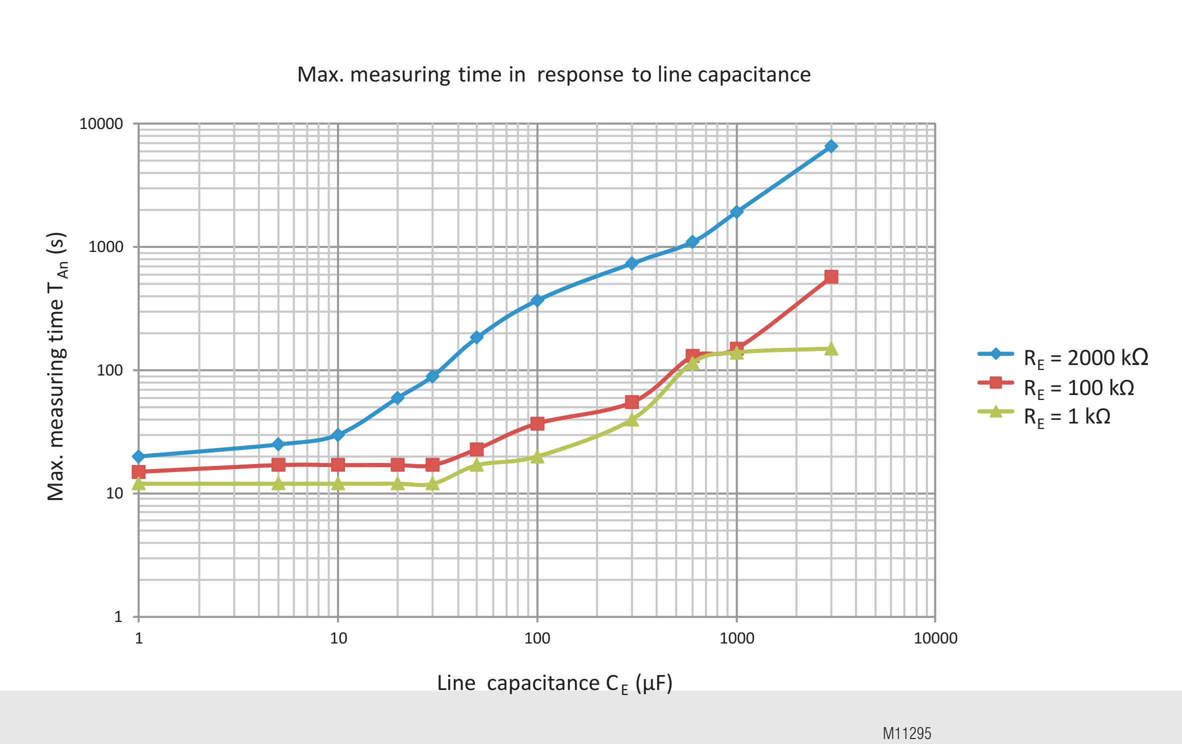


Insulation monitoring DC-side



Insulation monitoring AC-side


Analog output current IA
in response to insulation resistance R E
10000
1000
100
10
1
Insulation resistance R E (kΩ)
0 - 20 mA
4 - 20 mA
0
2
4
6
8
10
12
14
16
18
20
Analog output current IA (mA)


Max. measuring time in response to line capacitance
10000
1000
100
10
1
Max. measuring time T An (s)
1
10
100
1000
10000
Line capacitance C E (µF)
R E = 2000 kΩ
R E = 100 kΩ
R E = 1 kΩ
M11295

VARIMETER IMD
Insulation monitor
LK 5895

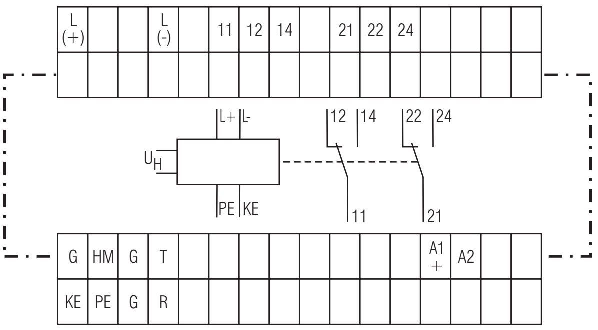
DOLD

0269336

Product Description

The insulation monitor LK 5895 of the varimeter IMD family provides best and up to date insulation monitoring of modern IT systems in an optimum and state of the art way fulfilling the relevant standards. The device can be used in the most flexible way for AC, DC and AC/DC systems even with large leakage capacity to earth (PE). The adjustment of the setting values is simple and user friendly done on 2 rotary switches on the front of the device. Via LEDs the measured value, device parameters and device status are indicated easy to read.

Circuit Diagram



M10839_a

Connection Terminals

Terminal designation	Signal designation
A1+, A2	DC-Auxiliary voltage
L(+), L(-)	Connection for measuring ciruit
KE, PE	Connection for protective conductor
G, R	Control input (manual/auto reset) G/R not bridged: manual reset G/R bridged: auto reset
G, T	Control input (External test input) connection option for external device test pushbutton
G, HM	Control input (measuring circuit deactivation) G/HM not bridged: measuring circuit activated G/HM bridged: measuring circuit deactivated
11, 12, 14	Alarm signal relay (1 changeover contact)
21, 22, 24	Prewarning signal relay (1 changeover contact)

Your Advantages
- Preventivefire and system protection
- Quick fault localisation through selective earth fault detection to L+ and L-
- Universal application in non-earthed AC, DC, AC/DC networks with up to 1000 V nominal voltage
- Suitable for large leakage capacitances up to 3000µF
- Simplest setting via engaging rotary switches
- For monitoring photovoltaic system, also with thinfilm technology
- Optimised measuring times – normally shorter than with known methods
- Monitoring also with voltage-free mains
- Measuring circuit with broken wire detection
- No additional coupling device required

Features
- Insulation monitoring according to IEC/EN 61557-8
- Detection of symmetric and asymmetric insulation faults
- Measuring circuits can be disconnected via control terminals, e.g. for mains couplings
- 1 changeover contact each for prewarning and alarm
- Prewarning threshold setting range: 20 kΩ ... 2 MΩ
- Alarm threshold setting range: 1 kΩ ... 250 kΩ
- Energized or de-energized on trip can be selected for output relay
- Setting the maximum leakage capacitance to shorten the response time
- Simple, clearly arranged adjustment of the device with screwdriver
- LED chain to indicate the current insulation resistance
- Display of active measuring circuits
- Automatic and manual device self-test
- Alarm storage selectable
- External test and reset pushbutton can be connected
- Width 90 mm

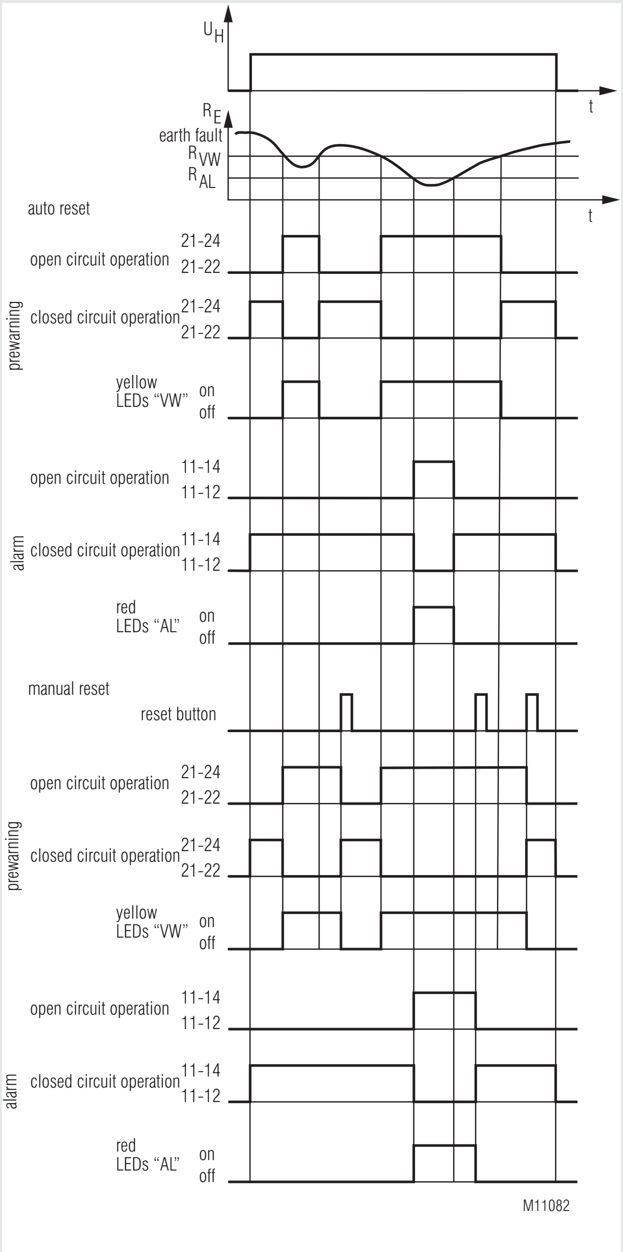
Approvals and Markings

CE	AC/DC	PV

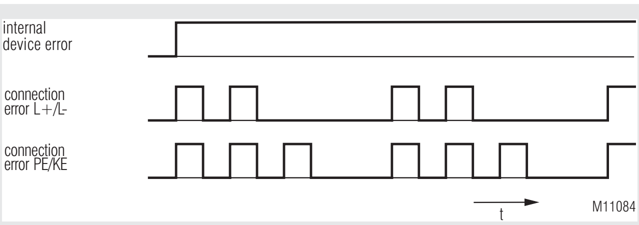
Applications

Insulation monitoring of:
- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Networks with frequency inverters
- Battery networks
- Networks with direct current drives
- Photovoltaic systems
- Hybrid and battery-powered vehicles

Function Diagram



Flashing Codes LED "ERR"



Function

If the device is supplied with DC auxiliary voltage, the a green "PWR" LED comes on. Switching on the auxiliary voltage is followed by an internal self-test for 10 sec, where the LEDs of the indicator string light up in sequence. After this, measurement of the insulation resistance in the measuring circuits begins.

Measuring circuit
(Insulation measurement between terminals L(+) / L(-) and PE / KE)
Terminals L(+) and L(-) are connected to the mains to be monitored. Broken wire detection, constantly effective during operation, generates an error messages if both terminals are not connected with low resistance through the mains.
In addition, the two terminals PE and KE must be connected to the protective conductor system via separate lines. An error message is given here as well if a line is interrupted (see section "Actions in case of connection faults").
If the main measuring circuit is activated (terminal HM open), an active measuring voltage with alternating polarity is applied between L(+) / L(-) and PE / KE to measure the insulation resistance. During the measuring phase with positive polarity, the "HM" LED flashes with a long On-phase and with negative polarity with a short On-phase. The "HM" LEDs goes off when the main measuring circuit is switched off through bridges of terminals HM-G. Measurement is suspended and no more measuring voltage reaches the measuring circuit, so that in case of coupling to a network where another insulation monitor is already active, no interference can occur.
The length of the positive and negative measuring phases depends on the settings on the rotary switch "CE/µF", the actual leakage capacitance of the monitored network and with DC networks, on the level and duration of possible mains voltage fluctuations. Correct and preferably quick measurement is thus given with different mains conditions. In the event of particularly adverse conditions and major interferences, the measuring analysis can be steadied and delayed in addition with rotary switch "tv" if necessary.
The current insulation resistance is determined and analysed at the end of each measuring phase. The LED-chain show the resistance determined, and the output relays for prewarning "VW" and alarm "AL" switch according to the respective response values set. If the response thresholds have been undercut, the LEDs "VW" or "AL" light according to the insulation fault location: "+", "-" or "+" and "-" simultaneously for AC faults or symmetric insulation faults.

Storing insulation fault message
If terminal R is open, the insulation fault messages (relay, LEDs) are stored when the respective response value is undercut, but also when the insulation resistance returns to the OK-range. In addition, the temporary minimum values of the insulation resistance are indicated on the LED-chain through dimmed LEDs.
If the "Reset" button on the device front is pressed or terminal R is connected with G, the stored insulation fault messages are reset when the insulation resistance is again in the OK-range.

Output relay for insulation fault messages
The rotary switch "CE/µF Rel." allows selecting the open circuit (A) or closed circuit (R) operation for the output relays "AL" (contacts 11-12-14) and "VW" (contacts 21-22-24).
With the open circuit operation, the relays respond when the response values are undercut, with the closed circuit operation they release when the response values are undercut.
If 2 different response values are not needed, "VW" and "AL" can be set to the same value. The output relays switch together in this case („2u").

Broken wire detection
As mentioned above, all terminals of the measuring circuit are constantly monitored for wire breaks - not only at Power-On or a manual or occasional automatic test. The response time of monitoring is only a few seconds.
Broken wire detection between L(+) and L(-) is performed via coupled alternating voltage. This alternating voltage is short-circuited if the terminals are connected to the connected mains at low-resistance. The device detects that the mains to be monitored is properly connected. Since this broken wire detection is carried out with alternating voltage, large capacitances should be avoided between L(+) and L(-), since the capacitive reactance of these capacitances also short-circuits this alternating voltage. The device would no longer detect a connection fault on L(+)/L(-). Especially parallel lines should be prevented over larger distances.
If larger capacitances between L(+)/L(-) cannot be avoided or if the coupled alternating voltage interferes with the system, version LK 5895.12/011 (without broken wire detection on L(+)/L(-)) shall be used.

Function

Device test functions
Principally, 2 different test functions are implemented: The "self-test" and the "expanded test":
The self-test of the device is performed automatically after Power-On and every 4 operating hours. It can also be triggered manually at any time by pressing the "Test" button at the device front or with an external pushbutton connected between terminals T and G.
With the self-test, contrary to the expanded test, the status of the output relays and the analogue output are not affected; the sequence is as follows:
Switching to the negative measuring phase is performed for 4 sec. The "HM" LED flashes here with a brief On-phase. The LEDs of the LED-chain are selected in sequence and the internal circuit is checked. After this, switching to the positive measuring phase is performed for 4 sec. The "HM" LED flashes here with a long On-phase. The LED-chain cycles again and additional internal tests are performed. Insulation measurement continues normally after a pause of 2 sec if no faults have occurred.
The expanded test is started when the internal or external "Test" button is pressed (or is still held) at the end of the 8 sec self-test, described above. The sequence is the same as with the self-test (2 measuring phases at 4 sec + 2 sec pause); however, the output relays "AL" and "VW" as well as the associated LEDs switch to the alarm state and the analogue output proceeds to its lowest value.
If the Reset button is pressed during the 8 sec or terminals R-G are connected, the expanded test is terminated after these 8 sec. Otherwise, the phases of the expanded test are constantly repeated, where, in addition, the "ERR" LED is on. However, the expanded test is terminated as soon as the Reset button is pressed. The device switches to the OK-state and restarts insulation measurement.

Behaviour with internal device faults
If internal device faults were detected during the test function, the "ERR" LED is lit continuously and the measuring circuit is deactivated internally ("HM" LED goes off). The output relays "AL" and "VW" as well as the associated LEDs switch to the alarm state and all LEDs of the LED-chain extinguish.

Behaviour in the case of connection faults
If broken wire is detected on terminals L(+) / L(-), the measurement is interrupted and the LED "HM" goes off. This connection failure is indicated by LED "ERR" with "failure code 2". The output relays "AL" and "VW" as well as the corresponding LEDs go into alarm state and all LEDs of the indicator LED chain go off. After removing the the interruption the measurement of the insulation resistance starts again. Stored alarm states remain active.
When interrupting the connection PE / KE to the protective ground, the unit reacts in the same way as with an interruption on L(+) / L(-), only the LED "ERR" shows "failure code 3".

Indicators

green LED „PWR“:	on when auxiliary supply connected	
red LED „ERR“:	permanent on: flashing:	at system error at connection failure
green LED „HM“:	flashing: ON-OFF-ratio per measurement phase:	at active main measuring ciruit, long ON period during measurement phase with positiv polarity short ON period during measurement phase with negative polarity
yellow LED-chain:	8 LEDs indicate the actual insulating resistance (≤ 10 kΩ ... ≥ 2 MΩ)	
gyellow LED „VW +“:	permanent on:	R_E lower then prewarning value to + potential
yellow LED „VW -“:	permanent on:	R_E lower then prewarning value to - potential
yellow LEDs „VW +“ and „VW -“ simultaneity:	permanent on:	AC-fault / symmetric fault
red LED „AL +“:	permanent on:	R_E lower then tripping value to + potential
ed LED „AL -“:	permanent on:	R_E lower then tripping value to - potential
red LEDs „AL +“ und „AL -“ simultaneity:	permanent on:	AC-fault / symmetric fault

Notes

Device terminals PE and KE must always be connected via separate lines to different terminal points of the protective-conductor system.

The measuring circuit can be connected with its terminals L(+) and L(-) both to the DC and also AC side of a mixed network; it is done most practically where the primary incoming power supply takes place. Selector switch "tv / U_N" should be set accordingly.
For photovoltaic systems and hybrid vehicles, the measuring circuit of the LK 5895 is connected on the DC side; the auxiliary measuring circuit can then be used to monitor the (deactivated) AC side.

For the main measuring circuit, the nominal voltage range for DC is specified with 1000 V; however, absolute values up to max. DC 1500 V are permissible.

Only one insulation monitor may be active in a network to be monitored, since the devices would otherwise influence each other. When coupling several networks or incoming feed sections, where each of them is equipped with its own insulation monitor, all of them must be deactivated except for one insulation monitor. Such deactivation can be beneficially handled via the HM-G control terminals with the LK 5895.

The measuring circuit is designed for large leakage capacitances up to 3000 µF. The selection switch "CE/µF" must be set accordingly. Measurement of the insulation resistances is not falsified by this; however, longer periods are required for the measuring phases than with small capacitances. If the maximum approximate leakage capacitance is known, the selector switch "CE/µF" can possibly be set to smaller values, which reduces the response time further.

The measuring circuit should not be connected via longer parallel guided wires, as this may interfere with the broken wire detection. Also large capacities between L(+) und L(-) have to be avoided.

No external potentials may be connected to control terminals, "HM", "T" and "R". The associated reference potential is "G" (identical with PE), and the connection of the terminals is made via bridges to "G".

Attention !

The device must not be operated without KE/PE connection.

Before making insulation and voltage tests, the monitor LK 5895 has to be disconnected. !

The voltage of the monitored voltage system is connected to terminals L(+) / L(-). Please observe sufficient distance to terminals of neighbour devices and to the grounded metal cabinet or box (min 0.5 cm).

WARNING

The device monitors HIGH-VOLTAGE
Caution High-Voltage when working on the device!
Disconnect all power supplies before servicing equipment!

Technical Data

Measuring ciruit L(+) / L(-) to PE / KE

Nominal voltage U_N:	DC 0 ... 1000 V; AC 0 ... 1000 V
Voltage range:	DC max. 1500 V; AC max. 1100 V
Frequency range:	DC or 16 ... 1000 Hz
Max. line capacitance:	3000 µF
Internal resistance (AC / DC):	> 280 kΩ
Measuring voltage:	approx. ± 95 V
Max. mesured current (R_E = 0):	< 0.35 mA

Response values R_E

Pre-warning („VW"):

kΩ:	20	30	50	70	100	150	250	500	1000	2000

Alarm („AL")

kΩ:	1	3	10	20	30	50	70	100	150	250

each adjustable via rotational switches

Response inaccuracy:	± 15 % + 1.5 kΩ	IEC 61557-8
Response value hysteresis		
at range 10 kΩ ... 700 kΩ:	approx. 25 %	
out of range:	approx. 40 % + 0.5 kΩ	
On delay		
at C_E = 1µF,		
R_E of ∞ to 0,5 * response value:	< 10 s	

Input auxiliary voltage

DC-Input (A1+ /A2)	
Nominal voltage U_H:	DC 24 V
Voltage range:	DC 20 ... 30 V
Nominal consumption:	max. 5 W

Control input (between HM, T, R and G)

Current flow:	approx. 3 mA
No-load voltage to G:	approx. 12 V
Permissible wire length:	< 50 m
Min. activation time:	0.5 s

Output

Contacts:	2 x 1 changeover contacts for VW and AL	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
at 8 A, AC 250 V:	1 x 10^4 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 60 °C	(device mounted away from heat generation components)
	- 25 ... + 45 °C	(device mounted without distance heated by devices with same load)
Storage:	- 40 ... + 70 °C	
Relative air humidity:	93 % bei 40 °C	
Atmospheric pressure:	860 ... 1600 mbar (86 ... 106 kPa)	
Altitude:	< 4.000 m	IEC 60 664-1
Clearance and creepage distances		
rated impulse voltage / pollution degree		IEC 60 664-1
Measuring ciruit L(+) / L(-) to auxiliary voltage DC und relay contacts VW, AL:	8 kV / 2	
auxiliary voltage DC to relay contacts VW, AL:	8 kV / 2	
relay contacts VW to relay contact AL:	4 kV / 2	
Insulation test voltage		
Routine test:	AC 5 kV; 1 s AC 2,5 kV; 1 s	

Technical Data

EMC

Electrostatic discharge (ESD):	8 kV (air)	IEC / EN 61000-4-2
HF irradiation:		
80 MHz ... 2.7 GHz:	10 V / m	IEC / EN 61000-4-3
Fast transients:	4 kV	IEC / EN 61000-4-4
Surge voltages		
between A1 - A2:	1 kV	IEC/EN 61000-4-5
between L(+) - L(-):	2 kV	IEC/EN 61000-4-5
between A1, A2 - PE and L(+), L(-) - PE:	4 kV	IEC/EN 61000-4-5
between control line:	0,5 kV	IEC/EN 61000-4-5
between control line and earth:	1 kV	IEC/EN 61000-4-5
HF-wire guided	10V	IEC / EN 61000-4-6
Interference suppression:	Limit value class A*)	

*) The device is designed for the usage under industrial conditions (Class A, EN 55011).
When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermpolastic with V0 behaviour according to UL subject 94	
Vibration resistance:	IEC/EN 60 068-2-6 Amplitude 0.35 mm frequency 10 ... 55 Hz Amplitude ± 1mm, frequency 2 ... 13.2 Hz 13.2 ... 100 Hz, acceleration ± 0.7 g_n	
Shock resistance:	10 g_n / 11 ms, 3 pulses	IEC/EN 60068-2-27
Climate resistance:	25 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminals (fixed):	1 x 4 mm² solid or 1 x 2,5 mm² stranded ferruled (isolated) or 2 x 1,5 mm² stranded ferruled (isolated) DIN 46228-1/-2/-3-4 or 2 x 2,5 mm² stranded ferruled (isolated) DIN 46228-1/-2/-3	
Insulation of wires or sleeve length:	8 mm	
Wire fixing:	Plus-minus terminal screws M3,5 terminal with wire protection	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC / EN 60715
Weight:	approx. 500 g	

Dimensions

Width x height x depth: 90 x 90 x 121 mm

Standard Type

LK 5895.12/010 DC 20 ... 30 V

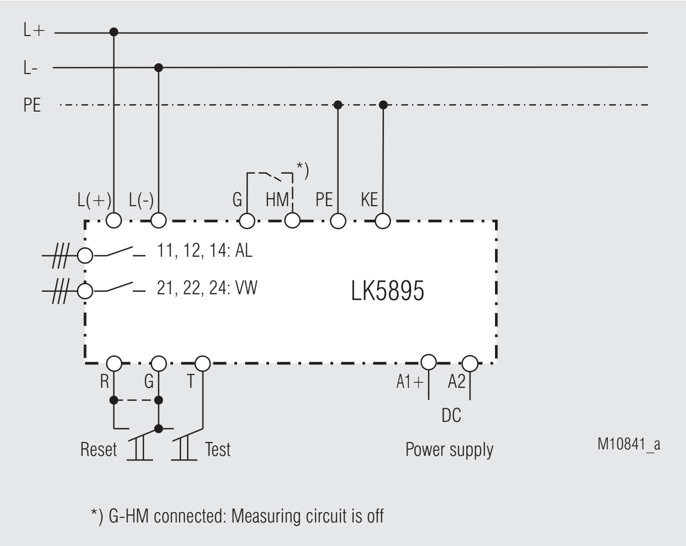
Article number: 0065217

- Outputs: 1 changeover contact for pre-warning; 1 changeover contact for alarm
- Auxiliary voltage: DC 20 ... 30 V
- Setting range pre-warning: 20 kΩ ... 2 MΩ
- Setting range alarm: 1 kΩ ... 250 kΩ
- Adjustable line capacitance
- Open- / or closed circuit operation
- Width: 90 mm

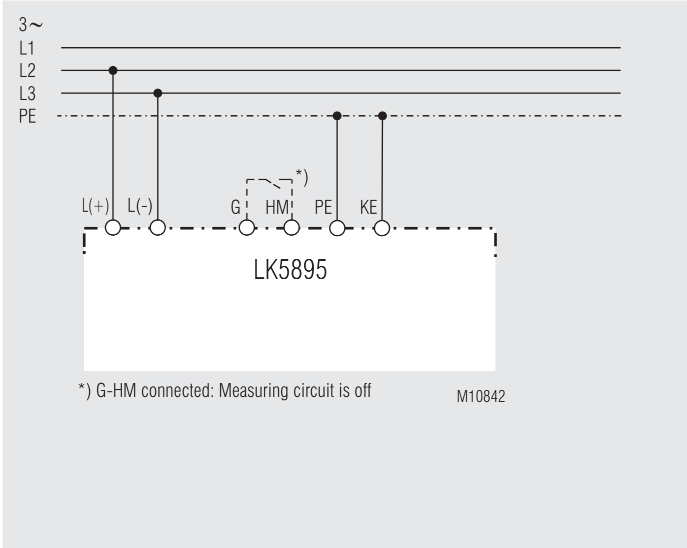
Variant

LK 5895.12/011: without wire-break detection at L(+)/L(-)

Connection Examples

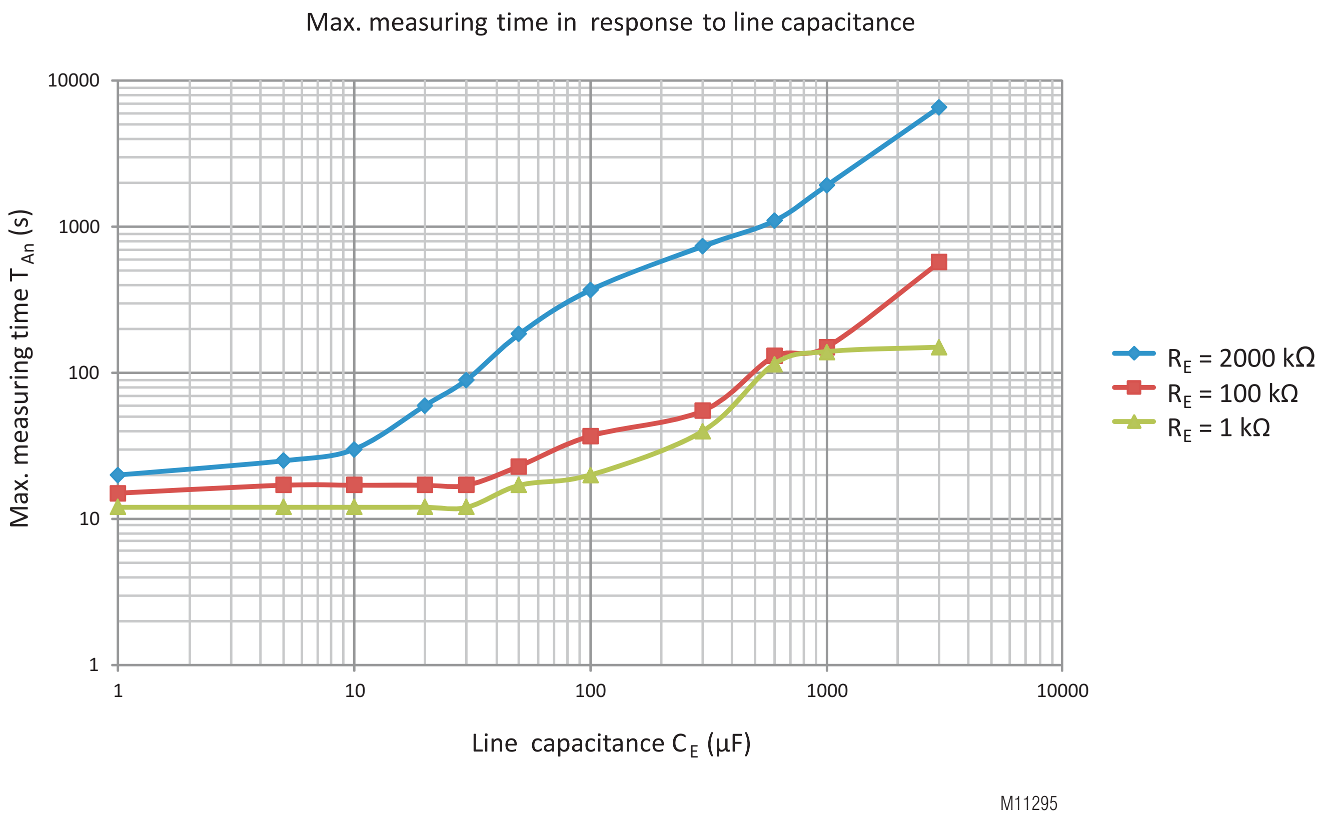


Insulation monitoring DC-side



Insulation monitoring AC-side

Characteristic



VARIMETER IMD
Insulation monitor
LK 5894

DOLD

0269334

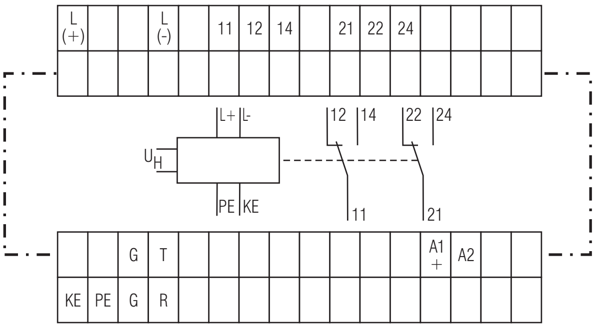
Your Advantages
- Preventivefire and system protection
- Quick fault localisation through selective earth fault detection to L+ and L-
- Universal application in non-earthed AC, DC, AC/DC networks with up to 690 V nominal voltage
- Suitable for large leakage capacitances up to 1000µF
- Simplest setting via engaging rotary switches
- Optimised measuring times - normally shorter than with known methods
- Monitoring also with voltage-free mains
- Measuring circuit with broken wire detection
- No additional coupling device required

Features
- Insulation monitoring according to IEC/EN 61557-8
- Detection of symmetric and asymmetric insulation faults
- 2 changeover contacts
- Prewarning threshold setting range: 20 kΩ ... 2 MΩ
- Alarm threshold setting range: 1 kΩ ... 250 kΩ
- Energized or de-energized on trip can be selected for output relay
- Setting the maximum leakage capacitance to shorten the response time
- Simple, clearly arranged adjustment of the device with screwdriver
- LED chain to indicate the current insulation resistance
- Display of active measuring circuits
- Automatic and manual device self-test
- Width: 90 mm

Product Description

The insulation monitor LK 5894 of the varimeter IMD family provides best and up to date insulation monitoring of modern IT systems in an optimum and state of the art way fulfilling the relevant standards. The device can be used in the most flexible way for AC, DC and AC/DC systems even with large leakage capacity to earth (PE). The adjustment of the setting values is simple and user friendly done on 2 rotary switches on the front of the device. Via LEDs the measured value, device parameters and device status are indicated easy to read.

Circuit Diagram



M10942

Approvals and Markings

CE AC/DC

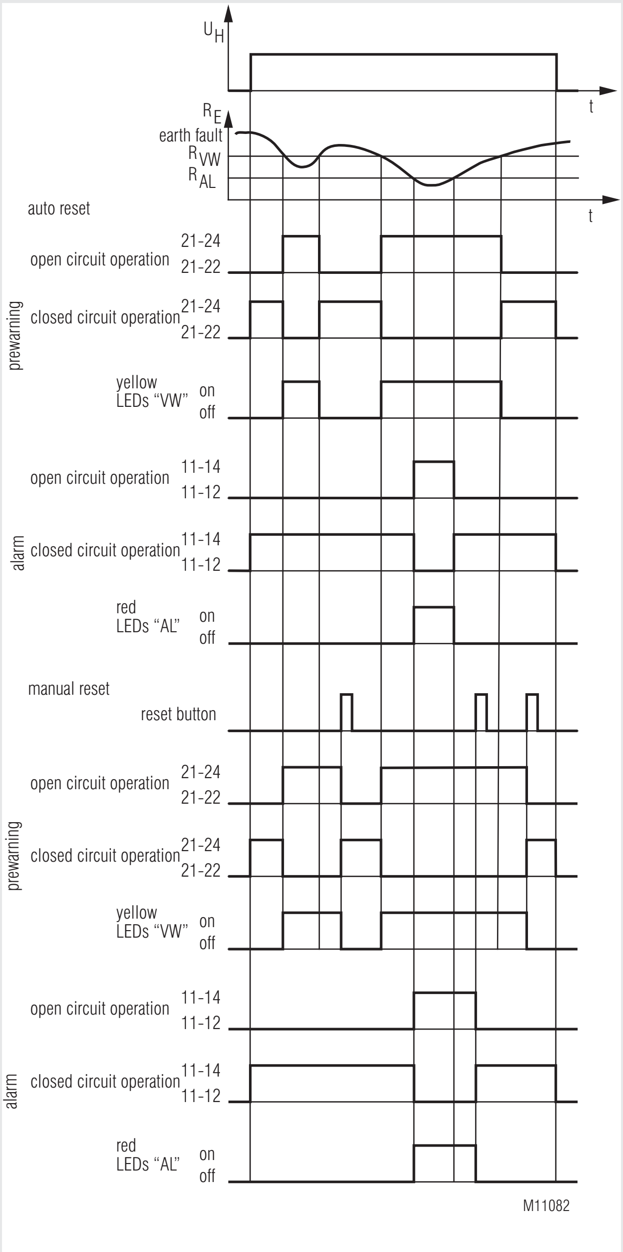
Applications

Insulation monitoring of:
- Non-earthed AC, DC, AC/DC networks
- UPS systems
- Networks with frequency inverters
- Battery networks
- Networks with direct current drives
- Hybrid and battery-powered vehicles

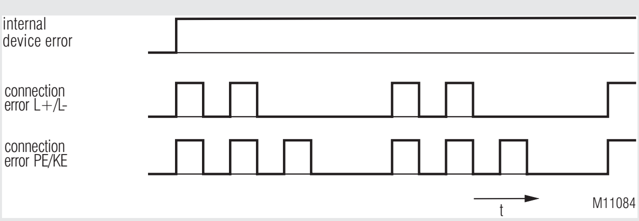
Connection Terminals

Terminal designation	Signal designation
A1+, A2	DC-Auxiliary voltage
L(+), L(-)	Connection for measuring ciruit
KE, PE	Connection for protective conductor
G, R	Control input (manual/auto reset) G/R not bridged: manual reset G/R bridged: auto reset
G, T	Control input (External test input) connection option for external device test pushbutton
11, 12, 14	Alarm signal relay (1 changeover contact)
21, 22, 24	Prewarning signal relay (1 changeover contact)

Function Diagram



Flashing Codes LED "ERR"



Function

If the device is supplied with DC auxiliary voltage, the a green "PWR" LED comes on. Switching on the auxiliary voltage is followed by an internal self-test for 10 sec, where the LEDs of the indicator string light up in sequence. After this, measurement of the insulation resistance in the measuring circuits begins.

Measuring circuit
(Insulation measurement between terminals L(+) / L(-) and PE / KE)
Terminals L(+) and L(-) are connected to the mains to be monitored. Broken wire detection, constantly effective during operation, generates an error messages if both terminals are not connected with low resistance through the mains.
In addition, the two terminals PE and KE must be connected to the protective conductor system via separate lines. An error message is given here as well if a line is interrupted (see section "Actions in case of connection faults").
If the main measuring circuit is activated, an active measuring voltage with alternating polarity is applied between L(+) / L(-) and PE / KE to measure the insulation resistance. During the measuring phase with positive polarity, the "Active" LED flashes with a long On-phase and with negative polarity with a short On-phase.
The length of the positive and negative measuring phases depends on the settings on the rotary switch "CE/µF", the actual leakage capacitance of the monitored network and with DC networks, on the level and duration of possible mains voltage fluctuations. Correct and preferably quick measurement is thus given with different mains conditions. In the event of particularly adverse conditions and major interferences, the measuring analysis can be steadied and delayed in addition with rotary switch "tv" if necessary.
The current insulation resistance is determined and analysed at the end of each measuring phase. The LED chain show the resistance determined, and the output relays for prewarning "VW" and alarm "AL" switch according to the respective response values set. If the response thresholds have been undercut, the LEDs "VW" or "AL" light according to the insulation fault location: "+", "-" or "+" and "-" simultaneously for AC faults or symmetric insulation faults.

Storing insulation fault message
If terminal R is open, the insulation fault messages from the main and auxiliary measuring circuit are stored when the respective response value is undercut, but also when the insulation resistance returns to the OK-range. In addition, the temporary minimum values of the insulation resistance are indicated on the LED chain through dimmed LEDs.
If the "Reset" button on the device front is pressed or terminal R is connected with G, the stored insulation fault messages are reset when the insulation resistance is again in the OK-range.

Output relay for insulation fault messages
The rotary switch "CE/µF Rel." allows selecting the operating current (A) or standby current (R) principle for the output relays "AL" (contacts 11-12-14) and "VW" (contacts 21-22-24).
With the operating current principle, the relays respond when the response values are undercut, with the standby current principle they release when the response values are undercut.
If 2 different response values are not needed, "VW" and "AL" can be set to the same value. The output relays switch together in this case.

Broken wire detection
As mentioned above, both the main measuring circuit and the auxiliary measuring circuit are constantly monitored for wire breaks - not only at Power-On or a manual or occasional automatic test. The response time of monitoring is only a few seconds.
Broken wire detection between L(+) and L(-) is performed via coupled alternating voltage. This alternating voltage is short-circuited if the terminals are connected to the connected mains at low-resistance. The device detects that the mains to be monitored is properly connected. Since this broken wire detection is carried out with alternating voltage, large capacitances should be avoided between L(+) and L(-), since the capacitive reactance of these capacitances also short-circuits this alternating voltage. The device would no longer detect a connection fault on L(+)/L(-). Especially parallel lines should be prevented over larger distances.
If larger capacitances between L(+)/L(-) cannot be avoided or if the coupled alternating voltage interferes with the system, version LK 5894.12/011 (without broken wire detection on L(+)/L(-)) shall be used.

Function

Device test functions
Principally, 2 different test functions are implemented: The "self-test" and the "expanded test":
The self-test of the device is performed automatically after Power-On and every 4 operating hours. It can also be triggered manually at any time by pressing the "Test" button at the device front or with an external pushbutton connected between terminals T and G.
With the self-test, contrary to the expanded test, the status of the output relays and the analogue output are not affected; the sequence is as follows:
Switching to the negative measuring phase is performed for 4 sec. The „Active“ LED flashes here with a brief On-phase. The LEDs of the LED chain are selected in sequence and the internal circuit is checked. After this, switching to the positive measuring phase is performed for 4 sec. The „Active“ LED flashes here with a long On-phase. The LED chain cycles again and additional internal tests are performed. Insulation measurement continues normally after a pause of 2 sec if no faults have occurred.
The expanded test is started when the internal or external "Test" button is pressed (or is still held) at the end of the 8 sec self-test, described above. The sequence is the same as with the self-test (2 measuring phases at 4 sec + 2 sec pause); however, the output relays "AL" and "VW" as well as the associated LEDs switch to the alarm state and the analogue output proceeds to its lowest value.
If the Reset button is pressed during the 8 sec or terminals R-G are connected, the expanded test is terminated after these 8 sec. Otherwise, the phases of the expanded test are constantly repeated, where, in addition, the "ERR" LED and the fault signalling relay (contacts 31-32-34) constantly receive current. However, the expanded test is terminated as soon as the Reset button is pressed. The device switches to the OK-state and restarts insulation measurement.

Behaviour with internal device faults
If internal device faults were detected during the test function, the "ERR" LED is lit continuously and the measuring circuit is deactivated internally ("Active" LED goes off). The output relays "AL" and "VW" as well as the associated LEDs switch to the alarm state and all LEDs of the LED chain extinguish.

Behaviour in the case of connection faults
If broken wire is detected on terminals L(+) / L(-), the measurement is interrupted and the LED "HM" goes off. This connection failure is indicated by LED "ERR" with "failure code 2". The output relays "AL" and "VW" as well as the corresponding LEDs go into alarm state and all LEDs of the indicator LED chain go off. After removing the the interruption the measurement of the insulation resistance starts again. Stored alarm states remain active.
When interrupting the connection PE / KE to the protective ground, the unit reacts in the same way as with an interruption on L(+) / L(-), only the LED "ERR" shows "failure code 3".

Indicators

green LED „PWR“:	on, when auxiliary supply connected	
red LED „ERR“:	permanent on: flashing:	at system error at connection failure
green LED „Active“:	flashing: ON-OFF-ratio per measurement phase:	at active measuring ciruit, long ON period during measurement phase with positiv polarity short ON period during measurement phase with negative polarity
yellow LED chain:	8 LEDs indicate the actual insulating resistance (≤ 10 kΩ ... ≥ 2 MΩ)	
yellow LED „VW +“:	permanent on:	R_E lower then prewarning value to + potential
yellow LED „VW -“:	permanent on:	R_E lower then prewarning value to - potential
yellow LEDs „VW +“ and „VW -“ simultaneity:	permanent on:	AC-fault / symmetric fault
red LED „AL +“:	permanent on:	R_E lower then tripping value to + potential
red LED „AL -“:	permanent on:	R_E lower then tripping value to - potential
red LEDs „AL +“ und „AL -“ simultaneity:	permanent on:	AC-fault / symmetric fault

Notes

Device terminals PE and KE must always be connected via separate lines to different terminal points of the protective-conductor system.

The main measuring circuit can be connected with its terminals L(+) and L(-) both to the DC and also AC side of a mixed network; it is done most practically where the primary incoming power supply takes place. Selector switch "tv / U_N" should be set accordingly.

For the main measuring circuit, the nominal voltage range for DC is specified with 690 V; however, absolute values up to max. DC 1000 V are permissible.

In one voltage system to be monitored, only one insulation monitor must be installed. A second insulation monitor would influence the first one. When coupling separate voltage systems that each have an insulation monitor, all insulation monitors except one have to be disabled.

The main measuring circuit is designed for large leakage capacitances up to 1000 µF. The selection switch "CE/µF" must be set accordingly. Measurement of the insulation resistances is not falsified by this; however, longer periods are required for the measuring phases than with small capacitances. If the maximum approximate leakage capacitance is known, the selector switch "CE/µF" can possibly be set to smaller values, which reduces the response time further.

The measuring circuit should not be connected via longer parallel guided wires, as this may interfere with the broken wire detection. Also large capacities between L(+) und L(-) have to be avoided.

No external potentials may be connected to control terminals "T" and "R". The associated reference potential is "G" (identical with PE), and the connection of the terminals is made via bridges to "G".

Attention !

The device must not be operated without KE/PE connection.

Before making insulation and voltage tests, the monitor LK 5894 has to be disconnected. !

The voltage of the monitored voltage system is connected to terminals L(+) / L(-). Please observe sufficient distance to terminals of neighbour devices and to the grounded metal cabinet or box (min 0.5 cm).

WARNING

The device monitors HIGH-VOLTAGE
Caution High-Voltage when working on the device!
Disconnect all power supplies before servicing equipment!

Technical Data

Measuring ciruit L(+) / L(-) to PE / KE

Nominal voltage U_N:	DC 0 ... 690 V;	AC 0 ... 690 V
Voltage range:	DC max. 1000 V;	AC max. 760 V
Frequency range:	DC or 16 ... 1000 Hz	
Max. line capacitance:	1000 µF	
Internal resistance (AC / DC):	> 280 kΩ	
Measuring voltage:	approx. ± 95 V	
Max. mesured current (R_E = 0):	< 0.35 mA	

Response values R_E

Pre-warning („VW"):

kΩ:	20	30	50	70	100	150	250	500	1000	2000

Alarm („AL")

kΩ:	1	3	10	20	30	50	70	100	150	250

each adjustable via rotational switches

Response inaccuracy:	± 15 % + 1.5 kΩ	IEC 61557-8
Response value hysteresis		
at range 10 kΩ ... 700 kΩ:	approx. 25 %	
out of range:	approx. 40 % + 0.5 kΩ	
On delay		
at C_E = 1µF,		
R_E of ∞ to 0.5 * response value:	< 10 s	

Input auxiliary voltage

DC-Input (A1+ /A2)	
Nominal voltage U_H:	DC 24 V
Voltage range:	DC 20 ... 30 V
Nominal consumption:	max. 5 W

Control input (between T, R and G)

Current flow:	approx. 3 mA
No-load voltage to G:	approx. 12 V
Permissible wire length:	< 50 m
Min. activation time:	0.5 s

Output

Contacts:	2 x 1 changeover contacts for VW and AL	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
at 8 A, AC 250 V:	1 x 10^4 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	10 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 60 °C	
Storage:	- 40 ... + 70 °C	
Relative air humidity:	93 % bei 40 °C	
Atmospheric pressure	860 ... 1600 mbar (86 ... 106 kPa)	
Altitude:	< 4.000 m	IEC 60 664-1
Clearance and creepage distances		
rated impulse voltage / pollution degree		
Measuring ciruit L(+) / L(-) to auxiliary voltage DC and relay contacts VW, AL:	8 kV / 2	
Auxiliary voltage DC to relay contacts VW, AL:	8 kV / 2	
Relay contact VW to relay contact AL:	4 kV / 2	
Insulation test voltage		
Routine test:	AC 5 kV; 1 s AC 2,5 kV; 1 s	

Technical Data

EMC

Electrostatic discharge (ESD):	8 kV (air)	IEC / EN 61000-4-2
HF irradiation:		
80 MHz ... 2.7 GHz:	10 V / m	IEC / EN 61000-4-3
Fast transients:	4 kV	IEC / EN 61000-4-4
Surge voltages		
between A1 - A2:	1 kV	IEC/EN 61000-4-5
between L(+) - L(-):	2 kV	IEC/EN 61000-4-5
between A1, A2 - PE and L(+), L(-) - PE:	4 kV	IEC/EN 61000-4-5
between control line:	0,5 kV	IEC/EN 61000-4-5
between control line and earth:	1 kV	IEC/EN 61000-4-5
HF-wire guided	10V	IEC / EN 61000-4-6
Interference suppression:	Limit value class A*)	

*) The device is designed for the usage under industrial conditions (Class A, EN 55011).
When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermpolastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
	Amplitude ± 1mm, frequency 2 ... 13.2 Hz 13.2 ... 100 Hz, acceleration ± 0.7 g_n IEC/EN 60068-2-6	
Shock resistance:	10 g_n / 11 ms, 3 pulses	IEC/EN 60068-2-27
Climate resistance:	25 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminals (fixed):	1 x 4 mm² solid or 1 x 2,5 mm² stranded ferruled (isolated) or 2 x 1,5 mm² stranded ferruled (isolated) DIN 46228-1/-2/-3-4 or 2 x 2,5 mm² stranded ferruled (isolated) DIN 46228-1/-2/-3	
Insulation of wires or sleeve length:	8 mm	
Wire fixing:	Plus-minus terminal screws M3,5 terminal with wire protection	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC / EN 60715
Weight:	approx. 500 g	

Dimensions

Width x height x depth:	90 x 90 x 121 mm

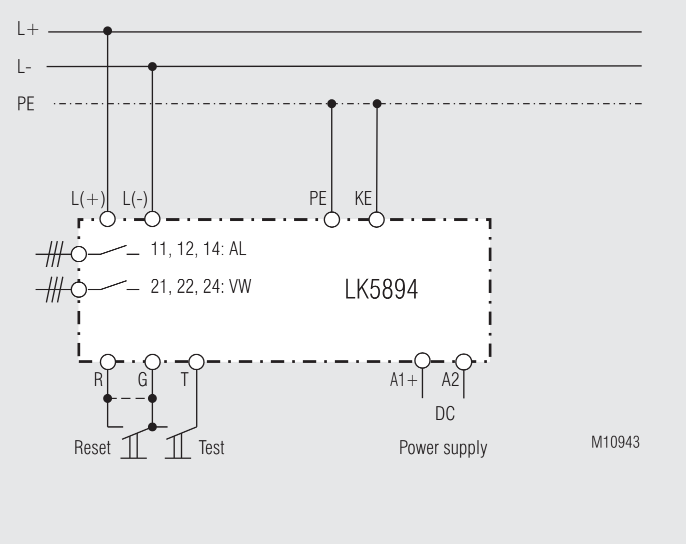
Standard Type

LK 5894.12/010 DC 20 ... 30 V	
Article number:	0065331
• Outputs:	1 changeover contact for pre-warning 1 changeover contact for alarm
• Auxiliary voltage:	DC 20 ... 30 V
• Setting range pre-warning:	20 kΩ ... 2 MΩ
• Setting range alarm:	1 kΩ ... 250 kΩ
• Adjustable line capacitance	
• Open- / or closed circuit operation	
• Width:	90 mm

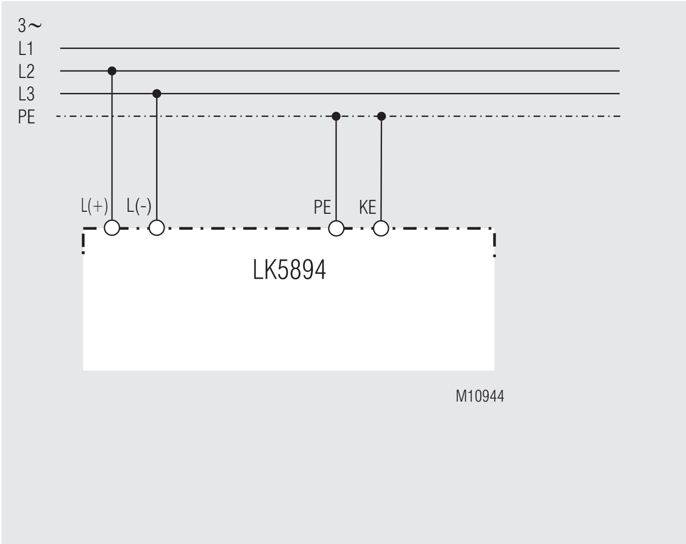
Variants

LK 5894.12/011:	without wire-break detection at L(+)/L(-)
LK5894.12/110:	Fixed function de-energised on trip, the relays react immediately after connection of auxiliary voltage
LK5894.12/111:	Fixed function de-energised on trip, the relays react immediately after connection of auxiliary voltage; without broken wire detection on L(+)/L(-)

Connection Examples

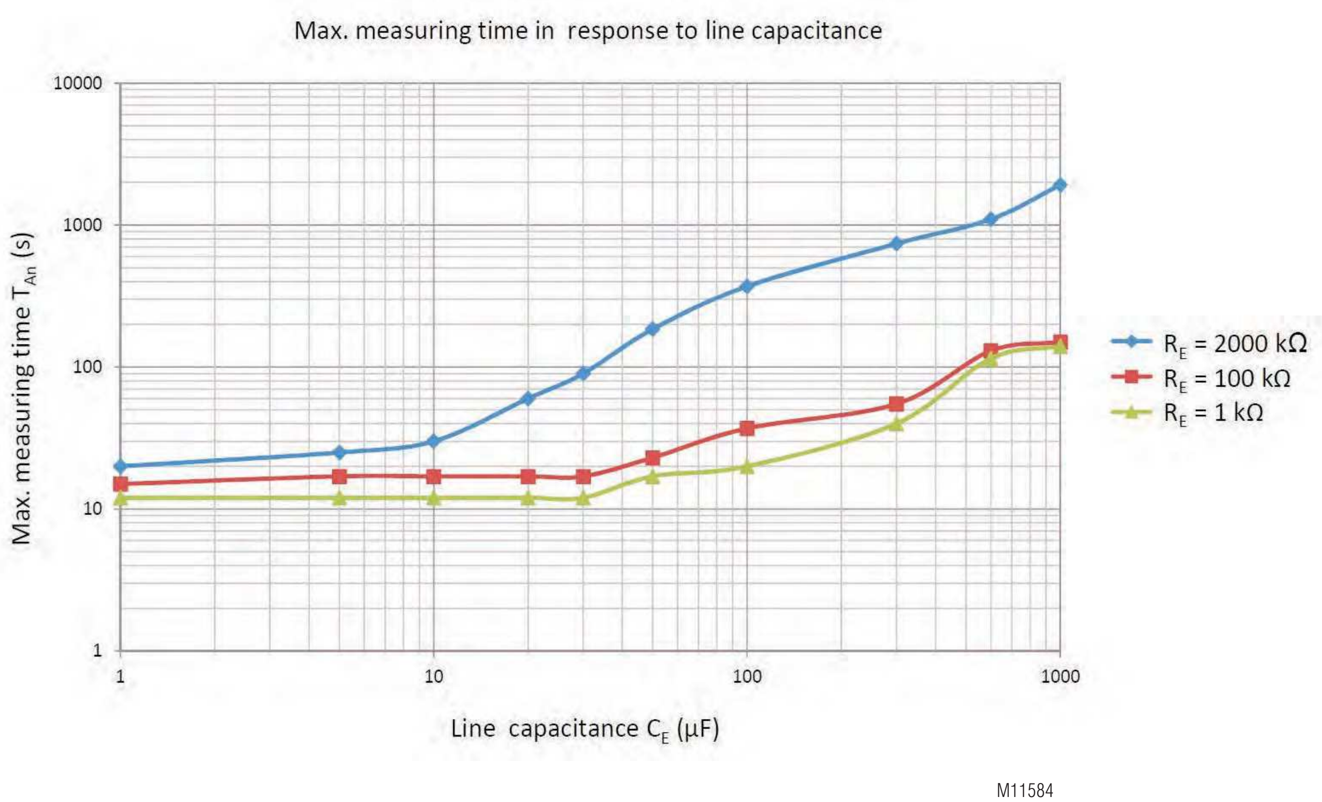


Insulation monitoring DC-side



Insulation monitoring AC-side

Characteristic



VARIMETER IMD
Insulation monitor
UH 5892

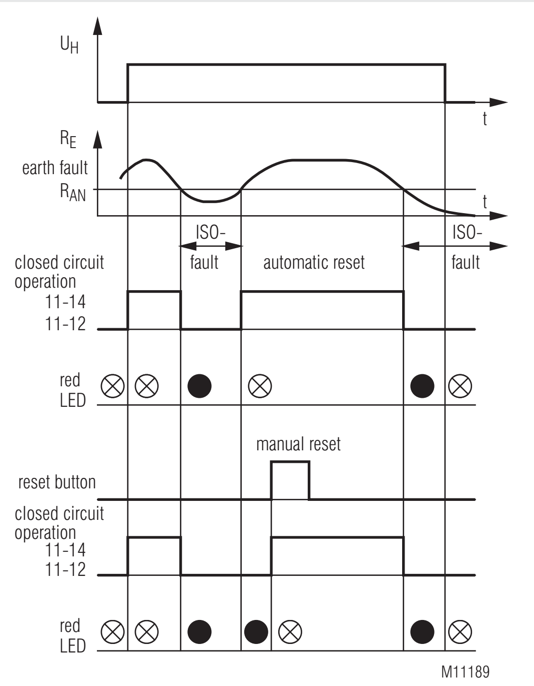
DOLD

0270804

Product description

The insulation monitor UH 5892 of the series varimeter IMD monitors the ground resistance of isolated DC-voltage systems (IT-systems) with nominal voltage up to DC 600 V. The unit detects symmetrical as well as unsymmetrical faults. The separate auxiliary supply of AC/DC 24...60 V or AC/DC 85...230 V allows also monitoring when the system is without voltage. To indicate the actual ground resistance value the unit has an LED chain and an analogue output. When a fault is detected the relay switches and the red LED Alarm lights up, The device can be used for system with leakage capacities up to 20 uF.

Function diagram



Your Advantages
- Preventive fire and system protection
- Insulation monitoring of DC voltage systems up to 600 V nominal voltage
- No additional coupling device required
- Suitable for leakage capacitances up to 20 µF
- Monitoring also with voltage-free mains
- 2 wide voltage input ranges for auxiliary voltage

Merkmale
- Insulation monitoring according to IEC/EN 61557-8
- Detection of symmetric and asymmetric insulation faults
- 1 changeover contact for alarm
- Fixed response value R_{AN}: 50 kΩ, other on request
- Internal reset and test pushbutton
- External test and reset pushbutton can be connected
- LED indicator for auxiliary voltage and alarm
- LED chain to indicate the current insulation resistance
- Automatic or manual reset, programmable
- Analogue output for insulating value
- External indicating instrument can be connected
- Closed circuit operation
- Open circuit operation on request
- With pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 45 mm

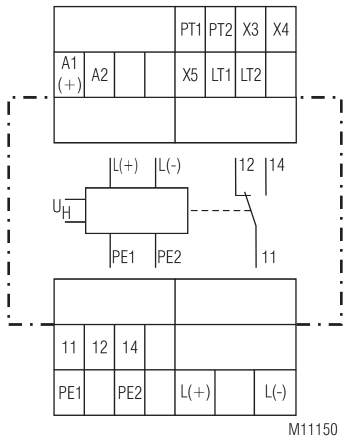
Approvals and Markings

CE AC/DC

Applications

Monitoring of the resistance to earth in ungrounded DC systems

Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
A1(+), A2	Auxiliary voltage U_H
L(+), L(-)	Connection for measuring circuit
PE1, PE2	Connection for protective conductor
X5(/LT1)	Control input (manual/auto reset) X5/LT1 bridged: manual reset X5/LT1 not bridged: auto reset
PT1, PT2	connection option for external device test pushbutton
LT1, LT2	connection option for external reset pushbutton
X3, X4	Analogue output
11, 12, 14	Alarm signal relay (1 changeover contact)

Function

The device is supplied with auxiliary voltage via terminals A1(+)/A2; ea green "ON" LED comes on. After connecting the auxiliary supply a 10 s start up delay is active allowing the measuring circuit to start.
After this, measurement of the insulation resistance in the measuring circuits begins.

Measuring circuit
(Insulation measurement between terminals L(+)/L(-) and PE1/PE2).

Terminals L(+) and L(-) are connected to the mains to be monitored.
In addition, the two terminals PE1 and PE2 must be connected to the protective conductor system via separate lines. An active measuring voltage with alternating polarity is applied between L(+)/L(-) and PE1/PE2 to measure the insulation resistance.

The length of the positive and negative measuring phases has a fixed factory setting of 16 s (max. leakage capacitance of 20µF).
The LED-chain and the analogue output show the actual determined insulating resistance, and the output relays witch according to the respective response values set. If the response thresholds has been undercut the red LED "Alarm" lights up.

Indication

green LED "ON": on, when auxiliary supply connected

red LED "Alarm": on, when resistance is below the response value R_{AN}

LED-chain: the approx. value of actual rsistance to ground (PE)

Notes

The response value R_{AN} is fixed. An external indicator instrument can be connected.

The unit works de-energized on trip, that means, the output relay relase in position of rest at a insulation failures $R_E < R_{AN}$).

A bridge between X5 and LT1 allows to select auto or manual reset. The UH 5892 has a built in reset button on the front and allows connection of an external button at terminals LT1 and LT2 also.

For function test an external (terminals PT1-PT2) or built in push button can be used to simulate a ground fault. The push button has to be pressed for the length of a measuring period.

Notes

The analogue output (terminals X3 and X4) provides a voltage signal proportional to the actual insulation resistance of the mains. The following formula describes the input to output ratio.:
(0V at R_E = 0 and 13.0 .... 13.5 V at $R_E = \infty$)

$$U_A = \frac{U_{max}}{\frac{180\ k\Omega}{R_E} + 1} \quad ; \quad U_{max} = 13.25\ V \pm 0.25\ V$$

These values are valid for $C_E = 0$ (see diagram page 4). In practice it makes no sense to monitor values above 11 ... 12V as the tolerances increase, especially with mains capacity. On fluctuation of the mains voltage momentary false readings can occur. This is normal and caused by the cyclic measuring principle.

In one voltage system only one insulation monitor can be used. This has to be observed when interconnecting two separate systems.

Technical Data

Auxiliary circuit

Auxiliary voltage U_H	Voltage range	Frequency range
AC/DC 24 … 60V	AC 19 … 68 V	45 … 400 Hz; DC 48 % W*)
	DC 18 … 96 V	W*) ≤ 5 %
AC/DC 85 ... 230 V	AC 65 … 276 V	45 … 400 Hz; DC 48 % W*)
	DC 75 … 300 V	W*) ≤ 5 %
*) W = permitted residual ripple of auxiliary supply		

Nominal consumption: max. 1.5 W

Measuring Circuit

Nominal voltage U_N: DC 0 ... 600 V / AC 0 ... 400 V
Voltage range: 0 ... 1,15 U_N
Frequency range: DC or 40 ... 60 Hz
Response value R_{AN}: 50 kΩ, 10 ... 440 kΩ on request
Setting R_{AN}: fixed
Internal AC resistance: > 120 kΩ
Internal DC resistance: > 150 kΩ
Messspannung: approx. ± 13 V
Max. measuring current (R_E = 0): < 0.3 mA
Measuring cycle internally adjustable: 2 ... 16 s
Line capacitance C_E to ground: 1 ... 20 µF
Factory setting: 16 s (für C_E = 20 µF)
Operate delay
at R_{AN} = 50 kΩ, C_E = 20 µF
R_E from ∞ to 0,9 R_{AN}: < 100 s
R_E from ∞ to 0 kΩ: < 60 s
Hysteresis
at R_{AN} = 50 kΩ: approx. 5 %
Response inaccuracy:: ± 15% ± 1.5 kΩ IEC/EN 61557-8

Output

Contacts: 1 changeover contact
Max. switching voltage: AC 250 V
Thermal current I_{th}: 5 A
Switching capacity
to AC 15:
NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
Electrical life
at 5 A, AC 230 V: 1 x 10^5 switching cycles
Mechanical life: > 50 x 10^6 switching cycles

Analogue output

for actual insulating value, no galvanic separation
Terminals X3-X4: typ. 0 ... 13.25 V / R_i approx. 50 Ω
(0 V at R_E = 0 and 13.0 ... 13.5 V at $R_E = \infty$)
X4 is internal connected with PE

Technische Daten

General Data

Operating mode:	Continuous operation	
Permissible ambient and stocking temperature:	- 20 ... + 60°C / - 25 ... + 70°C	
Clearance and creepage distances		
overvoltage category / pollution degree:		IEC 60 664-1
meas. ciruit to auxiliary voltage and relay contact:	6 kV/2	
auxiliary voltage to relay contact:	6 kV/2	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltage		
between A1(+)/A2:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	20 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Plug in with screw terminals		
max. cross section for connection:	1 x 0.25 ... 2.5 mm² solid or stranded ferruled (isolated) or 2 x 0.25 ... 1.0 mm² solid or stranded ferruled (isolated)	
Insulation of wires or sleeve length:	7 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 0.25 ... 2.5 mm² solid or stranded ferruled (isolated) 2 x 0.25 ... 1.5 mm² stranded twin ferruled (isolated)	
Insulation of wires or sleeve length:	10 mm	
Wire fixing:	captive slotted screw or cage clamp terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 270 g	

Dimensions

Width x height xdepth:	45 x 107 x 121 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Types

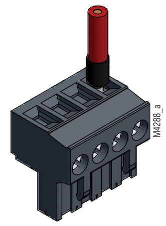
UH 5892.11PS AC/DC 24 ... 60 V 50 kΩ

Article number:	0066309
• Output::	1 Wechsler
• Auxiliary voltage U_H:	AC/DC 24 ... 60 V
• Response value R_{AN}:	50 kΩ
• Line capacitance:	20 μF
• De-energiezed on trip	
• Width:	45 mm

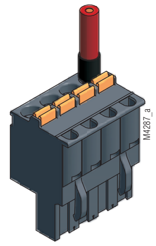
UH 5892.11PS AC/DC 85 ... 230 V 50 kΩ

Article number:	0066946
• Output::	1 Wechsler
• Auxiliary voltage U_H:	AC/DC 85 ... 230 V
• Response value R_{AN}:	50 kΩ
• Line capacitance:	20 μF
• De-energiezed on trip	
• Width:	45 mm

Options with Pluggable Terminal Blocks



Screw terminal
(PS / plug in screw)



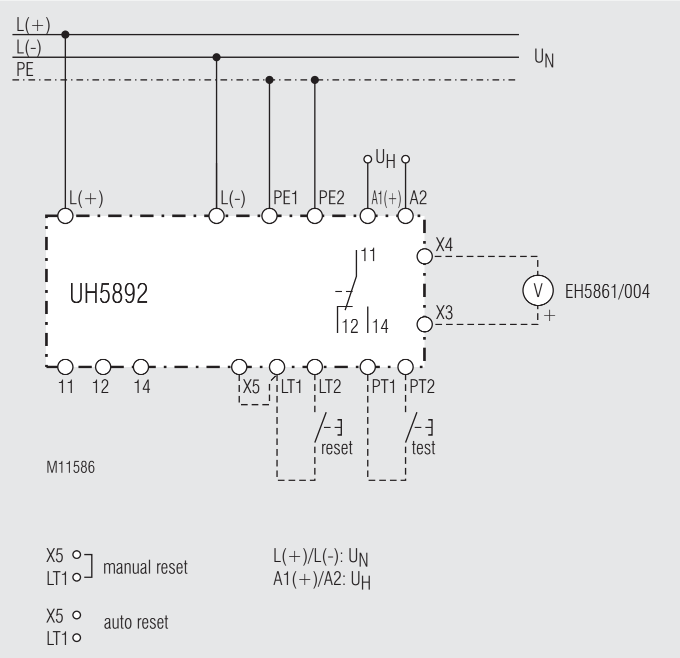
Cage clamp terminal
(PC / plug in cage clamp)

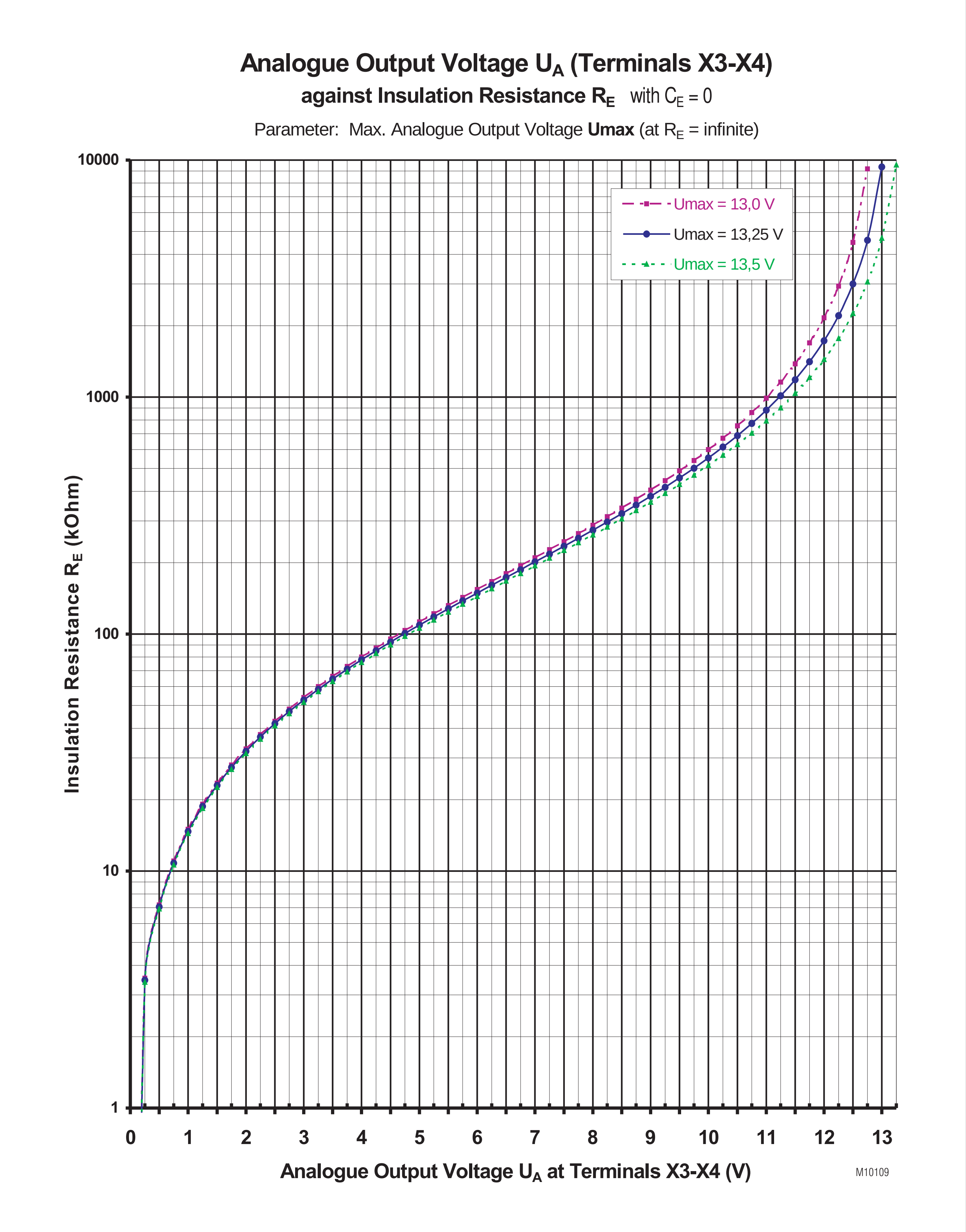
Accessories

EH 5861/004: indicating instrument, degree of protection: IP 52
Article number: 0030618

The indicating device EH 5861 is externally connected to the insulation monitor and shows the actual insulation resistance of the voltage system to ground.
Dimensions:
Width x heigth x depth
96 x 96 x 52 mm

Connection Example





Analogue Output Voltage U_A (Terminals X3-X4)
against Insulation Resistance R_E with $C_E = 0$
Parameter: Max. Analogue Output Voltage **Umax** (at R_E = infinite)
Umax = 13,0 V
Umax = 13,25 V
Umax = 13,5 V
10000
1000
100
10
1
Insulation Resistance R_E (kOhm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Analogue Output Voltage U_A at Terminals X3-X4 (V)
M10109

VARIMETER IMD
Insulation Monitor
IL 5880, IP 5880, SL 5880, SP 5880

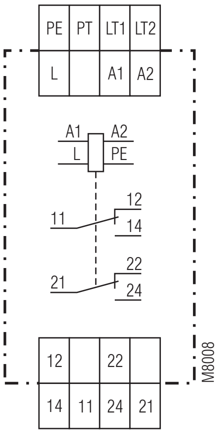
DOLD

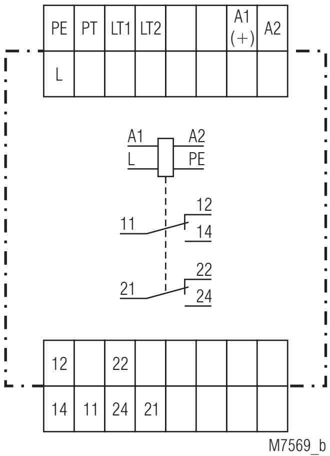
0238809

IL 5880/200 SL 5880/200

- According to IEC/EN 61 557-8
- For single and 3-phase AC-systems up to 0 ... 500 V and 10 ... 10000 Hz
- Adjustable tripping value R_{AL} of 5 ... 100 kΩ
- Monitors also disconnected voltage systems
- De-energized on trip
- Auxiliary voltage Measuring Circuit and output contacts are galvanically separated
- Manual and auto reset
- With test and reset button
- Connections of external test and reset buttons possible
- LED indicators for operation and alarm
- 2 changeover contacts
- IL/SL 5880/200 with additional prewarning
  - adjustable prewarning value 10 kΩ ... 5 MΩ
  - output function programmable
- Variant IL/SL 5880/300 according to DIN VDE 0100-551 for mobile generator sets available
- 4 models available:
  IL 5880, IP 5880: 61 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 880
  SL 5880, SP 5880: 98 mm deep with terminals near to the top to be mounted in cabinets with mounting plate and cable ducts
- DIN rail or screw mounting
- 35 mm width

Circuit Diagram





IL 5880, SL 5880 IP 5880, SP 5880

Connection Terminals

Terminal designation	Signal designation
A1	L / +
A2	N / -
L	Connection for monitored IT-systems
PE	Connection for protective conductor
PT	Connection for external test button
LT1, LT2	Connections for external reset or manual and auto reset: LT1/LT2 bridged: hysteresis function LT1/LT2 not bridged: manual reset
11, 12, 14 21, 22, 24	Changeover contact (each for switch in position VW or AL)

Approvals and Markings

A025518

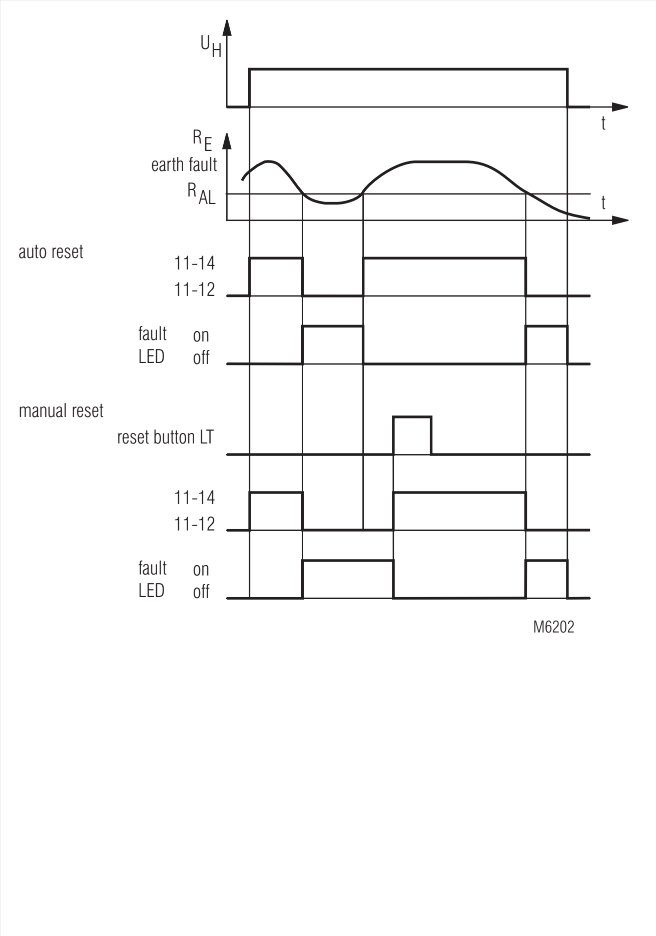
Applications

- Monitoring of insulation resistance of ungrounded voltage systems to earth.
- IL/SL 5880/200 can also be used to monitor standby devices for earth fault, e.g. motor windings of devices that have to function in the case of emergency.
- IL/SL 5880/300 according to DIN VDE 0100-551 to monitor mobile generator systems
- Other resistance monitoring applications.
- For industrial and railway applications

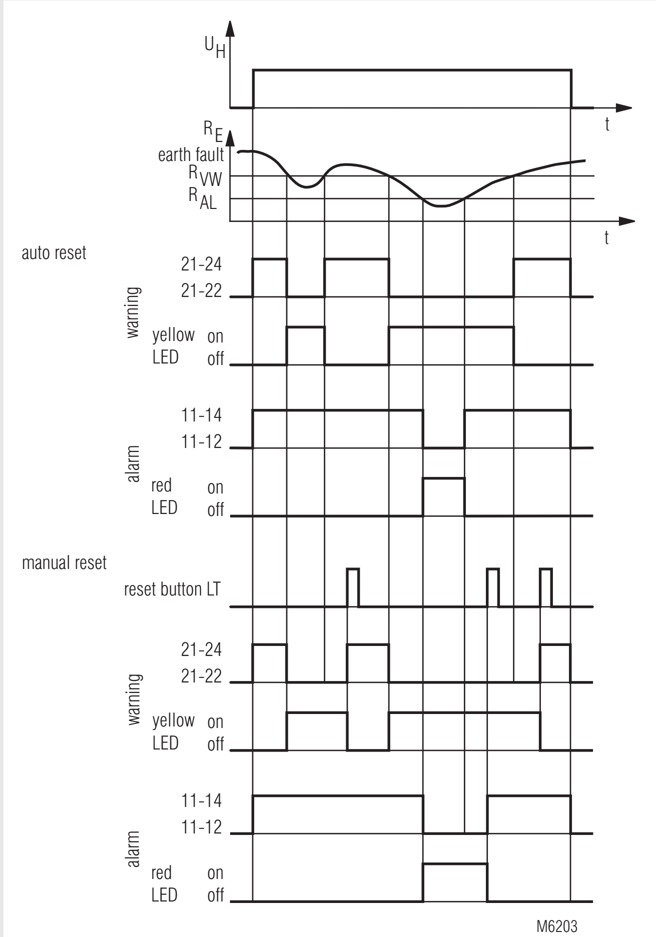
Function

The device is connected to the supply via terminals A1-A2. The unit can either be supplied from the monitored voltage system or from an separate auxiliary supply. Terminal L is connected to the monitored voltage and PE to earth. If the insulation resistance R_E drops below the adjusted alarm value R_{AL} the red LED goes on and the output relay switches off (de-energized on trip). If the unit is on auto reset (bridge between LT1-LT2) and the insulation resistance gets better (R_E rises), the insulation monitor switches on again with a certain hysteresis and the red LED goes off. Without the bridge between LT1-LT2 the Insulation monitor remains in faulty state even if the insulation resistance is back to normal. (In order to achieve failure storage, the voltage system showing a fault must not be switched off too fast after detection of the failure, see notes). The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply. By activating the "Test" button an insulation failure can be simulated to test the function of the unit.
The variants IL/SL 5880.12/200 have a second setting range with a higher resistance up to 5 MΩ (Potentiometer R_{VW}). This setting value can be used for pre-warning with relay output, by positioning the lower setting switch to "AL 11-12-14; VW 21-22-24".
If the higher setting range should be used only, the setting switch is put in position "VW 2u" and both contacts react only to the higher setting.
If the lower setting range should be used only, the setting switch is put in position "AL 2u" and both contacts react only to the lower setting.
When set to manual reset the latching is active on both settings R_{AL} and R_{VW}. Therefore it is possible in the case of a short insulation decrease (Switch position AL 11-12-14; VW 21-22-24), to pass the warning signal to a PLC while the main fault does not lead to a disconnection of the mains via the contacts 11-12-14.

Function Diagram



IL 5880, SL 5880, IP 5880, SP 5880



IL 5880/200, SL 5880/200, IP 5880/200, SP 5880/200

Indicators

Green LED "ON":	On, when supply voltage connected
Red LED "AL":	On, when insulation fault detected, ($R_E < R_{AL}$)
Yellow LED "VW":	On, when insulation resistance is under prewarning value, $R_E < R_{VW}$ (only with variant IL/SL 5880.12/2_ _ and /300)

Notes

Storing of insulation failures:
The storing of an insulation failure is delayed slightly longer the reaction of the output relay because of interference immunity. In cases where the defective voltage system is switched off immediartely by the output of the insulation monitor it can happen that the fault is not stored (e. g. mobile generator sets).

For these applications we recommend the variant IL/SL 5880/300, where the output relay reacts only after the fault ist stored. All other features of this variant are simular to IL/SL 5880/200.
The Insulation monitors IL/SL 5880 are designed to monitor AC-voltage systems. Overlayed DC voltage does not damage the instrument but may change the conditions in the Measuring Circuit.

Notes

In one voltage system only one Insulation monitor must be connected. This has to be observed when coupling voltage system.
Line capacitance C_E to ground does not influence the insulation measurement, as the measurement is made with DC-voltage. It is possible that the reaction time in the case of insulation time gets longer corresponding to the time constant $R_E * C_E$.

The model /200 can be used, because of it´s higher setting value, to monitor single or 3-phase loads for ground fault. If the load is operated from a grounded system the insulation resistance of the load can only be monitored when disconnected from the mains. This is normally the fact with loads which are operated seldom or only in the case of emergency but then must be function (see connection example).

The auxiliary supply can be connected to a separate auxiliary supply or to the monitored voltage system. The range of the auxiliary supply input has to be observed.

When monitoring 3-phase IT systems it is sufficient to connect the insulation monitor only to one phase. The 3-phases have a low resistive connection (approx. 3 - 5 Ω) via the feeding transformer. So failures that occure in the non-connected phases will also be detected.

Technical Data

Auxiliary Circuit

Nominal voltage U_N	
IL 5880, SL 5880:	AC 220 ... 240 V, AC 380 ... 415 V
	0.8 ... 1.1 U_N
	DC 12 V, DC 24 V
	0.9 ... 1.25 U_N
IP 5880, SP 5880:	AC / DC 110 ... 240 V
	0.7 ... 1.25 U_N
Frequency range (AC):	45 ... 400 Hz
Nominal consumption:	
AC:	approx. 2 VA
DC:	approx. 1 W

Measuring Circuit

Nominal voltage U_N:	AC 0 ... 500 V	
Voltage range:	0 ... 1.1 U_N	
Frequency range:	10 ... 10000 Hz	
Alarm value R_{AL}:	5 ... 100 kΩ	
Prewarning value R_{VW} (only at IL/SL 5880/2_ _ and IL/SL 5880/300):	10 kΩ ... 5 MΩ	
Setting R_{AL}, R_{VW}:	infinite variable	
Internal test resistor:	equivalent to earth resistance of < 5 kΩ	
Internal AC resistance:	> 250 kΩ	
Internal DC resistance:	> 250 kΩ	
Measuring voltage:	approx. DC 15 V, (internally generated)	
Max. measuring current (R_E = 0):	< 0.1 mA	
Max. permissible noise DC voltage:	DC 500 V	
Operate delay		
at R_{AL} = 50 kΩ, CE = 1 µF		
R_E from ∞ to 0.9 R_{AL}:	< 1.3 s	
R_E from ∞ to 0 kΩ:	< 0.7 s	
Response inaccuracy:	± 15 % + 1.5 kΩ	IEC 61557-8
Hysteresis		
at R_{AL} = 50 kΩ:	approx. 15 %	

Output

Contacts:		
IL / SL 5880.12, IP / SP 5880.12:	2 changeover contacts	
IL / SL 5880.12/2_ _, IL / SL 5880.12/300, IP / SP 5880.12/2_ _:	2 x 1 changeover contact, programmable	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	≥ 5 x 10^5 switching cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 20 ... + 70°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
between auxiliary supply		IEC 60 664-1
connections (A1- A2):	4 kV / 2 at AC-auxiliary voltage	
between measuring input connections (L - PE):	4 kV / 2	IEC 60 664-1
between auxiliary supply and measuring input connections:	4 kV / 2	IEC 60 664-1
auxiliary supply connections and measuring input to relay contacts:	6 kV / 2	IEC 60 664-1
relay contact 11-12-14 to relay contact 21-22-24:	4 kV / 2	IEC 60 664-1
Insulation test voltage		
Routine test:	AC 4 kV; 1 s	
	AC 2,5 kV; 1 s	

Technical Data

EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.5 GHz:	3 V / m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
between A1 - A2:	1 kV	IEC/EN 61 000-4-5
between L - PE:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL Subjekt 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	DIN 46 228-1/-2/-3/-4	
Cross section:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded wire	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight:		
IL 5880:	160 g	
SL 5880:	189 g	
IP 5880:	250 g	
SP 5880:	300 g	

Dimensions

Width x height x depth:	
IL 5880:	35 x 90 x 61 mm
SL 5880:	35 x 90 x 98 mm
IP 5880:	70 x 90 x 61 mm
SP 5880:	70 x 90 x 98 mm

Classification to DIN EN 50155 for IL 5880

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Types

IL 5880.12 AC 220 ... 240 V
Article number: 0053378
- Auxiliary voltage U_H: AC 220 ... 240 V
- adjustable alarm value R_{AL}: 5 ... 100 kΩ
- Width: 35 mm

SL 5880.12 AC 220 ... 240 V
Article number: 0055396
- Auxiliary voltage U_H: AC 220 ... 240 V
- adjustable alarm value R_{AL}: 5 ... 100 kΩ
- Width: 35 mm

Variants

IL / SL 5880.12/200:	with pre-warning and programmable outputs
IL / SL 5880.12/201:	as version IL / SL 5880.12/200, but both output relays with ergized on Trip principle
IL / SL 5880.12/300:	according to DIN VDE 0100-551 as version IL / SL 5880.12/200, but for use with mobile generator sets

Ordering example for variants

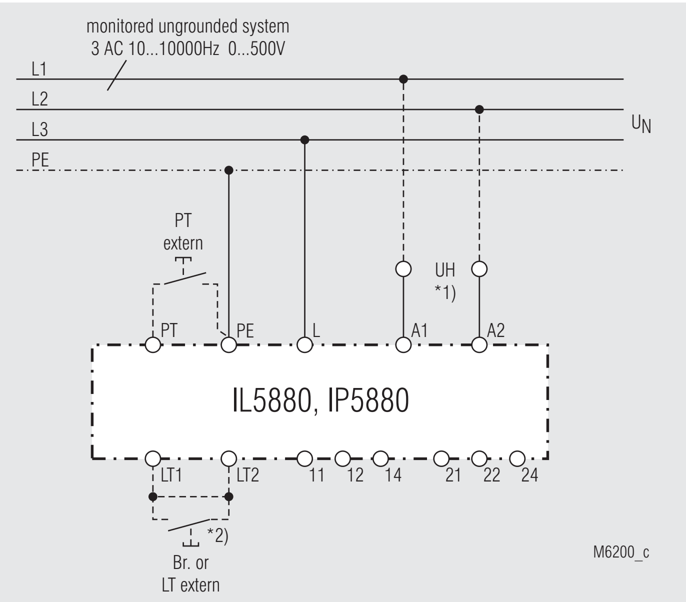
IL 5880 .12 / _ _ _ AC 380 ... 415 V AL 5 ... 100 kΩ VW 10 K ... 5MΩ

- Pre-warning setting
- Alarm setting
- Auxiliary voltage
- Variant, if required
- Contacts
- Type

Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578

Connection Example

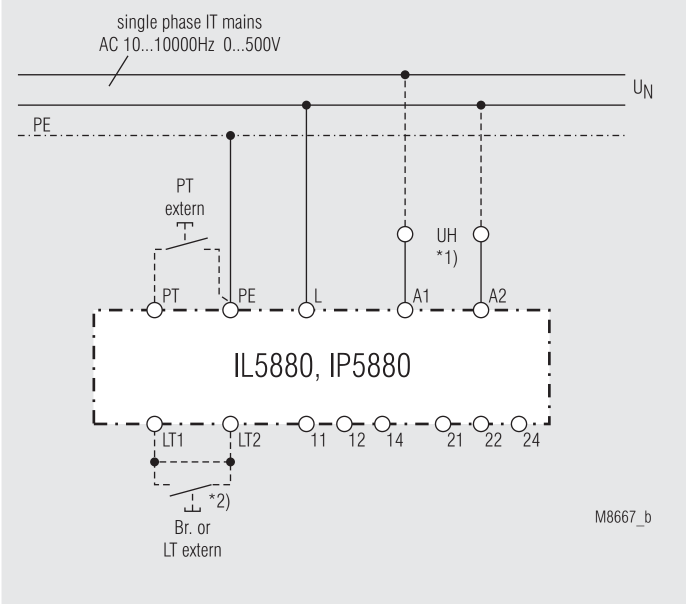


Monitoring of an ungrounded voltage system.

*1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The voltage- and frequency range of the auxiliary supply input must be observed.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

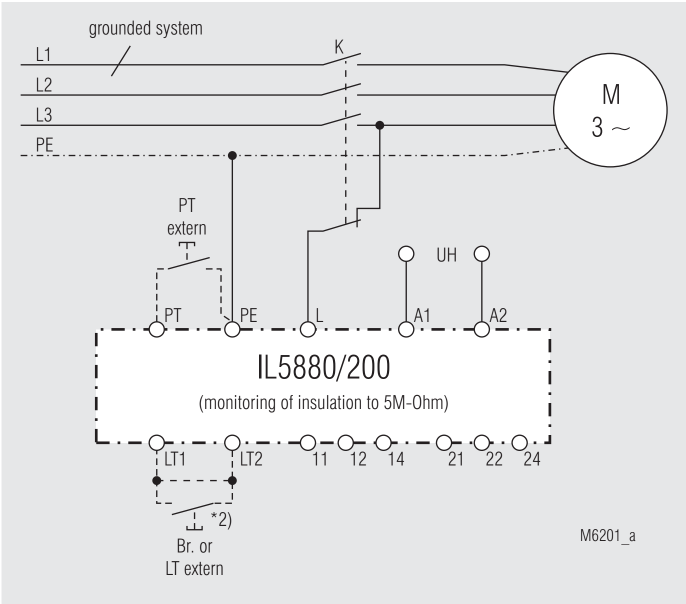
Connection Example



Monitoring of an ungrounded voltage system.

*1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The voltage- and frequency range of the auxiliary supply input must be observed.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT



Monitoring of motorwindings against ground.
The insulation of the motor to ground is monitored as long as contactor K does not activate the load.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

VARIMETER IMD
Insulation Monitor
MK 5880N, MH 5880

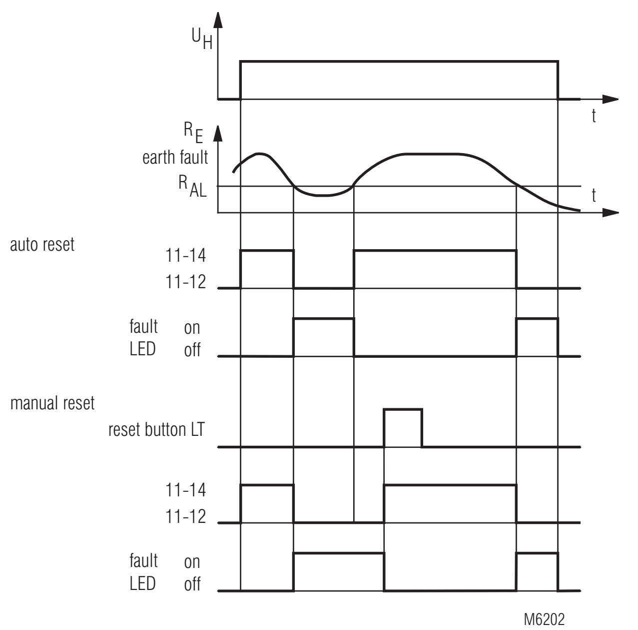
DOLD

0239279

MK 5880N MH 5880

- According to IEC/EN 61 557-8
- For single and 3-phase AC-systems up to 0 ... 500 V and 10 ... 1000 Hz
- Monitors also disconnected voltage systems
- Adjustable tripping value R_{AL} of 5 ... 100 kΩ
- De-energized on trip
- Auxiliary voltage, measuring circuit and output contacts are galvanically separated
- Manual and auto reset
- With test and reset button
- Connections for external test and reset buttons possible
- LED indicators for operation and alarm
- 2 changeover contacts
- MK 5880N/200 with additional prewarning
  - adjustable prewarning value 10 kΩ ... 5 MΩ
  - 1 output relay for alarm and 1 for pre-warning
- MH 5880/500: similar to MK 5880N but with galvanic separated analogue output and 11 step LED chain for the actual insulation value
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- MK 5880N: 22.5 mm width
  MH 5880: 45 mm width

Function diagramm



MK 5880N

Approvals and Markings

1) A025518

[1] only MK 5880N, see CCC-Data

Applications

- Monitoring of insulation resistance of ungrounded voltage systems to earth
- MK 5880N/200 can also be used to monitor standby devices for earth fault, e. g. motor windings of devices that have to function in the case of emergency.
- Other resistance monitoring applications

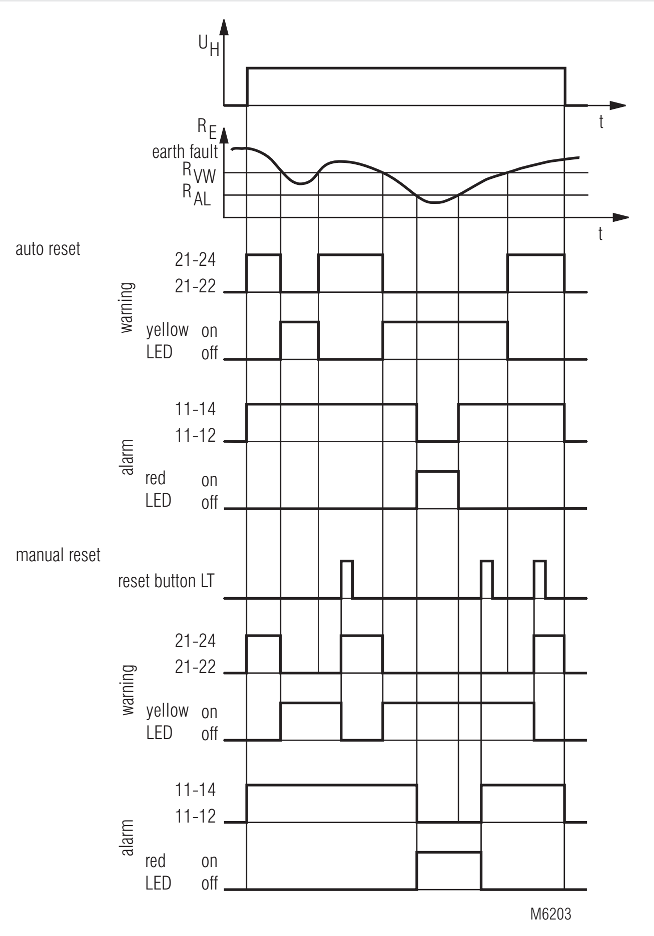
Notes

When monitoring 3-phase IT systems it is sufficient to connect the insulation monitor only to one phase. The 3-phases have a low resistive connection (approx. 3 - 5 Ω) via the feeding transformer. So failures that occure in the non-connected phases will also be detected.

Function

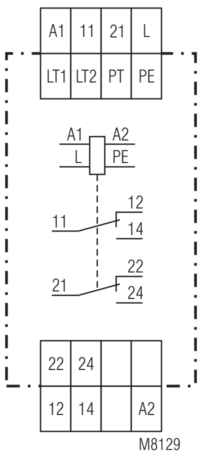
The device is connected to the supply via terminals A1-A2. The unit can either be supplied from the monitored voltage system or from an separate auxiliary supply. Terminal L is connected to the monitored voltage and PE to earth. If the insulation resistance R_E drops below the adjusted alarm value R_{AL} the red LED goes on and the output relay switches off (de-energized on trip). If the unit is on auto reset (bridge between LT1-LT2) and the insulation resistance gets better (R_E rises), the insulation monitor switches on again with a certain hysteresis and the red LED goes off. Without the bridge between LT1-LT2 the Insulation monitor remains in faulty state even if the insulation resistance is back to normal. The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply. By activating the "Test" button an insulation failure can be simulated to test the function of the unit.
The variant MK 5880N.38/200 has a second setting range with a higher resistance up to 5 MΩ (Potentiometer R_{VW}). This setting value can be used for pre-warning with relay output.
When set to manual reset the latching is active on both settings R_{AL} and R_{VW}. Therefore it is possible in the case of a short insulation decrease that the fault is stored and passed via contacts 21-22-24 to a PLC while the main fault does not lead to a disconnection of the mains via the contacts 11-12-14.

Function diagramm

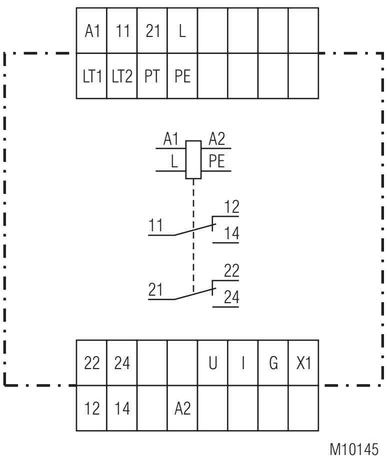


MK 5880N/200

Circuit diagram



MK 5880N



MH 5880

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
L	Connection for measuring circuit
PE	Connection for protective conductor
PT(/PE)	Connection for external test button
LT1/LT2	Connection for external reset or control input for hysteresis function or manual reset LT1/LT2 bridged: Hysteresis function LT1/LT2 not bridged: Manual reset
11, 12, 14	Alarm signal relay (1 changeover contact)
21, 22, 24 [1]	Prewarning signal relay (1 changeover contact)
U, I, G, X1 [2]	Analogue output X1/G not bridged: U-G 0 ... 10V; I-G 0 ... 20mA X1/G bridged: U-G 2 ... 10V; I-G 4 ... 20mA

[1] only MK 5880N/200 and MH 5880
[2] only MH 5880

Indicators

green LED "ON": On, when supply voltage connected
red LED "AL": On, when insulation fault detected ($R_E < R_{AL}$)
yellow LED "VW": On, when insulation resistance is under prewarning value, $R_E < R_{VW}$ (only with variant MK 5880N.38/200)

Notes

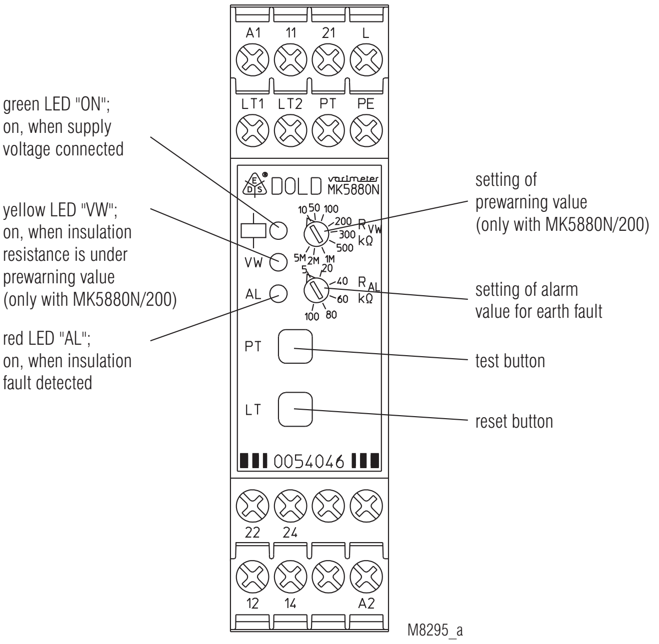
The insulation monitor MK 5880N is designed to monitor AC-voltage systems. Overlayed DC voltage does not damage the instrument but may change the conditions in the measuring circuit.
In one voltage system only one Insulation monitor must be connected. This has to be observed when coupling voltage system.

Line capacitance C_E to ground does not influence the insulation measurement, as the measurement is made with DC-voltage. It is possible that the reaction time in the case of insulation fault gets longer corresponding to the time constant $R_E * C_E$.
The model MK 5880N.38/200 can be used, because of it´s higher setting value up to 5 MΩ, to monitor single or 3-phase loads for ground fault. If the load is operated from a grounded system the insulation resistance of the load can only be monitored when disconnected from the mains. This is normally the fact with loads which are operated seldom or only in the case of emergency but then must be function (see connection example).

The auxiliary supply can be connected to a separate auxiliary supply or to the monitored voltage system. The range of the auxiliary supply input has to be observed.

The MH5880/500 has in addition to the prewarning function also a galvanic separated analogue output and an 11 step LED chain indicator, that displays the actual insulation value between 20 kOhm and 1 MOhm. On terminals U/G of the analogue output 0-10 V are provided, on terminals I/G 0-20 mA are available. By bridging terminals X1 and G the output can be switched over to 2-10 V and 4-20 mA. For the scaling of the analogue output see diagram M10142.

Setting



Technical Data

Auxiliary circuit

Nominal voltage U_N:	AC 220 ... 240 V, AC 380 ... 415 V DC 12 V, DC 24 V
Voltage range	
AC:	0.8 ... 1.1 U_N
DC:	0.9 ... 1.25 U_N
Frequency range (AC):	45 ... 400 Hz
Nominal consumption:	
AC:	approx. 2 VA
DC:	approx. 1 W

Measuring circuit

Nominal voltage U_N:	AC 0 ... 500 V
Voltage range:	0 ... 1.1 U_N
Frequency range:	10 ... 1000 Hz
Alarm value R_{AL}:	5 ... 100 kΩ
Prewarning value R_{VW} (only at MK 5880N/200):	10 kΩ ... 5 MΩ
Setting R_{AL}, R_{VW}:	infinite variable
Internal test resistor:	equivalent to earth resistance of < 5 kΩ
Internal AC resistance:	> 250 kΩ
Internal DC resistance:	> 250 kΩ
Measuring voltage:	approx. DC 15 V, (internally generated)
Max. measuring current (R_E = 0):	< 0.1 mA
Max. permissible noise DC voltage:	DC 500 V
Operate delay	
at R_{AL} = 50 kΩ, C_E = 1 µF	
R_E from ∞ to 0.9 R_{AL}:	approx. 1.3 s
R_E from ∞ to 0 kΩ:	approx. 0.7 s
Hysteresis	
at R_{AL} = 50 kΩ:	approx. 15 %

Technical Data

Output

Contacts:		
MK 5880N.12:	2 changeover contacts	
MK 5880N.38/200:	2 x 1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	≥ 3 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

Analogue output with MH 5880/500

galvanic separation AC 3750V
to auxiliary supply, measuring circuit and relay output

terminal U(+) / G(-):	0 ... 10 V, max. 10 mA
terminal I (+) / G(-):	0 ... 20 mA, burden 500 Ohm

change to 2 ... 10 V or 4 ... 20 mA by bridging terminal X1 and G (see diagram M10142)

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
between auxiliary supply		IEC 60 664-1
connections (A1- A2):	4 kV / 2 at AC-auxiliary voltage	
between measuring input		IEC 60 664-1
connections (L - PE):	4 kV / 2	
between auxiliary supply		IEC 60 664-1
and measuring input connections:	4 kV / 2 (3 kV at DC-auxiliary voltage)	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
Fast Transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
between A1 - A2:	1 kV (at AC-auxiliary voltage)	IEC/EN 61 000-4-5
between L - PE:	1 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled or 2 x 1.5 mm² stranded ferruled or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled	
Insulation of wires or sleeve length:	8 mm	

Technical Data

Plug in with cage clamp terminals

max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled
min. cross section for connection:	0.5 mm²
Insulation of wires or sleeve length:	12 $^{\pm 0.5}$ mm
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals
Mounting:	DIN rail IEC/EN 60 715
Weight	
MK 5880N:	approx. 180 g
MH 5880:	approx. 320 g

Dimensions

Width x heigth x depth

MK 5880N:	22.5 x 90 x 97 mm
MK 5880N PC:	22.5 x 111 x 97 mm
MK 5880N PS:	22.5 x 104 x 97 mm
MH 5880:	45 x 90 x 97 mm

CCC-Data

Auxiliary circuit	
Nominal voltage U_N:	AC 220 … 240 V DC 12 V, DC 24 V
Switching capacity:	
to AC 15	
NO contact:	1.5 A / AC 230 V

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard type

MK 5880N.12 AC 220 ... 240 V

Article number:	0054044
• Auxiliary voltage U_H :	AC 220 ... 240 V
• adjustable alarm value R_{AL}:	5 ... 100 kΩ
• Width:	22.5 mm

Variants

MK 5880N.38/200:	with pre-warning
MH 5880.38/500:	similar to MK 5880N but with galvanic separated analogue output (current/voltage) and 11 step LED chain for the actual insulation value Width: 45 mm

Ordering example for variants

MK 5880N .38 PS /200 AC 380 ... 415 V AL 5 ... 100 kΩ VW 10 K ... 5MΩ

- Pre-warning setting
- Alarm setting
- Auxiliary value
- Variant, if required
- Type of terminals
  - without indication: terminal blocks fixed, with screw terminals
  - PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  - PS (plug in screw): pluggable terminal blocks with screw terminals
- Contacts
- Type

Options with Pluggable Terminal Blocks

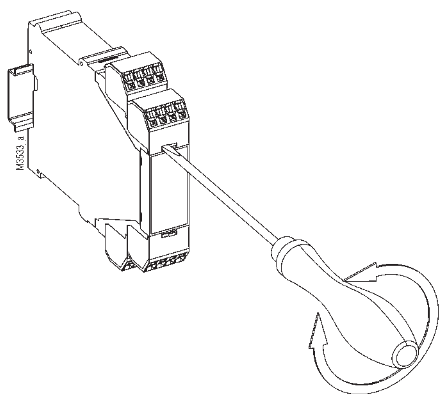
Screw terminal (PS/plugin screw)

Cage clamp terminal (PC/plugin cage clamp)

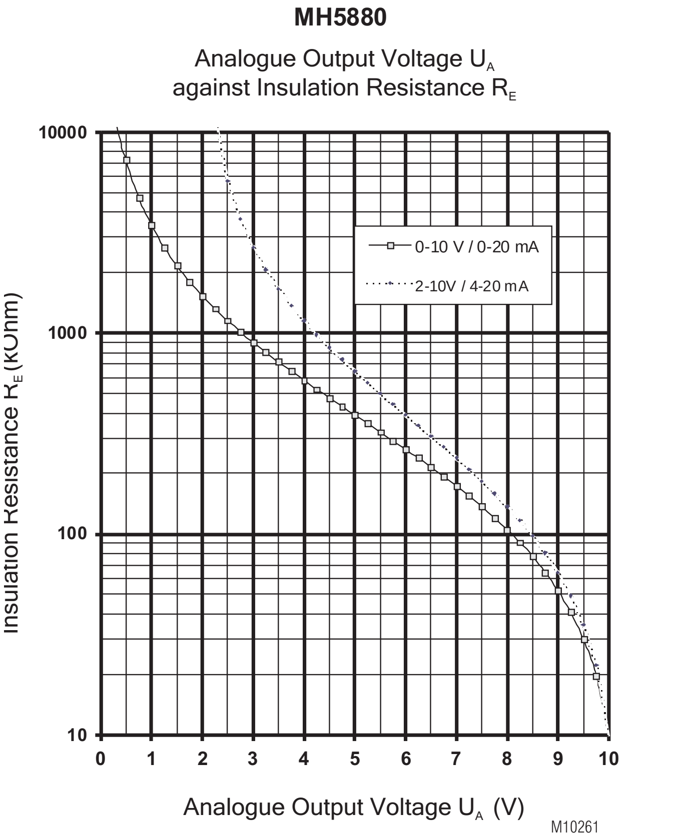
Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.

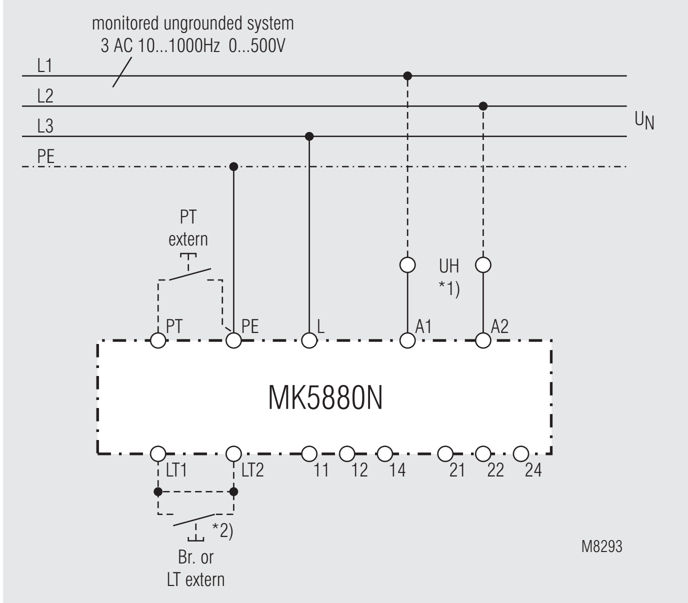


Characteristics



Analogue output voltage is proportional to the insulation resistance R_E

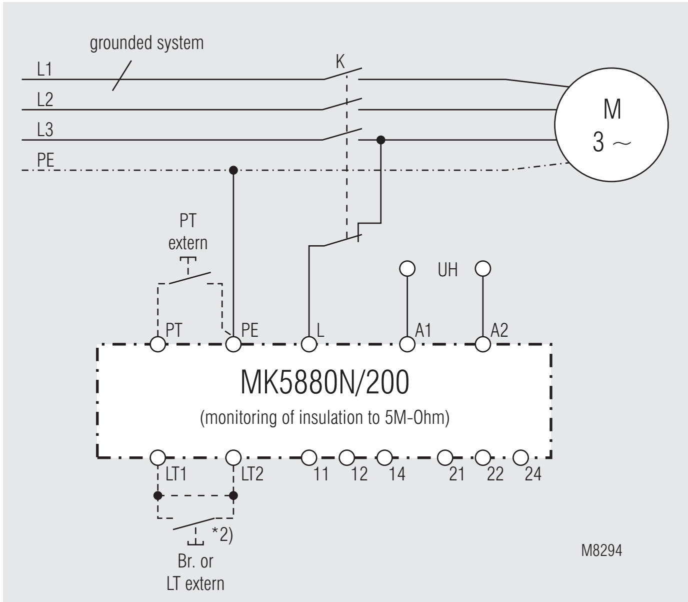
Connection diagrams



Monitoring of an ungrounded voltage system.

*1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The range of the auxiliary supply input must be observed.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT



Monitoring of motorwindings againgst ground
The insulation of the motor to ground is monitored as long as contactor K does not activate the load.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

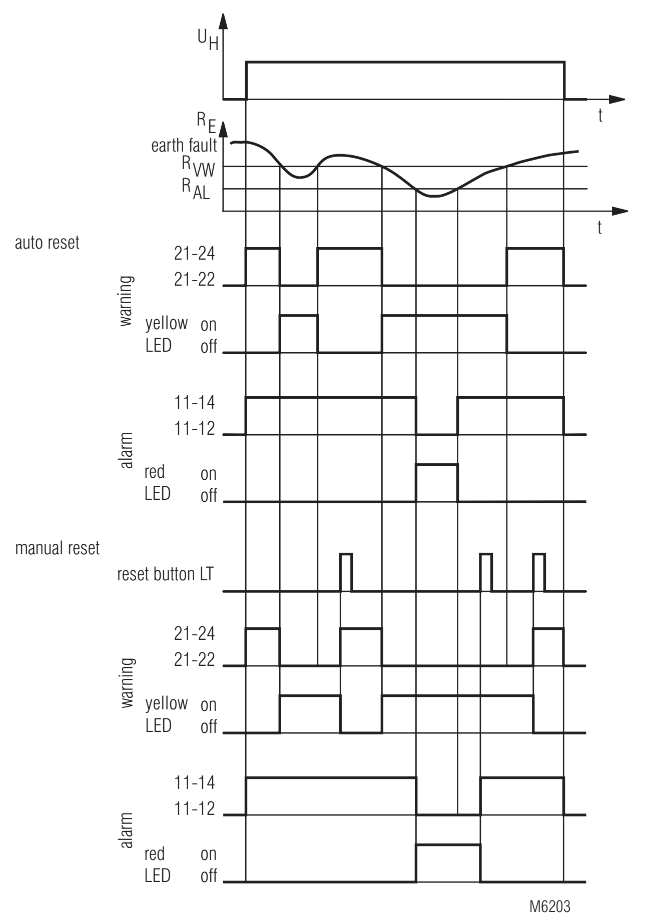
VARIMETER IMD
Insulation Monitor
RP 5888

DOLD

0272088

- Increasing the availability of machines and plants
- For preventive maintenance
- According to IEC/EN 61 557-8
- With configurable analogue output for insulating value
- For three-phase and A.C. power systems with 0 ... 500 V and 10 ... 1000 Hz
- Adjustable alarm value for ground fault R_{AL} of 5 k ... 5 MΩ
- Monitors also disconnected voltage systems
- Energized / de-energized on trip settable
- Measuring circuit, auxiliary voltage, output contacts and analogue output are galvanically separated
- Programmable for manual reset or hysteresis function
- With test and reset button
- Connections for external test and reset buttons possible
- LED indicators for operation and alarm
- 2 changeover contacts
- Output function programmable
- Width: 70 mm

Function Diagram



Function: de-energized on trip
With function energized on trip, the status of the relay contacts 11, 12, 14 and 21, 22, 24 is inverted

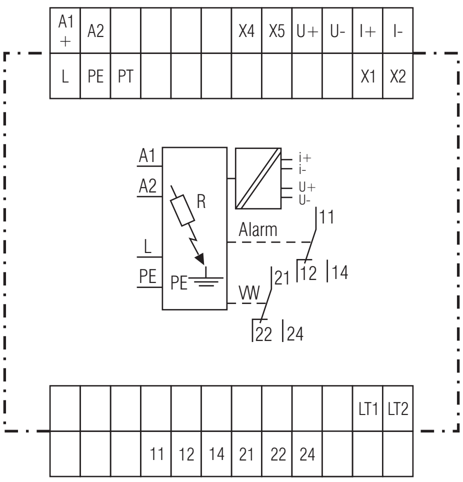
Approvals and Markings

CE

Application

- Monitoring of insulation resistance of ungrounded voltage systems to earth
- Can also be used to monitor standby devices for earth fault, e.g. motor windings of devices that have to function in the case of emergency
- Other resistance monitoring applications

Circuit Diagram



M9581_c

Function

The device is connected to the supply via terminals A1-A2. The unit can either be supplied from the monitored voltage system or from an separate auxiliary supply. Terminal L is connected to the monitored voltage and PE to earth. If the insulation resistance R_E drops below the adjusted alarm value R_{AL} the red LED goes on and the output relay switches off (de-energized on trip) or switches on (energized on trip). If the unit is on auto reset (bridge between LT1-LT2) and the insulation resistance gets better (R_E rises), the insulation monitor switches on (de-energized on trip) or switches off (energized on trip) again with a certain hysteresis and the red LED goes off. Without the bridge between LT1-LT2 the Insulation monitor remains in faulty state even if the insulation resistance is back to normal. The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply. By activating the "Test" button an insulation failure can be simulated to test the function of the unit.

5 measuring ranges can be selected by rotary switch. 5 ... 50 kOhm; 10 ... 100 kOhm; 50 ... 500 kOhm; 100 K ... 1 MOhm and 0.5 M ... 5 MOhm. The fine tuning is done with potentiometer R_{AL} x Bereich. With the range selector also the relay function is set. The 5 ranges on the left are with function de-energized on trip, the 5 functions on the right with function energized on trip.

With the 4 smaller ranges up to max. 1 MOhm a pre-warning can be adjusted between setting value and 5 MOhms. On the range 0.5 … 5 MOhm the pre-warning is adjustable between setting value and 10 MOhm. The pre-warning reacts on contact 21, 22, 24, the alarm value on contact 11, 12, 14. Turning R_{VW} fully anti clockwise contact 21, 22, 24 switches together with the alarm contact.

The pre-warning behaves similar as the alarm signal concerning manual reset. Hysteresis, energized or de-energized on trip

The devices have an analogue output that indicates the insulation resistance.

A Version with RS 485 interface is in preparation.

Analogue output:

Output Terminal	Terminal X4-X5 bridged	Terminal X4-X5 open
u+ / u-	2 ... 10 V	0 ... 10 V
i+ / i-	4 ... 20 mA	0 ... 20 mA

Terminal X1-X2, Analogue output:

X1-X2 open: Insulation value within the adjusted measuring range R_{AL} e. g. 50 ... 500 kOhm is proportional to 0 … 10 V on terminals u+/u- (x4-X5 is open).
The analogue value in relation to the insulation resistance can be seen in the diagrams M9605, M9606 (page 3 Setting aid).

X1-X2 bridged: Insulation value from 5 times the measuring range max 10 MOhm down to R_{AL} setting. e.g. range R_{AL}= 5 kOhm x 10 (max fine tuning) x 5 = 250 kOhm setting value range 5 kOhm x 4 (fine tuning) = 20 kOhm Analogue output 4... 20 mA is proportional to 20 … 250 kOhm

Indication

green LED "ON": On, when supply voltage connected (readiness for operation)

yellow LED "VW": On, when insulation resistance is under prewarning value, $R_E < R_{VW}$

red LED "AL": On, when insulation fault detected, $R_E < R_{AL}$ (value has fallen below alarm level)

Notes

The Insulation monitor RP 5888 is designed to monitor AC-voltage systems. Overlayed DC voltage does not damage the instrument but may change the conditions in the Measuring Circuit. In one voltage system only one Insulation monitor must be connected. This has to be observed when coupling voltage system.
Line capacitance C_E to ground does not influence the insulation measurement, as the measurement is made with DC-voltage. It is possible that the reaction time in the case of insulation time gets longer corresponding to the time constant $R_E * C_E$.

The Insulation monitor can be used, because of it´s higher setting value, to monitor single or 3-phase loads for ground fault.
If the load is operated from a grounded system the insulation resistance of the load can only be monitored when disconnected from the mains. This is normally the fact with loads which are operated seldom or only in the case of emergency but then must be function (see connection example).
The auxiliary supply can be connected to a separate auxiliary supply or to the monitored voltage system. The range of the auxiliary supply input has to be observed.
When monitoring 3-phase IT systems it is sufficient to connect the insulation monitor only to one phase. The 3-phases have a low resistive connection (approx. 3 - 5 Ω) via the feeding transformer. So failures that occure in the non-connected phases will also be detected.

Technical Data

Auxiliary circuit

Auxiliary voltage U_H:	AC/DC 24 ... 80 V, AC/DC 80 ... 230 V
Voltage range:	DC 19 ... 110 V, AC 19 ... 90 V, DC 64 ... 300 V, AC 64 ... 265 V 0.9 ... 1.25 U_N
Nominal frequency:	AC 50 / 60 Hz
Nominal consumption	
at AC:	5 VA
at DC:	2.5 W

Measuring ciruit

Nominal voltage U_N:	AC 0 ... 500 V
Voltage range:	0 ... 1.1 U_N
Frequency range:	10 ... 1000 Hz
Alarm value R_{AL}:	5 k ... 5 MΩ
Prewarning value R_{VW}:	R_{AL} ... 5 MΩ
Setting of ranges R_{AL} in 5 steps:	5 ... 50 kΩ, 10 ... 100 kΩ, 50 ... 500 kΩ, 100 k ... 1 MΩ and 0.5 M ... 5 MΩ
Setting R_{AL}:	infinite variable
Setting R_{VW}:	on relative scale related to R_{AL} setting value
Internal test resistor:	equivalent to earth resistance of < 5 kΩ
Internal AC resistance:	> 250 kΩ
Internal DC resistance:	> 250 kΩ
Measuring voltage:	approx. DC 15 V, (internally generated)
Max. measuring current (R_E = 0):	< 0.1 mA
Max. permissible noise DC voltage:	DC 500 V
Operate delay	
at R_{AL} = 50 kΩ, CE = 1 μF	
R_E from ∞ to 0,9 R_{AL}:	< 2 s
R_E from ∞ to 0 kΩ:	< 1,4 s
Hysteresis	
at R_{AL} = 50 kΩ:	approx. 15 %

Output

Contacts:	1 changeover contact for alarm 1 changeover contact for prewarning	
at R_{AL} = R_{VW}:	2 changeover contacts	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contacts:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	≥ 5 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impuls voltage / pollution degree		IEC 60 664-1
auxiliary supply / measuring input / contacts:	6 kV / 2	IEC 60 664-1
measuring input / analogue output:	4 kV / 2	IEC 60 664-1
contacts 11,12,14 / 21,22,24:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge(ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
between A1 - A2:	1 kV	IEC/EN 61 000-4-5
between L - PE:	1 kV	IEC/EN 61 000-4-5
Interference supression:		EN 61 000-6-3
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529

Technical Data

Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded wire DIN 46 228-1/-2/-3/-4	
Wire fixing:	box terminal with wire protection	
Fixing torque:	0.4 Nm max.	
Stripping length:	7.5 mm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 200 g	

Dimensions

Width x height x depth:	70 x 90 x 71 mm

Standard Type

RP 5888.12 AC/DC 80 ... 230 V

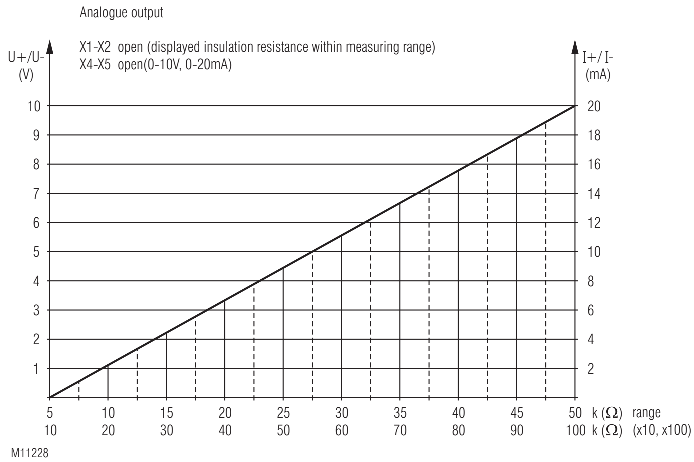
Article number:	0060868
• Auxiliary voltage U_H:	AC/DC 80 ... 230 V
• Setting alarm value: R_{AL}:	5 k ... 5 MΩ
• Width:	70 mm

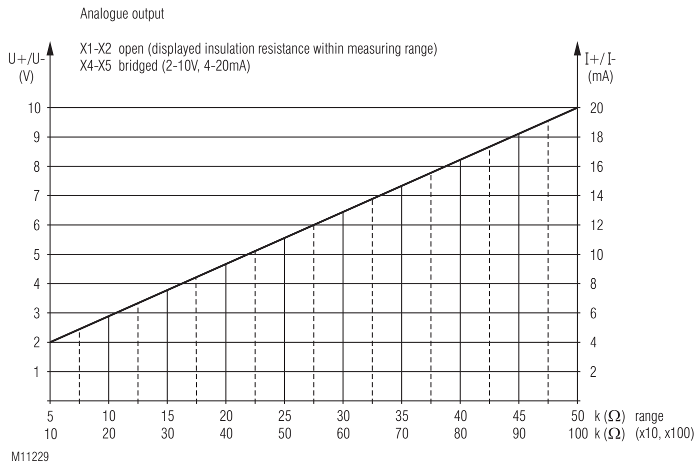
Ordering Example

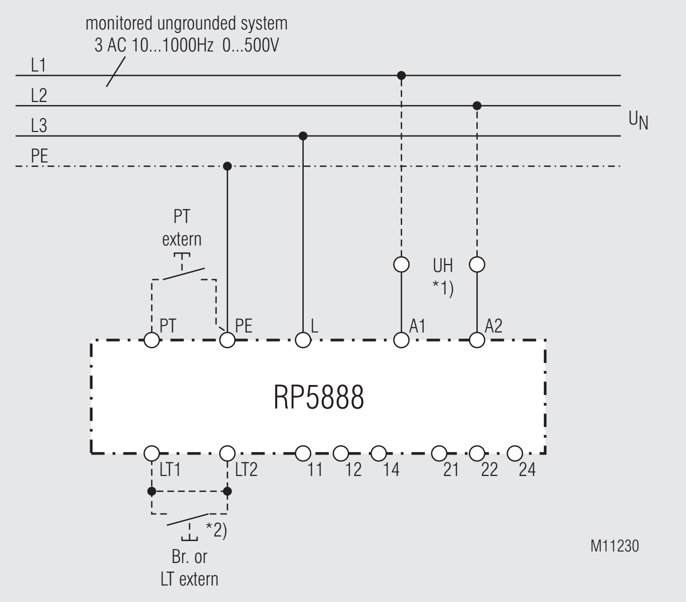
RP 5888 .12 AC/DC 80 ... 230 V R_{AL} 5 k ... 5 MΩ

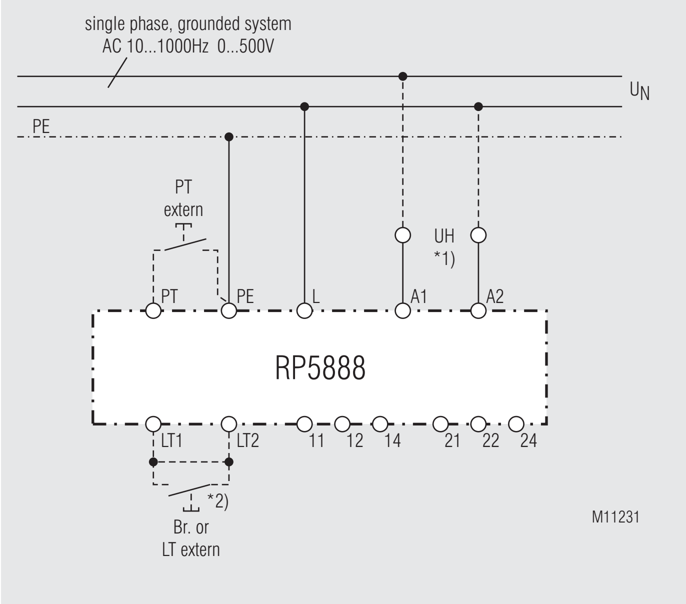
- Alarm value
- Auxiliary voltage
- Contacts
- Type

Setting Aid









Monitoring of an ungrounded voltage system.

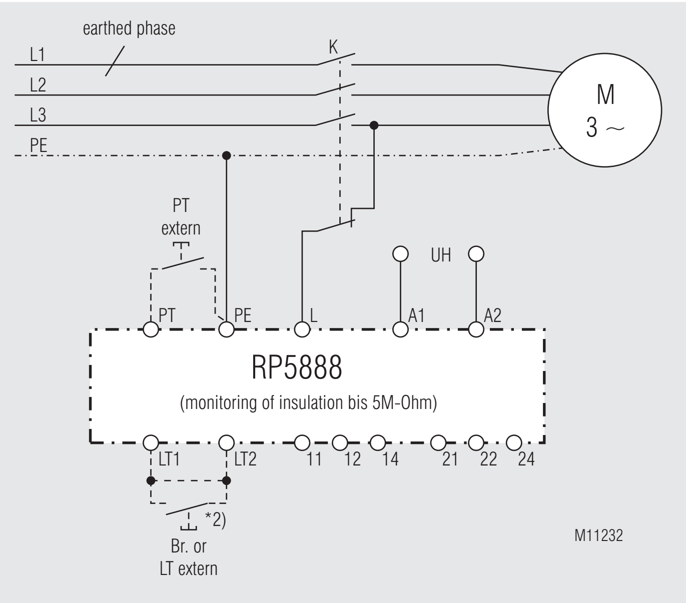
*1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The range of the auxiliary supply input must be observed.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

Monitoring of an ungrounded voltage system.

*1) Auxiliary supply U_H (A1 - A2) can be taken from the monitored voltage system. The range of the auxiliary supply input must be observed.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT



Monitoring of motorwindings against ground.
The insulation of the motor to ground is monitored as long as contactor K does not activate the load.

*2) with bridge LT1 - LT2: automatic reset
without bridge LT1 - LT2: manual reset, reset with button LT

VARIMETER IMD
Insulation Monitor
IN 5880/710, IN 5880/711, IP 5880/711

DOLD

0247384


IN 5880/710


IN 5880/711


IP 5880/711

- According to IEC/EN 60 255, DIN VDE 0435-303, IEC/EN 61 557-8
- For rooms used for medical purposes according to IEC 60364-7-710, DIN VDE 0100-710
- For three-phase and A.C. power systems with 0 … 500 V and 10 … 1000 Hz (IT power systems)
- Adjustable alarm value for ground fault R_{AL} of 50 … 500 kΩ
- Measuring circuit with broken wire protection
- As option, programmable for storing or non-storing of errors
- With reset and test button
- Additional external reset and test buttons can be connected
- LED indicators for operation, insulation fault, and interruption of Measuring circuit
- 2 changeover contacts
- As option, with LED chain for indication of the current insulation status
- 52.5 mm width

Approvals and Markings

CE

Application

For insulation monitoring of the IT system of rooms used for medical purposes according to VDE 0100-710:

Design and Method of Functioning

The terminals L/L' and PE/PE' are connected to the respective lines of the IT power system. If the IT transformer has a centre tapping or a star point, the terminals L / L' are preferably connected to this point. The terminals L' and PE' should be connected with separate lines and possibly not in the same place (at least not at the same terminal) of the IT power system to allow for safe recognition of an interruption in the measuring circle.

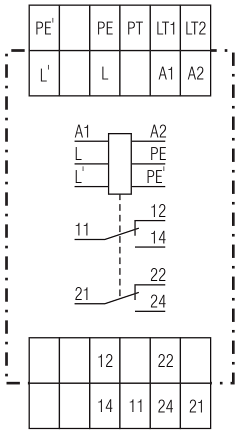
The insulation resistance of the IT power system against ground is measured between the terminals L / L' and PE / PE'. If the ground fault resistance R_E falls below the pickup value R_{AL} of the line isolation monitor, the red LED "AL" will be illuminated, and the two changeover contacts fall back into normal position. On interruption of the Measuring circuit, the two changeover contacts will likewise fall back into normal position, and the red LED "MK" will be illuminated.
After correction of the error ($R_E > R_{AL}$, Measuring circuit connected) and jumpered terminals LT1 – LT2 (= error not stored), the changeover contacts will change into work position (correct status), and the red error LEDs will stop lighting.
If you wish to store errors, remove the jumper LT1 – LT2. In this way, also short-lived errors as e.g. a temporary deterioration of insulation, for example by touching of a line or unreliable contact making in the Measuring circuit may trigger a stored alarm: The output contacts remain open also after the error has been corrected. The type of the error can be seen in retrospect from the illuminated error LED "AL" or "MK".
The error memory can be reset by pressing the internal or external reset key, or by switching off the auxiliary voltage.

By pressing the internal or external "Test" key, a deterioration of insulation is simulated in the Measuring circuit (= R_E approx. 40 kΩ); thus, the correct response of the isolation monitor is checked.

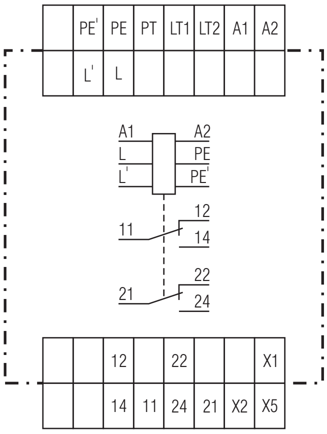
The variant IN 5880/711 comprises an 11-stage LED chain for indication of the current insulation resistance of the power system. By means of differently colored LEDs, the insulation status in the range of 20 kΩ ... 1 MΩ is indicated. In this way, deterioration of insulation can be detected even before an alarm is triggered.

The variant IP 5880/711 includes a 11 step LED indicator to monitor the actual state of the insulation, an additional power supply and relays to connect a test and indicator unit UP 5862. The width is 70 mm.

Circuit Diagrams

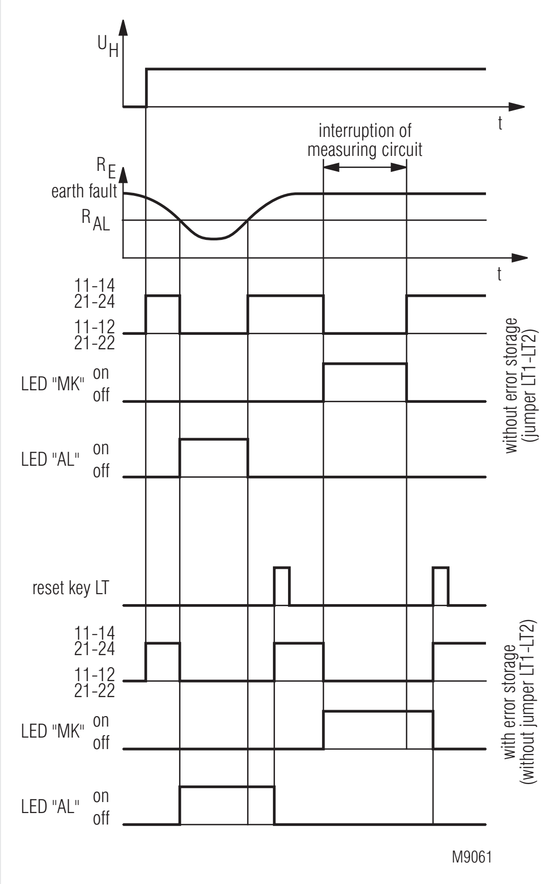


IN 5880/710, IN 5880/711



IP 5880/711

Function Diagram Insulation Monitoring System



Notes

General

Before checking insulation and voltage of the system, disconnect the monitoring device IN 5880 from the power source.

Insulation monitoring system

The isolation monitor is designed to monitor straight AC power systems. Any interfering direct voltages getting into the Measuring circuit will not damage the device but will falsify the conditions in the Measuring circuit while they are affecting it. As insulation measuring is performed via direct current, it will not be falsified by system capacitances against protective ground C_E. However, the pickup time may be longer in case of insulation failure, in the order of the time constant R_E times C_E.
In every IT circuit, only one isolation monitor must be connected.
This has to be observed when coupling voltage system.

Indicators

Green LED “ON”:	is illuminated when auxiliary voltage has been applied (operability)
Red LED “AL”:	is illuminated when an insulation failure is present, $R_E < R_{AL}$ (value has fallen below alarm level)
Red LED “MK”:	is illuminated when one of the lines of the Measuring circuit is interrupted (L, L’, PE, PE’)

With IN 5880/711, additional 11-stage LED chain:

Green LEDs:	at ≥ 1 MΩ, 750 kΩ, 550 kΩ
Yellow LEDs:	at 400 kΩ, 300 kΩ, 220 kΩ, 160 kΩ, 110 kΩ, 75 kΩ
Red LEDs:	at 40 kΩ, ≤ 20 kΩ

Technical Data

Insulation Measuring Circuit

Nominal voltage U_N:	AC 0 ... 500 V	
Voltage range:	0.8 ... 1.1 U_N	
Frequency range:	10 ... 1000 Hz,	
Alarm value R_{AL}:	Adjustable from 50 … 500 kΩ	
Internal testing resistor:	corresponds to an R_E of approx. 40 kΩ	
AC internal resistance:	> 250 kΩ	
DC internal resistance:	> 250 kΩ	
Measuring voltage:	approx. DC 15 V (generated internally)	
Max. measuring current (R_E = 0):	< 50 µA	
Max. permissible interfering direct voltage:	DC 500 V	
Operate delay:	with R_{AL} = 50 kΩ, CE = 1 µF	
R_E of ∞ to 0.9 R_{AL}:	< 1.3 s	
R_E of ∞ to 0 kΩ:	< 0.7 s	
Hysteresis:	approx. 15 %	

Auxiliary Circuit

Auxiliary voltage U_H:	AC 220 ... 240 V
Voltage range:	0.85 ... 1.1 U_H
Nominal consumption:	approx. 2 VA
Nominal frequency:	45 ... 400 Hz

Output

Number of contacts provided:	2 changeover contacts	
Thermal current I_{th}:	5 A	
Switching capacity acc. to AC 15		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
Contact life		
to AC 15 with 1 A, AC 230V:	5 x 10^5 operating cycles	IEC/EN 60 947-5-1
Short circuit strenght		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 operating cycles	

General Data

Nominal operation:	Permanent operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
overvoltage category/ pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Static discharge (ESD):	8 kV (air discharge)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surges		
between supply lines:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Radio interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0 behavior according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm^2 massive, or 2 x 1.5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3	
Wire fixing:	Screw terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Net weight		
IN 5880/710:	approx. 190 g	
IN 5880/711:	approx. 250 g	
IP 5880/711:	approx. 350 g	

Dimensions

Width x height x depth	
IN 5880/710, IN 5880/711:	52.5 x 90 x 59 mm
IP 5880/711:	70 x 90 x 59 mm

Standard Type

IN 5880.12/710 AC 220 – 240 V

Article number:	0056739
• Output:	2 changeover contacts
• Auxiliary voltage U_H:	AC 220 ... 240 V
• Overall width:	52.5 mm
• Adjustable alarm value R_{AL}:	50 ... 500 kΩ

Variant

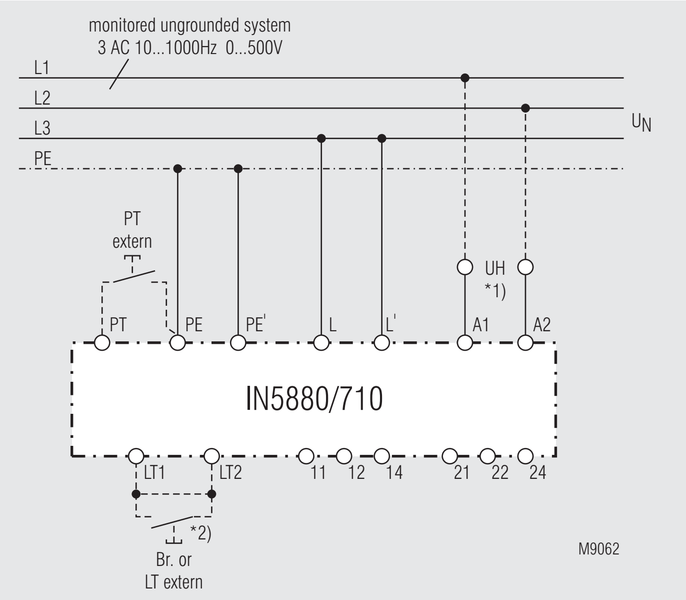
IN 5880/711:	with 11-stage LED chain for indication of the current insulation value
IP 5880/711:	with 11-stage LED chain for indication of the current insulation value, in addition with connection for test and indicator panel UP 5862

Ordering Example

IN 5880.12/710   AC 220 ... 240 V   50 ... 500 kΩ

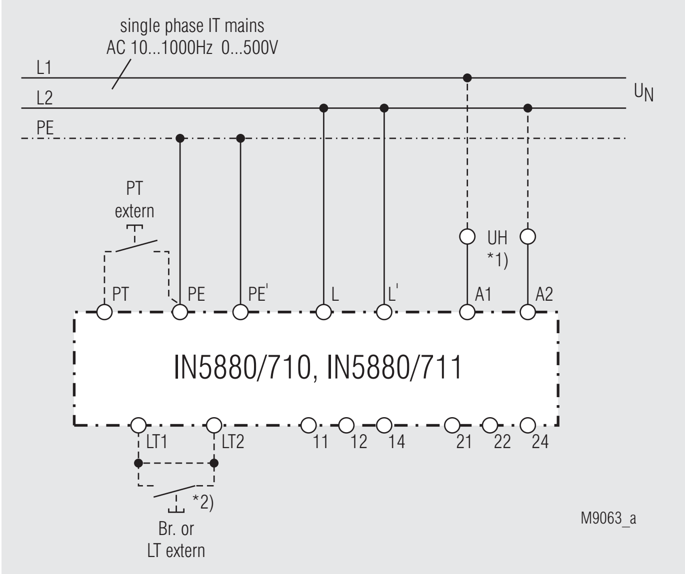
Alarm value
Auxiliary voltage
Type

Connection Example



Monitoring of a 3-phase IT power system

Connection Examples

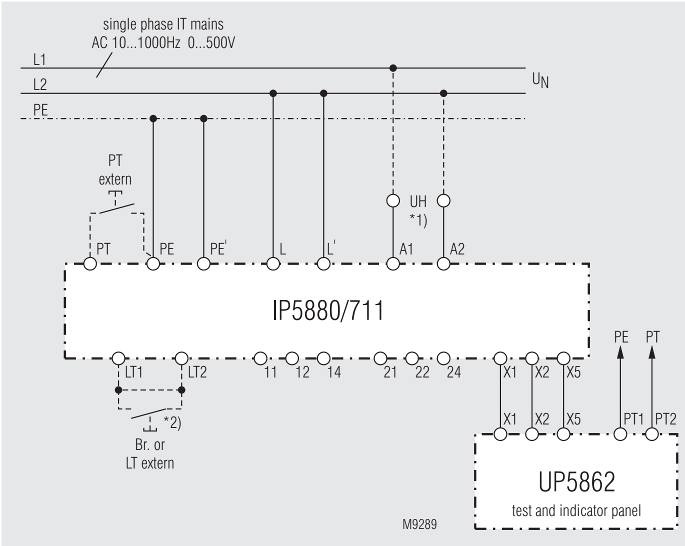


Monitoring of a single phase IT power system

*1) The auxiliary voltage U_H (A1 – A2) can also be drawn from the power system to be monitored. However, the voltage range of the auxiliary voltage must be taken into consideration.

*2) With jumper LT1 – LT2: No storing of error message (hysteresis behavior)

With jumper LT1 – LT2: Storing of error message; can be deleted by pressing the Delete (Reset) key LT



Accessories

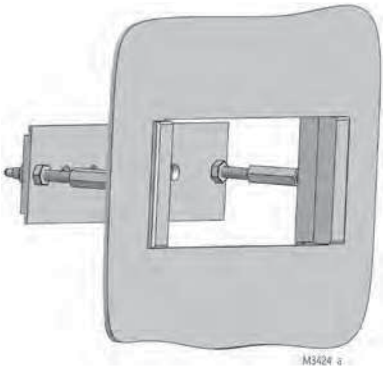
Test and indicator panel UP 5862
For insulation monitors in medically used rooms according to
IEC 60 364-7-710, DIN VDE 0100-710

- to mount in flush device boxes ø 60 mm, 35 mm deep;
- test button to check the function of the device
- with green LED to indicate operation
- reset button for audible alarm
- with yellow LED to monitor insulation failure

Max. wire length to IN / IP 5880
at wire cross section A = 0.5 mm^2: 500 m
at wire cross section A = 1.5 mm^2: 1000 m

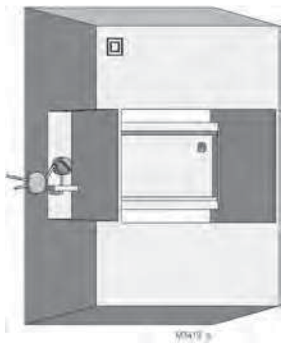
Dimensions (width x height): 80 x 80 mm
Article number: 0041706

Flush mounting kit
Order reference: KU 4087-150/005659



For universal use with:
- I-series devices of 17,5 to 105 mm width
- easy mounting

Mounting kit for surface mounting
KU 4087-100



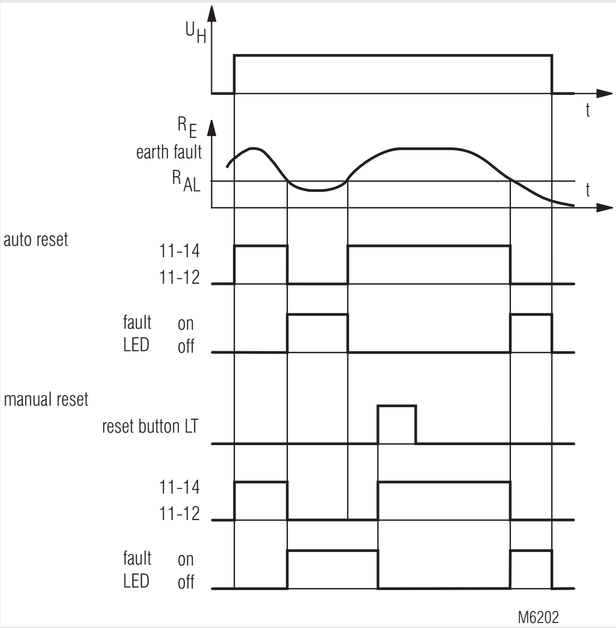
Device of I-series	Width (mm)	Order reference
IK	17.5	KU4087-100/56763
IL	35.0	KU4088-100/56764
IN	52.5	KU4084-100/56765
IP	70.0	KU4089-100/56766
IR	105.0	KU4090-100/56767

VARIMETER IMD
Insulation Monitor
IL 5881, SL 5881

0238810

IL 5881 SL 5881

Function Diagram



IL 5881/100, SL 5881/100; IL 5881, SL 5881

- According to IEC/EN 61 557-8
- For DC voltage systems up to 12 ... 280 V
- Wide voltage range of measuring input U_N DC 12 ... 280 V (on request DC 24 ... 500 V with separate auxiliary supply, Measuring range 20 ... 500 kΩ)
- Adjustable tripping value R_{AL} of 5 ... 200 kΩ
- Selective ground fault indication for L+ and L- allows fast fault finding
- Without auxiliary supply
- De-energized on trip
- 2 changeover contacts
- Automatic or manual reset, programmable
- With test and reset buttons
- Connection for external test and reset button possible
- galvanic separated AC or DC auxiliary supply available as option
- adjustable time delay as option
- 2 models available:

IL 5881:	61 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 880
SL 5881:	98 mm deep with terminals near to the top to be mounted in cabinets with mounting plate and cable ducts

- DIN rail or screw mounting
- 35 mm width

Approvals and Markings

A025518

Application

- Monitoring of insulation resistance of ungrounded DC-voltage systems to earth.
- For industrial and railway applications

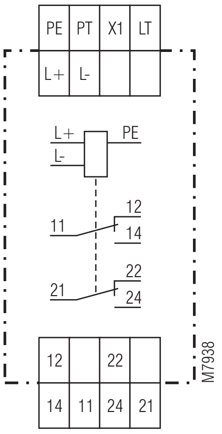
Function

If the insulation resistance R_E between L+ or L- to ground drops below the adjusted alarm value R_{AL} (insulation failure) the corresponding red LED goes on and the output relay switches off (de-energized on trip). If the unit is on auto reset (bridge between LT-X1) and the insulation resistance gets better (R_E rises), the insulation monitor switches on again with a certain hysteresis and the red LED goes off.
Without the bridge between LT-X1 the insulation monitor remains in faulty state even if the insulation resistance is back to normal. The location of the fault on L+ or L- is indicated on the corresponding LED (selective fault indication).
The reset is done by pressing the internal or external reset button or by disconnecting the auxiliary supply.
By activating the "Test" button internal or external an insulation failure can be simulated to test the function of the unit.

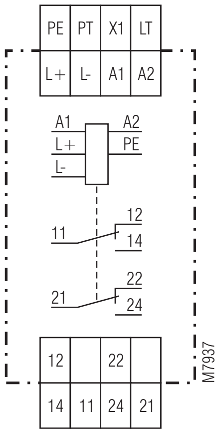
Indicators

Green LED "ON":	On, when supply voltage connected
Red LED "RE+":	On, when insulation fault detected (R_{E+} < R_{AL}) on L+
Red LED "RE-":	On, when insulation fault detected (R_{E-} < R_{AL}) on L-

Circuit Diagrams



IL 5881.12/100



IL 5881.12

Connection Terminals

Terminal designation	Signal designation
A1	L / +
A2	N / -
L+, L-	Connection for monitored IT-systems
PE	Connection for protective conductor
PT, X1	Connection for external test button
LT, X1	Connections for external reset or manual and auto reset: LT/X1 bridged: hysteresis function LT/X1 not bridged: manual reset
11, 12, 14 21, 22, 24	Changeover contact (insulation failure)

Notes

The IL/SL 5881 can be used in systems with high leakage capacity to ground. When the unit is adjusted to high alarm values a leakage capacity can create a pulse when switching the system on (short alarm pulse). This happens at the following values:

IL / SL 5881: R_{AL} = 200 kΩ: C_E > 1 µF
IL / SL 5881: R_{AL} = 50 kΩ: C_E > 6 µF
IL / SL 5881: R_{AL} = 20 kΩ: C_E > 16 µF

IL / SL 5881/100: R_{AL} = 500 kΩ: C_E > 0.8 µF
IL / SL 5881/100: R_{AL} = 200 kΩ: C_E > 0.8 µF
IL / SL 5881/100: R_{AL} = 50 kΩ: C_E > 2.0 µF
IL / SL 5881/100: R_{AL} = 20 kΩ: C_E > 4.5 µF

An optional time delay (on request) could suppress this pulse.

Because of the measuring principle with a resistor bridge (asymmetry principle) the insulation monitor IL/SL 5881 will not detect symmetric ground faults of L+ and L-. Also a voltfree (disconnected U_N = 0V) system cannot be monitored.

Notes

On models with separate auxiliary supply the alarm state is not defined when the voltage drops below 3 V. To avoid false alarm an additional auxiliary relay should be used which is connected to the monitored voltage or the variant IL 5881.12/010 is used.

On the models with galvanic separation between DC auxiliary supply and measuring input, the supply (A1/A2) can be connected to the monitored voltage system (L+/L-). The voltage range of the auxiliary input must be noticed which is only 1.25 of U_H while the measuring input always goes up to 280 V.

If no auxiliary supply is available the model IL/SL 5881/100 (without auxiliary supply) can be used which takes the auxiliary supply from the monitored system (U_H = U_N = DC 12 ... 280 V).

In one isolated voltage system only one insulation monitor must be connected, because several units would influence each other (half response value if 2 devices are connected).

Technical Data

Auxiliary Circuit
(only at IL/SL 5881)

Auxiliary voltage U_H: AC 220 ... 240 V, 380 ... 415 V
DC 12 V, 24 V
DC 24 ... 60 V
Voltage range:
AC: 0.8 ... 1.1 U_H
DC: 0.9 ... 1.25 U_H
Frequency range (AC): 45 ... 400 Hz
Nominal consumption
AC: approx. 2 VA
DC: approx. 1 W

Measuring Circuit

	Standard	extended, on request
Nominal voltage U_N at		
≤ 5 % residual ripple:	DC 12 ... 280 V	DC 24 ... 500 V
≤ 48 % residual ripple:	DC 12 ... 220 V	
Voltage range:	0,9 ... 1,1 U_N	0,9 ... 1,1 U_N
Alarm value R_{AL}:	5 ... 200 kΩ	20 ... 500 kΩ
Setting R_{AL}:	infinite setting	infinite setting
Internal AC resistance L+ and L- to PE:	each approx. 75 kΩ	each approx. 190 kΩ
Max. Messstrom an PE (R_E = 0):	U_N / 75 kΩ	U_N / 190 kΩ

Operate delay
at R_{AL} = 50 kΩ, C_E = 1 µF
R_E from ∞ to 0.9 R_{AL}: approx. 0.8 s
R_E from ∞ to 0 kΩ: approx. 0.4 s
Response inaccuracy: ± 15 % + 1.5 kΩ IEC 61557-8
Hysteresis
at R_{AL} = 50 kΩ: approx. 10 ... 15 %
Time delay: 0.5 ... 20 s (variant)

Output

Contacts:
IL / SL 5881.12: 2 changeover contacts
Thermal current I_{th}: 4 A
Switching capacity
to AC 15: 3 A / AC 230 V IEC/EN 60 947-5-1
Switching capacity
to DC 13: 2 A / DC 24 V
0.2 A / DC 250 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V: ≥ 2 x 10^5 switching cycles IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 10 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 20 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
between auxiliary supply connections(A1 / A2):	4 kV / 2 at AC-auxiliary voltage	IEC 60 664-1
between measuring input connections (L+ / L- / PE):	4 kV / 2	IEC 60 664-1
between auxiliary supply and measuring input connections:	4 kV / 2	IEC 60 664-1
Input to output(contacts):	6 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:		
80 MHz ... 1 GHz:	12 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
between A1 - A2 and L+ - L-:	1 kV	IEC/EN 61 000-4-5
between A1, A2 - PE and L+, L- - PE:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL Subjekt 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	DIN 46 228-1/-2/-3/-4	
Cross section:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded wire	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight		
IL 5881:	approx. 170 g	
SL 5881:	approx. 200 g	

Dimensions

Width x height x depth:	
IL 5881:	35 x 90 x 61 mm
SL 5881:	35 x 90 x 98 mm

Classification to DIN EN 50155 for IL 5881

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Types

IL 5881.12/100 DC 12 ... 280 V 5 ... 200 kΩ
Article number: 0053805
- Without auxiliary supply U_H
- Nominal voltage U_N: DC 12 ... 280 V
- adjustable alarm value R_{AL}: 5 ... 200 kΩ
- Width: 35 mm

SL 5881.12/100 DC 12 ... 280 V 5 ... 200 kΩ
Article number: 0055168
- Without auxiliary supply U_H
- Nominal voltage U_N: DC 12 ... 280 V
- adjustable alarm value R_{AL}: 5 ... 200 kΩ
- Width: 35 mm

Variants

IL / SL 5881.12:	with auxiliary supply
IL / SL 5881.12/010	with auxiliary supply no alarm at U_N < 3 V
IL / SL 5881.12/300	without auxiliary supply Nominal voltage U_N DC 12 ... 280 V closed circuit operation Time delay 0.5 ... 20 s

Ordering example for variants

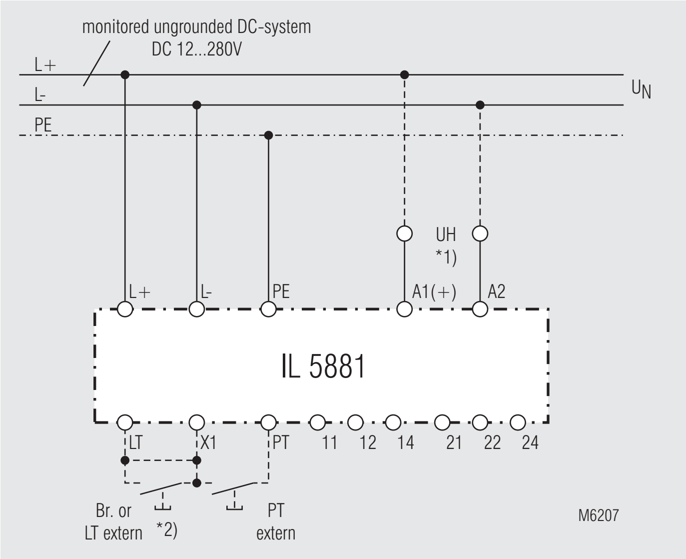
IL 5881 .12 AC 220 ... 240 V 5 ... 200 kΩ

Response value
Auxiliary voltage
Contacts
Type

Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578

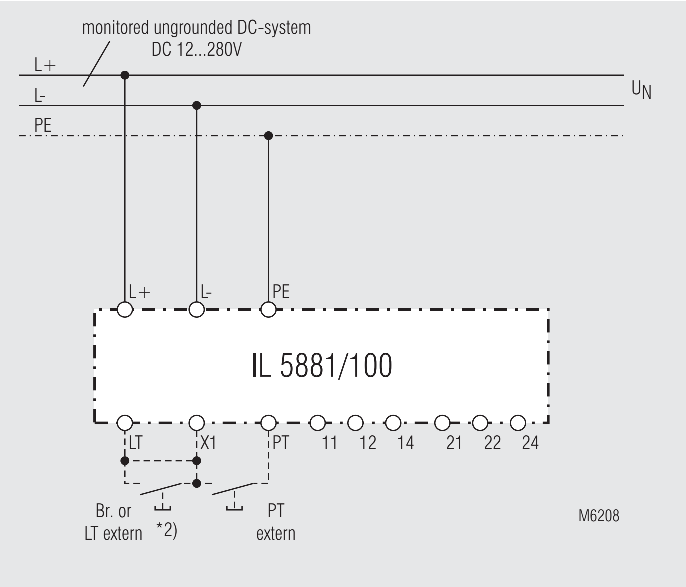
Connections Examples



Monitoring of an ungrounded system.

*1) Auxiliary supply U_H (A1-A2) can be taken from monitored voltage system. The range of the auxiliary supply input must be observed.

*2) with bridge LT - X1: automatic reset
without bridge LT - X1: manual reset, reset with button LT



Monitoring of an ungrounded system without auxiliary supply.

*2) with bridge LT - X1: automatic reset
without bridge LT - X1: manual reset, reset with button LT

VARIMETER EDS
Locating current injector
RR 5886

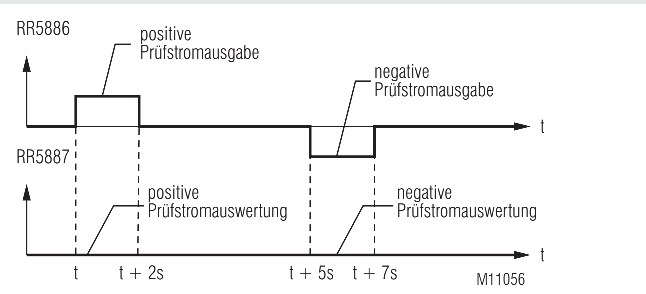
Your Advantages
- Quick correction of insulation faults in complex power networks
- Universal auxiliary voltage range AC/DC 85 ... 265 V

Features
- Insulation troubleshooting in DC, AC and mixed IT systems in connection with the insulation fault locator RR 5887 according to DIN EN 61557-9 (VDE 0413-9):2009 and DIN EN 61557-1 (VDE 0413-1)
- Insulation coordination according to IEC 60664-1
- External control via insulation monitor possible
- Positive and negative test current to monitor DC networks and networks with simultaneous alternating current and direct current portions present
- RS-485 bus connection to synchronise the test current analysis and optionally for the connection to the EDS measuring bus
- Control via insulation monitor via RS-485 bus or external control input possible
- Pushbutton for manual test current output
- Terminal connection for automatic test current output
- Status output of insulation fault detection via external switching output
- Width: 105 mm

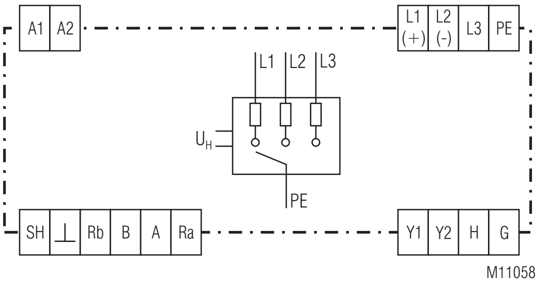
Product description
The locating current injector RR 5886 in connection with the insulation fault locator RR 5887 monitors and localises insulation faults in complex AC/DC networks (IT systems). The external current transformers work independently of each other, calibrate themselves and are simply connected to the measuring channels of the insulation fault locator RR 5887. The number of measuring channels is increased by combining several insulation fault locators via a RS-485 bus connection. The search for insulation faults in extensive networks can be refined in this manner. Two different alarm levels facilitate the timely detection of a dangerous insulation state. The devices are operated easily and intuitively thanks to automatic balancing and a clear layout of the setting elements. The early detection and localisation of insulations faults permits their quick and targeted correction. As user you will benefit from the operating reliability and high availability of your system.

Approvals and Markings
CE

Application
- Insulation fault detection in complex AC/DC networks
- Industry, shipbuilding, plant engineering, PV systems
- Quick fault correction of insulation faults in medical facilities

Function Diagram


Indication
green LED "ON":	on, when supply connected
yellow LED „ ⊓ “:	Indicates the output of the positive test current pulse
yellow LED „ ⊔ “:	Indicates the output of the negative test current pulse
yellow LED „RS485“:	Indicates RS-485 bus activity and test current output

Circuit Diagram


Connection Terminals
Terminal designation	Signal designation
A1(+), A2	Auxiliary voltage AC or DC
L1(+), L2(-), L3, PE	IT network voltage connections DC/ AC/3AC
SH, GND, Rb, B, A, Ra	RS-485 Bus (galvanic separation)
Y1, Y2	Switching input Test current output to control
G, H	Status switching output Test current output

Notes

Switching input
The test current output can be externally controlled via the switching input (terminals Y1, Y2). If the terminal connection is left open, the test current output can be controlled manually via the start/stop button. The test current output is started and stopped in alternating fashion with each push of the button.

When bridging terminals Y1-Y2, the test current is output automatically after switching on the device. The start-stop button is inactive at this time.

The switching input can also be selected directly via an external device, e.g. insulation monitoring device. The switching input is supplied as well via the electrically separated supply voltage. The switching input can therefore be switched via a transistor or a relay output.

Configuration options for the test current output:

Y1
Y2 *Automatic test current output*

Y1 *Release of the test current output through*
Y2 *higher level control or external switch*

Y1 *Test current output controlled manually*
Y2 *via device pushbutton*

Switching output
The status of the test current output can be monitored via the switching output (terminals H, G). The switching output consists of a switching transistor, which is low-resistance at test current output and otherwise high-resistance. To generate digital output signals, the switching output must be connected to an external voltage source via a pull-up resistor.

RS-485 bus connection
The locating current injector can be operated both in master mode and slave mode. The bus mode is set via a rotary switch.

The RS485 telegrams the locating current injector sends to synchronise the insulation fault measurement are identical in both bus modes.
While in the master mode the output of the telegrams occurs automatically every 12 seconds, in slave mode it occurs as response to a bus master request. A pending test current output is announced here in the user data range of the response telegram.

The insulation fault locators RR 5887, generally working in slave mode, synchronise themselves by monitoring the RS485 telegram network with manual test current output.

The RS-485 LED is permanently on during the test current output and bus activity and flashes when bus failures occur.

Technical Data

Auxliary voltage

Nominal voltage range	
A1(+) / A2:	AC/DC 100 ... 230 V
Voltage range:	AC/DC 85 ... 265 V
Nominal consumption:	< 3 VA

Monitored network

Nominal voltage:	DC / AC / 3AC 24 … 360 V
Voltage range AC / 3AC	
L1/L2/L3:	21 ... 400 V, 40 ... 60 Hz
Voltage range DC	
L1(+)/L2(-):	21 ... 400 V
Rated current range for insulation test currents:	1 ... 5 mA
Maximum test current output:	6.5 mA
Test clock/test pause:	2 s / 3 s
Bus (galvanic separation):	RS-485

Technical Data

Switching input

Terminals:	Y1, Y2
Connection (passive)	
Low-signal:	Bridge set / input low resistance
High-signal:	Input open / input high resistance
Connection (active)	
Voltage range (low/high):	0V / 12 ... 24 V
Max. switching current (24 V):	10 mA

Switching output

Terminals:	H(+), G(-)
Switching output (passive):	transistor outputs
Test current output:	Output low resistance (minimal 220 Ω via PTC)
No test current output:	Output high resistance
Switching voltage max.:	24 V
Switching current max. (24 V):	10 mA

RS-485 Bus

Terminals:	SH, ⊥, Rb, B, A, Ra
Bus:	galvanic separation
Geräte Mode	
Bus-Master/Slave:	adjustable via rotational switch
Transmission medium:	twisted, shielded two-wire line (SH)
Data transmission rate:	115.2 kBit/s
Network termination:	Bus termination via bridges Rb, B and Ra, A

General Data

Nominal operating mode:	continuous operation	
Temperature range:	-20 ... + 60 °C	
Clearance and creepage distance		
rated impulse voltage/ pollution degree:	4 kV / 3	IEC 60 664-1
EMC		
Electro static discharge (ESD):	8 kV (air)	IEC/EN 61000-4-2
HF irradiation:	10 V / m	IEC/EN 61000-4-3
Fast transients:	2 kV	IEC/EN 61000-4-4
Surge voltage between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10...55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04	
Terminal designation:	EN 50 005	
Wire connection		
screw terminals:	fixed max. 4 mm² solid or 2.5 mm² stranded wire with sleeve min. 0.20 mm²	
clamping screw:	M2.5	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx. 200 g	

Dimensions

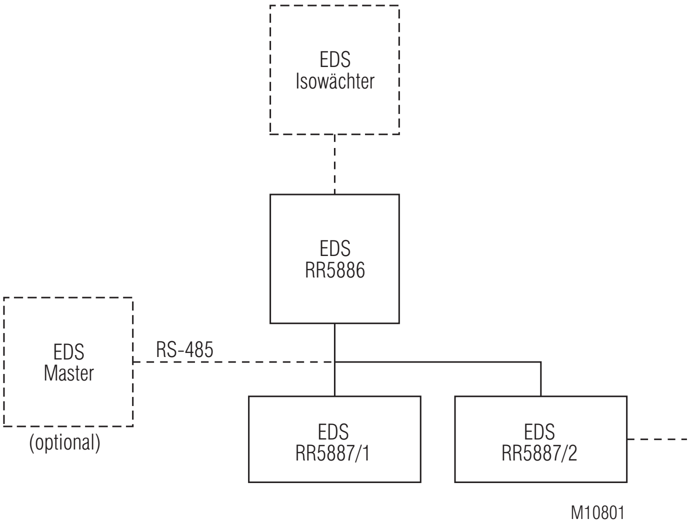
Width x height x depth:	105 x 90 x 71 mm

Standard Type

RR 5886 AC/DC 85 ... 265 V

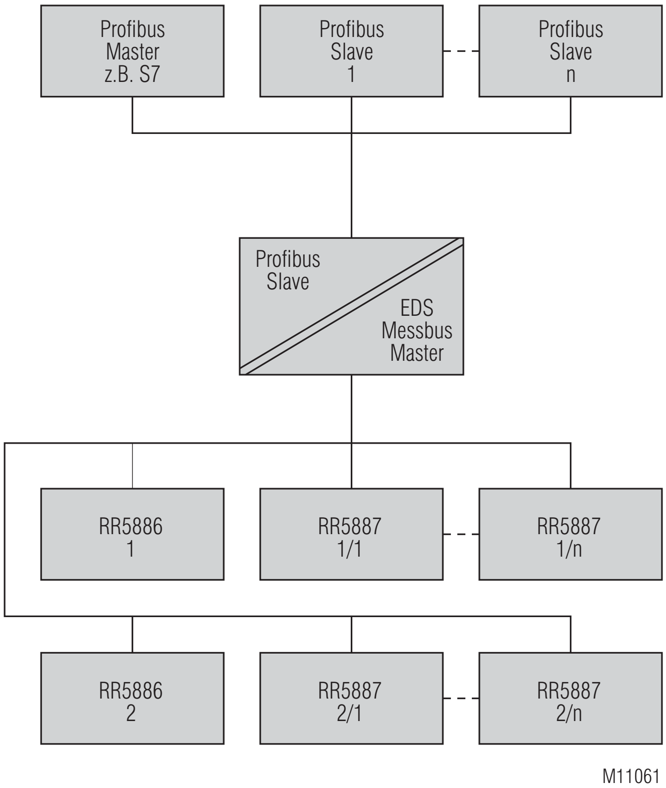
Article number:	0065011
• Rated current range for insulation test currents:	1 ... 5 mA
• Maximum test current output:	6.5 mA
• Width:	105 mm

System overview

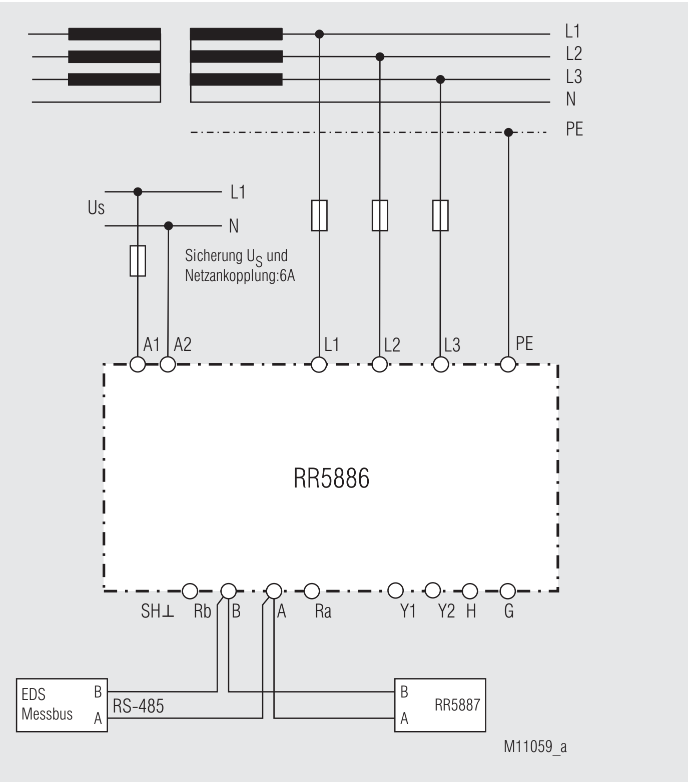


- Insulation fault detection in DC / AC / 3AC IT networks in connection with the insulation fault locator RR 5887
- External selection via an insulation monitoring device possible

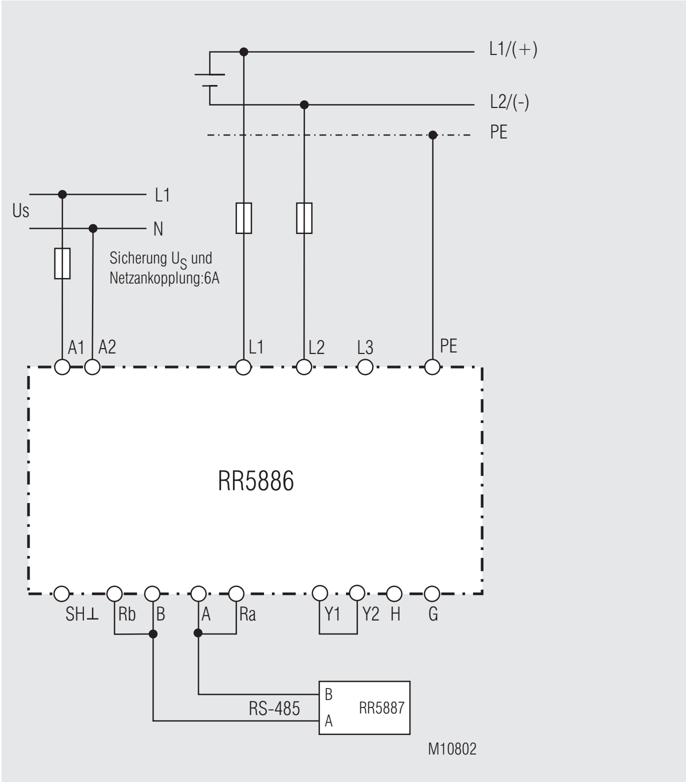
Connection to measuring bus /Profibus gateway



Connection Examples

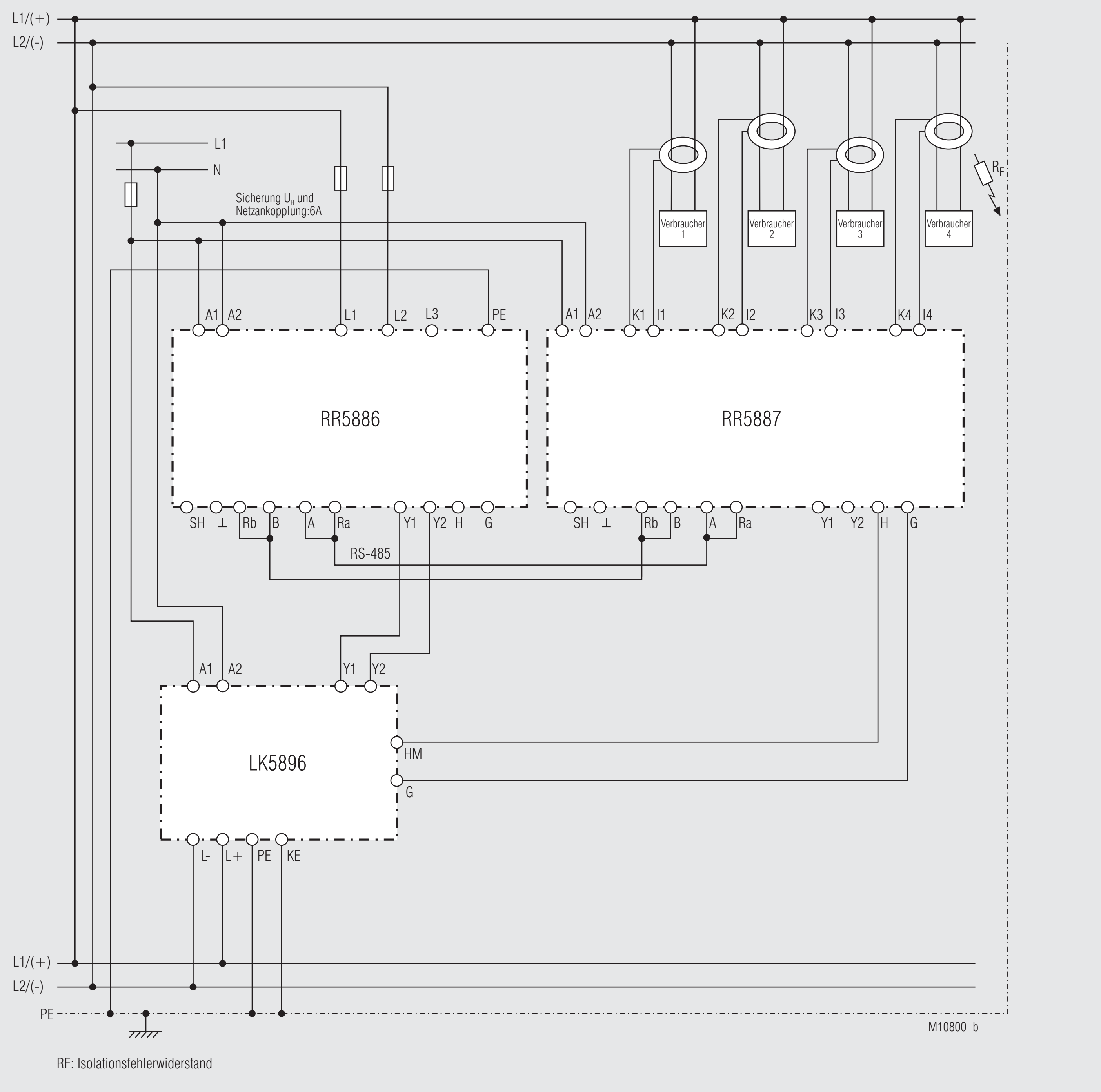


3AC network with manual test current output;
EDS measuring bus connection without bus termination



AC (DC) network with automatic test current output;
RR5886 is bus master; bus termination on the device

Connection Example



Insulation monitoring and insulation fault detection with 4 connected current transformers in a DC/AC network with subdistribution - insulation fault detection can be controlled by the insulation monitor /LK 5896); ALARM MEMORY active, i.e. alarm states are stored; bus termination of the first and last device on the RS-485 bus.

VARIMETER EDS
Insulation fault locator
RR 5887

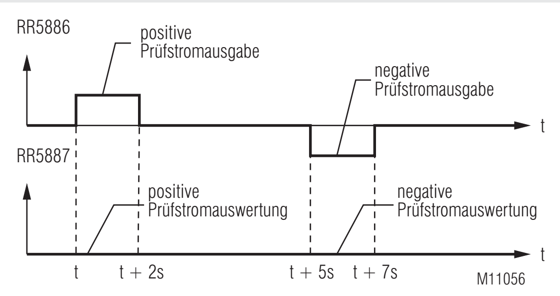
0269248

4-channel design

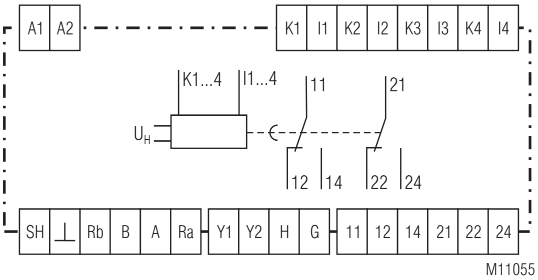
Product Description

The locating current generator RR 5886 in connection with the insulation fault locator RR 5887 monitors and localises insulation faults in complex AC/DC networks (IT systems). The external current transformers work independently of each other, calibrate themselves and are simply connected to the measuring channels of the insulation fault locator RR 5887. The number of measuring channels is increased by combining several insulation fault locators via a RS-485 bus connection. The search for insulation faults in extensive networks can be refined in this manner. Two different alarm levels facilitate the timely detection of a dangerous insulation state. The devices are operated easily and intuitively thanks to automatic balancing and a clear layout of the setting elements. The early detection and localisation of insulations faults permits their quick and targeted correction. As user you will benefit from the operating reliability and high availability of your system.

Function Diagram



Circuit Diagram



Your Advantages
- Quick correction of insulation faults in complex power networks
- Universal auxiliary voltage range AC/DC 85 ... 265 V
- Easy operation

Features
- Insulation troubleshooting in DC, AC and mixed IT systems in connection with the locating current injector RR 5886 according to DIN EN 61557-9 (VDE 0413-9):2009 and DIN EN 61557-1 (VDE 0413-1)
- Insulation coordination according to IEC 60664-1
- Connection of max. 4 or 8 differential current transformers depending on the design
- RS-485 bus connection to synchronise the test current output and optionally for the connection to the EDS measuring bus for reading insulation fault currents
- Status output of insulation fault detection via external switching output
- Memory characteristics adjustable via bridge Y1-Y2
- Collective signalling relay to output preliminary warning and alarm states
- Pushbutton for manual reset of alarm states as well as testing of differential current transformers and their calibration
- Terminal connection for the storage of alarm states
- Width: 105 mm

Approvals and Markings

CE

Application

- Insulation fault detection in complex AC/DC networks
- Industry, shipbuilding, plant engineering, PV systems
- Quick fault correction of insulation faults in medical facilities

Indication

green LED "ON":	On, when supply connected
yellow LED Kanal 1..4:	Pre-warning: Display of an insulation fault current > 1 mA in the corresponding channel
red LED Kanal 1..4:	Alarm: Display of an insulation fault current > 5 mA in the corresponding channel
yellow LED „RS-485“:	Indicates RS-485 bus activity and active insulation fault detection

Connection Terminals

Terminal designation	Signal designation
A1(+), A2	Auxiliary voltage AC or DC
K1..K4/ I1..I4	Current transformer measur. channel
SH, GND, Rb, B, A, Ra	RS-485 Bus (galvanic separation)
Y1, Y2	Switching input Alarm storage
G, H	Status switching output Insulation fault detection
11, 12, 14	Indicator relay prewarning (changeover contact)
21, 22, 24	Indicator relay alarm (changeover contact)

Notes

Switching input

The device is equipped with a switching input (terminals Y1, Y2), which can be furnished either with a simple wire bridge or selected actively as digital control input from an external device with max. 24 V DC.

The input is low-active, i.e. when applying a low-level, the function "ALARM MEMORY" is active, otherwise it is inactive.

If the function is active, no prewarning/alarm states are reset following an insulation fault locating cycle. A reset takes place only after pushing the "Alarm reset/ Test/ Transformer calibration" button for at least 2 sec.

Y1
Y2

ALARM MEMORY active
- Alarm states are preserved
- Manually resettable via pushbutton

Y1
Y2

ALARM MEMORY inactive
- Alarm states are updated after each measuring cycle

Technical Data

Auxliary voltage

Nominal voltage range	
A1(+) / A2:	AC/DC 100 ... 230 V
Voltage range:	AC/DC 85 ... 265 V
Nominal consumption:	< 3 VA

Monitored network

Nominal voltage:	DC / AC / 3AC 24 … 360 V
Voltage range AC / 3AC	
L1/L2/L3:	21 ... 400 V, 40 ... 60 Hz
Voltage range DC	
L1(+)/L2(-):	21 ... 400 V
Rated current range for insulation test currents:	1 ... 5 mA
Maximum test current output:	6.5 mA
Response sensitivity:	0.5 mA
Bus (galvanic separation):	RS-485

Differential current transformer

Terminals:	K1, I1 … K4, I4
Differential current transformer:	ND 5017
Burden:	180 Ω
Rated voltage:	500 V
Rated frequency:	40 … 60 Hz
Response sensitivity:	0.2 mA
Measuring range:	0.5 … 10 mA
Number of measuring channel:	4

Switching input

Terminals:	Y1, Y2
Configuration (passive)	
Low-level:	Bridge set / input low resistance
High-level:	Input open / input high-resistance
Configuration (active)	
Voltage range (low/high):	0V / 12 ... 24 V
Max. switching current (24 V):	0.5 mA

Switching output

Terminals:	H(+), G(-)
Switching output (passive):	transistor outputs
Test current output:	Output low resistance (minimal 220 Ω via PTC)
No test current output:	Output high resistance
Switching voltage max.:	24 V
Switching current max. (24 V):	10 mA

Technical Data

RS-485 Bus

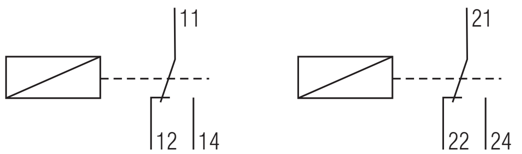
Terminals:	SH, ⊥, Rb, B, A, Ra
Bus:	galvanic separation
Device mode	
Bus-Master/Slave:	adjustable via rotational switch
Transmission medium:	twisted, shielded two-wire line (SH)
Data transmission rate:	115.2 kBit/s
Network termination:	Bus termination via bridges Rb, B and Ra, A

Connection alarm signalling relay

Output:	2 changeover contacts	
Nominal voltage:	AC/DC 24 … 240 V	
Limiting continuous current (I_{th} max):	2 x 5 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230V	IEC/EN 60 947-5-1
Elektrical life to AC 15		
at 3 A, AC 230V:	2 x 10^5 switching cycl.	IEC/EN 60 947-5-1
Short circuit strength max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 20 x 10^6 switching cycles	

Terminal designation relay:

Prewarning: Alarm:



M11062

General Data

Nominal operating mode:	continuous operation	
Temperature range:	-20 ... + 60 °C	
Clearance and creepage distance		
rated impulse voltage/ pollution degree:	4 kV / 3	IEC 60 664-1
EMC		
Electro static discharge (ESD):	8 kV (air)	IEC/EN 61000-4-2
HF irradiation:	10 V / m	IEC/EN 61000-4-3
Fast transients:	2 kV	IEC/EN 61000-4-4
Surge voltage between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequenz 10...55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04	
Terminal designation:	EN 50 005	
Wire connection		
screw terminals:	fixed max. 4 mm² solid or 2.5 mm² stranded wire with sleeve min. 0.20 mm²	
clamping screw:	M2.5	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx**:** ca. 225 g	

Dimensions

Width x height x depth:	105 x 90 x 71 mm

Function

Switching output
The device is equipped with a transistor switching output (terminals G, H), which is protected by a series-connected PTC (RN = 220 Ω).

In the idle state, the output is high-resistance. During insulation fault detection, the output is low-resistance (RN) and delivers a low-level in conjunction with a series resistor and an external voltage source.

RS-485 bus connection
The insulation fault locator RR 5887 generally works in slave mode.
It synchronises itself independently with the test current output by monitoring the RS485 telegram. All connected insulation fault locators RR 5887 work in parallel and independently from each other.

A bus address can be defined for the device via a rotary switch (RS-485 Bus). If the devices are integrated in an EDS measuring bus system for insulation fault detection, it must be remembered that each insulation fault locator receives its own channel number. An EDS measuring bus master can read insulation fault current values from the connected devices via this channel number.

The bus address of the associated locating current injector RR 5886 can be set via another rotary switch (RR 5886 Channel). A unique reference between a locating current injector and one or several insulation fault locators is established here. This way, several device combinations can be connected jointly to a RS-485 bus and monitor separate networks.

In the absence of an EDS measuring bus connection, the bus address does not have any special significance and be chosen arbitrarily.

The RS-485 LED is permanently on during the insulation fault detection and bus activity and flashes when bus failures occur.

Influence of discharge capacities
The insulation fault locator is also able to perform reliable measurements under the influence of discharge capacities up to a certain size. The influence of discharge capacities depends on the insulation resistance and the mains voltage. Reliable detection of insulation resistance is ensured up to a discharge capacity of 1 µF.
The lower the mains voltage, the greater the permissible discharge capacity may be. For example, with mains voltages of 50 V, 20µF and more can also be processed without problem.

Insulation fault detection is no longer possible if the influence of the discharge capacities becomes too great. The measuring result may become poorer, in addition, when the discharge capacities are distributed unevenly in the network.
However, the symmetry relationships of the insulation fault resistances themselves do not affect the quality of the measurement.
If insulation faults are present between several conductors and PE, mains compensation currents flow through the insulation fault resistances overlaying the actual insulation fault currents. The measured insulation fault current can be reduced by half here in the extreme case.

Current transformer calibration
Current transformer calibration is performed after switching on the device or after pushing the "Alarm reset/ Test/ Transformer calibration" pushbutton to compensate tolerances of the magnetic material of the current transformers and the resulting differences of the magnetic amplification.

Insulation fault measurement in mixed networks
If an alternating current network, containing a downstream rectifier, is monitored, insulation fault detection can also be performed in the direct voltage circuit if the discharge capacities in this circuit are not too high.
Because fault detection can be performed simultaneously in two different network forms – alternating current network and direct current network – the indications displayed for prewarning and alarm are quantitatively valid only for the network form set with the rotary switch. The network form not set will deliver results deviating by the factor 2. However, they can still be analysed in terms of their tendency, i.e. a potential insulation fault is still indicate.

Insulation fault current display
The locating current injector takes the power for the test current from the monitored network itself. Insulation fault current measurements are nearly identical both for AC and DC networks. However, a difference in the level of the test current is obtained through the network form itself. With AC networks, the test current is only half the value as with DC networks. With 3AC networks, the factor is 0.67. These differences are taken into account when determining the level of the insulation fault current and with the display of the alarm values.

Indication of alarm- and states

Indication of alarm states
The display of an alarm state as well as the response of the corresponding common alarm signalling relay act at least for the duration of a measuring cycle (12 sec). The alarm state is cancelled again when the respective threshold of the insulation fault current, under consideration of a defined hysteresis, is fallen below again.

The switching terminal "ALARM MEMORY" must be equipped if the alarm state shall persist permanently.

The response threshold for the insulation fault current does not depend on the network form chosen.

Prewarning

Response threshold:	1 mA
Indication:	yellow LED continuously on
Common alarm relay:	Collective signalling relay "Prewarning" responds
Hysteresis for return:	0.1 mA
Duration of the alarm state:	Until response threshold if fallen below

Alarm

Response threshold:	5 mA
Indication:	rote LED leuchtet dauer-rot
Common alarm relay:	Collective signalling relay "Alarm" responds
Hysteresis for return:	0.5 mA
Duration of the alarm state:	Until response threshold if fallen below

No insulation faults present

Indication:	The yellow LED briefly (200 ms) lights after the measuring cycle has been completed

Display of current transformer faults
The insulation fault locator does not feature any control elements for setting the completion of current transformers. For this reason, the device must detect the presence of transformers independently. This happens together with the transformer calibration after switching on the device or after pushing the "Alarm Rest/ Test/ Transformer calibration" button.

The device can detect both, a transformer short circuit and a broken supply line (open transformer contact) individually for each channel.

The check for transformer faults is cyclically repeated after an insulation fault measurement has been completed allowing a transformer fault to be detected also under ongoing operation.

Short circuit at current transformer

Indication:	red LED flashes
Duration of indication:	Until the short circuit is resolved

Indication detected/interrupted differential current transformer

Indication:	yellow LED flashes
Duration of indication:	Until current transformer test is completed or open current transformer connection is closed again

Indication of invalid insulation fault measurements

If the value determined for the insulation fault current is invalid, e.g. because of excessive discharge capacities, or the direction of line routing through the current transformer is wrong, this condition is also indicated.

Indication:	yellow LED flashes
Duration of indication:	Until a valid measured value is determined again or the line direction through the transformer was turned around

Indication of alarm- and function states

Summary: Indication of alarm- and function states

Operation	State of transducer	Insulation failure current Ifs	Indication
Measuring operartion	Transducer connection ok	Prewarning: Ifs > 1 mA	yellow LED continuously on
		Alarm: Ifs > 5 mA	red LED continuously on
		no Insulation failure: Ifs < 1 mA	yellow LED Briefly lights at the end of the measuring cycle
		Messwert ungültig	yellow LED flashes
	short circuit at transducer		red LED flashes
	breaking at transducer		yellow LED flashes
	Transducer not connected		No indication
Transducer Test/ calib-ration	Transducer connection		red LED flashes
	Transducer detected		yellow LED flashes

Standard Type

RR 5887.12 AC/DC 85 ... 265 V
Article number: 0065012

- Rated current range for insulation test currents: 1 ... 5 mA
- Maximum test current output: 6.5 mA
- Response sensitivity: 0.5 mA
- Prewarning Hysteresis: 0.1 mA): 1.0 mA
- Alarm (Hysteresise: 0.5 mA): 5.0 mA
- Width: 105 mm

Ordering example

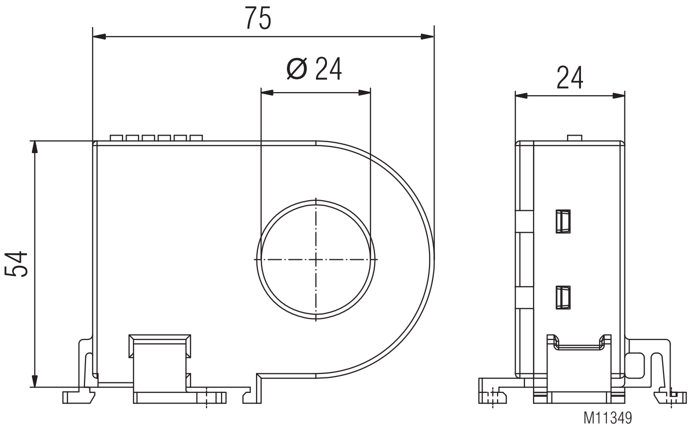
RR 5887 .12 / 00_

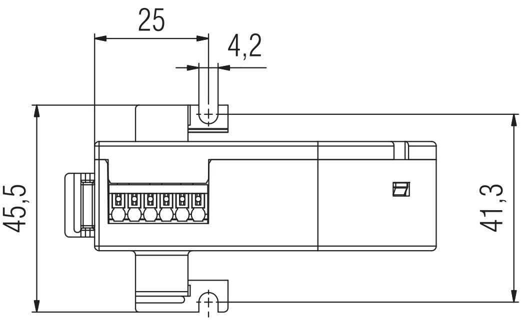
- Number of measuring channels:
  0: 4-channel
  1: 8-channel
- Contacts
- Type

Accessories

Residual Current Monitor ND 5017/024

- The differential current transformer ND5017/024 is designed for DIN rail mounting or screw-type mounting
- Mounting on the top-hat rail may be done horizontally or vertically





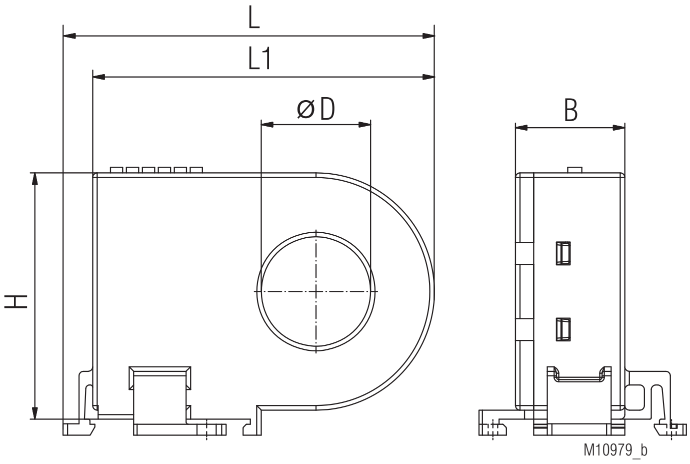
Technical Data

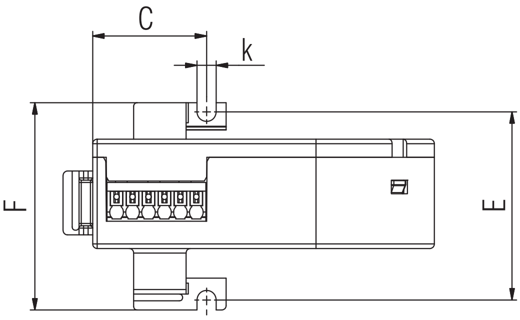
Rated voltage: 500 V
Rated nominal voltage: 1 A
Rated transformation ratio: 1 : 3000
Burden: 180 Ω
Rated frequency: 40 … 65 Hz
Temperature range: -20 ... + 60 °C
Rated impulse voltage/ pollution degree: 4 kV / 3
Housing: thermoplastic with VO behaviour acc. to UL subject 94
Vibration resistance: Amplitude 0.35 mm frequency 10...55 Hz, IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04
Wire connection
Single wire
≥ 0.75 mm² : up to 1 m
≥ 0.75 mm² twisted: up to 10 m
Cable shield ≥ 0.5 mm² : up to 25 m (Shield on one side on I-conductor and not to be earthed)
DIN rail mounting: integrated clips for vertical and horizontal mounting
Screw fixing: M3 or M4
Fixing torque: max. 0.8 Nm
Weight: 97 g

Dimensions

Width x height x depth: 105 x 90 x 71 mm

Residual Current Monitor ND 5017/070 (on request)





for DIN rail mounting or screw mounting

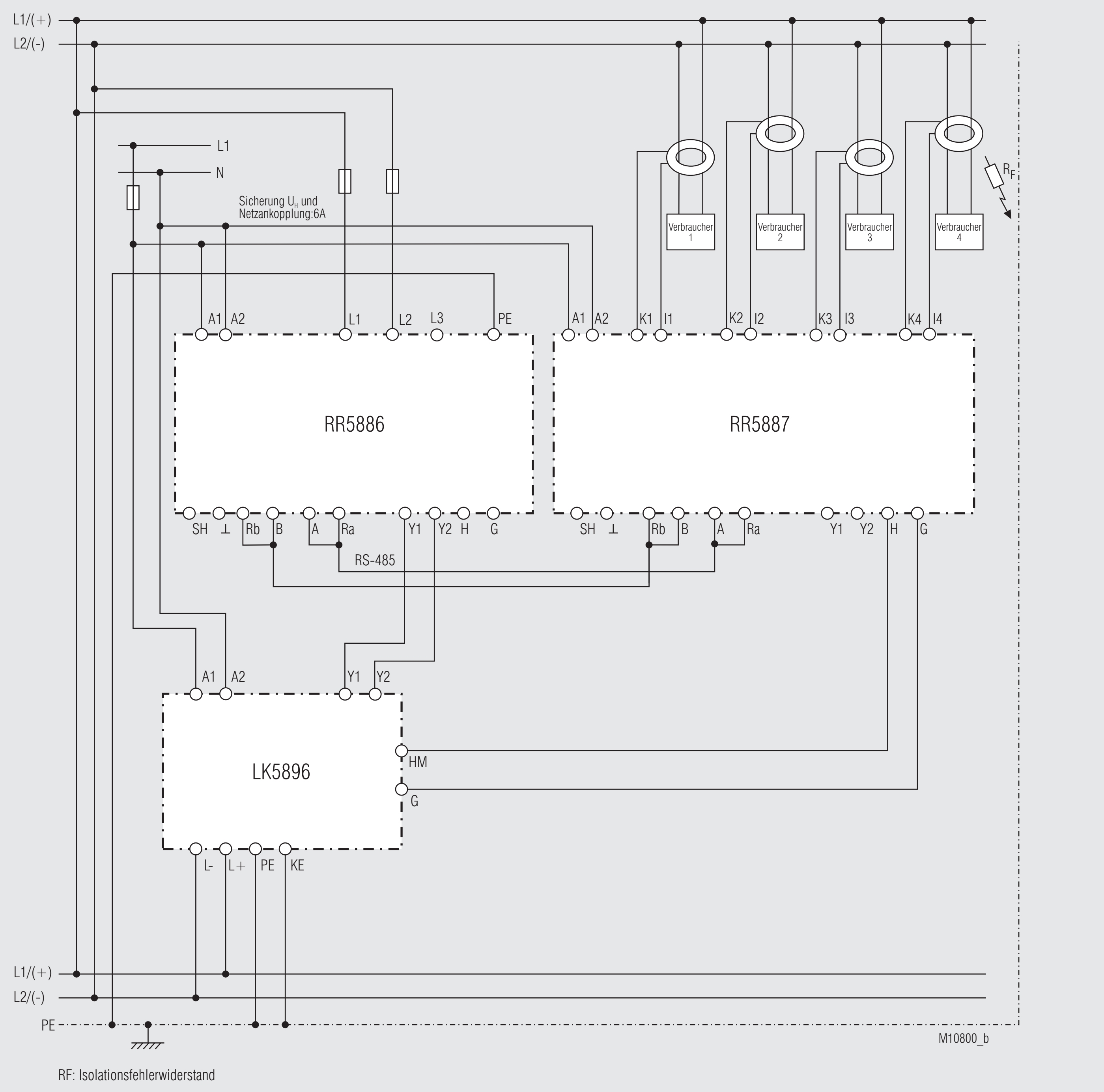
ND 5017/070	øD	L	H	H1	B	C	F	k	E	G
Dimensions/mm	70	111	110	115	32	37	55	4,2	50*	74*
Weight / g	approx. 220									

*) Drill tolerance for screw mounting: ± 0.5 mm

Mounting instructions for screw mounting

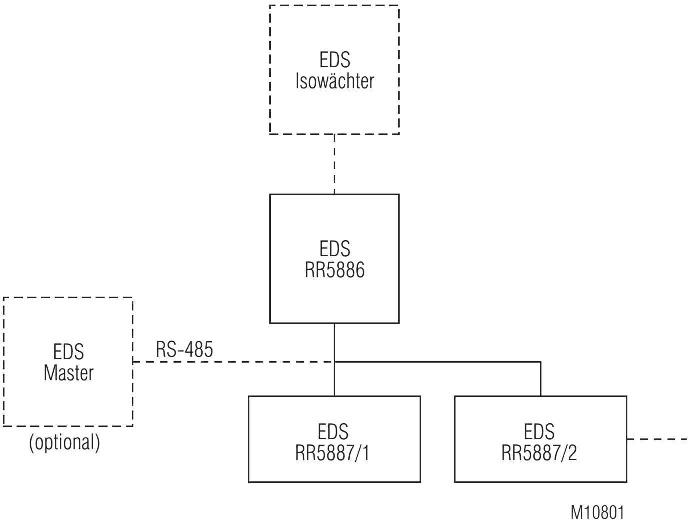
High forces when mounting may damage the current transformer fixtures. The fixing clips are designed to support the current transformer. Forces that are applied by the cable running through the current transformer can only be tolerated within limitations.
During installation and afterwards please make sure that the wires are led through the current transformer without applying pressure and remain stable in that position.

Connection Example



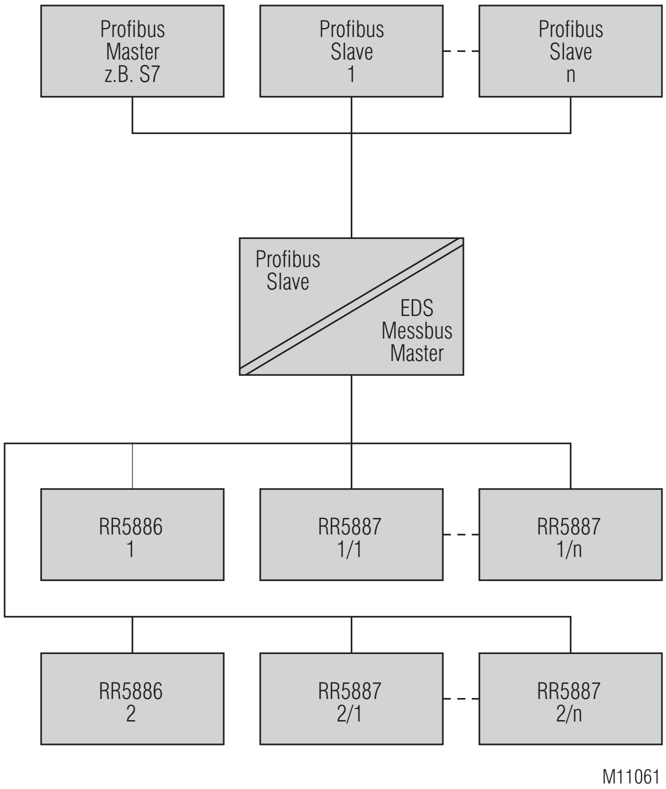
Insulation monitoring and insulation fault detection with 4 connected differential current transformers in a DC/AC network with subdistribution - insulation fault detection can be controlled by the insulation monitor /LK 5896); ALARM MEMORY active, i.e. alarm states are stored; bus termination of the first and last device on the RS-485 bus.

System overview



- Insulation fault detection in DC / AC / 3AC IT networks in connection with the locating current injector RR 5886
- External selection via an insulation monitoring device possible

Connection to measuring bus /Profibus gateway



VARIMETER RCM
Residual Current Monitor
IL 5882, SL 5882, IR 5882

DOLD

0239971

IL 5882

IR 5882
with internal
residual current transformer

ND 5016/024

ND 5016/035

ND 5016/070

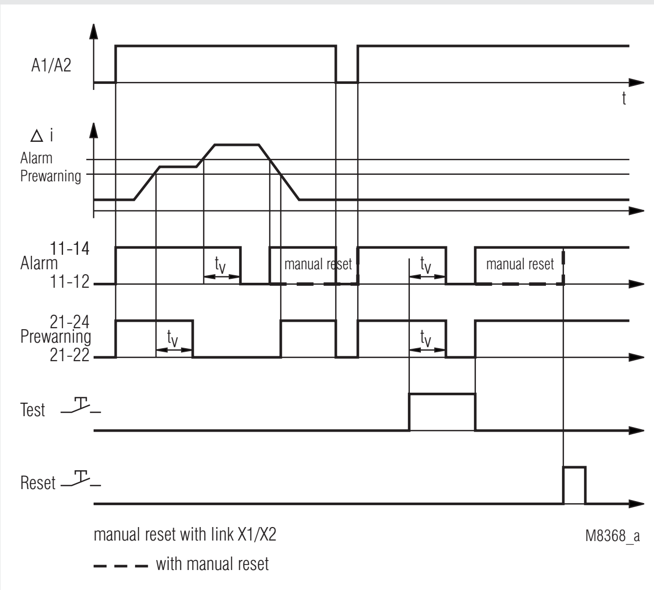
Your advantages
- Preventivefire and system protection
- Increasing the availability of plants by early fault detection
- As option with external or internal residual current transformer
- Protection against manipulation by sealable transparent cover over setting switches

Features
- According to IEC/EN 62 020
- for AC and pulsating DC currants Type A to IEC/TR 60755
- 9 tripping values from 10 mA to 10 A or from 10 mA ... 30 A
- Frequency range 20 ... 2000 Hz
- Selection of manual or automatic reset
- With prewarning
- With test and reset button
- Broken wire detection
- Short reaction time
- With adjustable delay t_v
- De-energized on trip
- LED indication for auxiliary supply and state of contact
- 2 x 1 changeover contact
- Devices available in 3 enclosure versions:
  IL 5882: 63 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 880
  - width 35 mm
  - for connection of external residual current transformer, e. g. DOLD ND 5016, ND5019

  SL 5882: 100 mm deep with terminals near to the top to be mounted in cabinets with mounting plate and cable ducts
  - width 35 mm
  - for connection of external residual current transformer, e. g. DOLD ND 5016, ND5019

  IR 5882: 63 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 88
  - width 105 mm
  - with internal residual current transformer

Function Diagram



Approvals and Markings

A025518

Application

Detection of insulation faults in grounded voltage systems. The residual current relay is used to maintain electrical plants before faults occur. Decrease in insulation can be detected and indicated early without interruption of operation.

Function

The function of the IL/SL 5882 and IR 5882 can be compared to a fault current circuit braker unit. It detects and indicates residual currents, but does not disconnect.
The measurement is done by an external residual current transformer e. g. ND 5016 which is connected via terminals i and k to the IL/SL 5882. At the device IR 5882 the residual current transformer is integrated. All conductors of the voltage system to be monitored are run through the CT except the ground wire. In a fault free voltage system the sum of all current is 0 and the CT induces no secondary voltage. If due to an insulation fault a fault current flows to ground, the current difference in the CT creates a measuring current, which is detected and measured by the IL/SL 5882 or IR 5882. A broken wire in the sensing circuit would disable the measurement, therefore a special circuit detects broken wire and forces the unit to trip.

The unit has 2 x 1 changeover contacts. Contact 11-12-14 for alarm (AL) and 21-22-24 for prewarning (VW). Prewarning is detected at 70 % of the selected alarm value. With external bridge X1-X2 the alarm is stored and has to be reset by pressing the reset button or by disconnecting the auxiliary supply. Without bridge X1-X2 the unit works with auto-reset and the fault is not stored. With the button "Test" a fault can be simulated (Alarm). Each contact is delayed with an adjustable time delay t_v (same delay time for alarm and pre-warning).

To avoid unauthorised adjustment of the potentiometers the unit has a transparent cover that could be seald with laquer. Two holes above the push buttons allow activation of test and reset.

Connection terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
i, k (only at IL/SL 5882)	Conn. f. external current transformer ND5016, ND5019 ; terminals i, k
X1, X2	control input X1/X2 bridged: with manual reset of alarm X1/X2 not bridged: without manual reset of alarm (Hysteresis function)
11, 12, 14	1. C/O contact (Alarm)
21, 22, 24	1. C/O contact (Pre-warning)

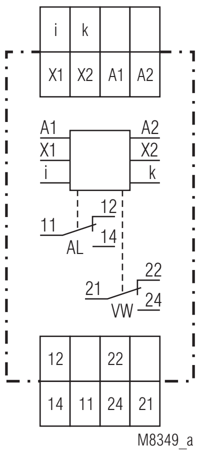
Indication

green LED "ON": on, when supply connected
red LEDs "VW", "AL": on, when insulation failure (prewarning and alarm)

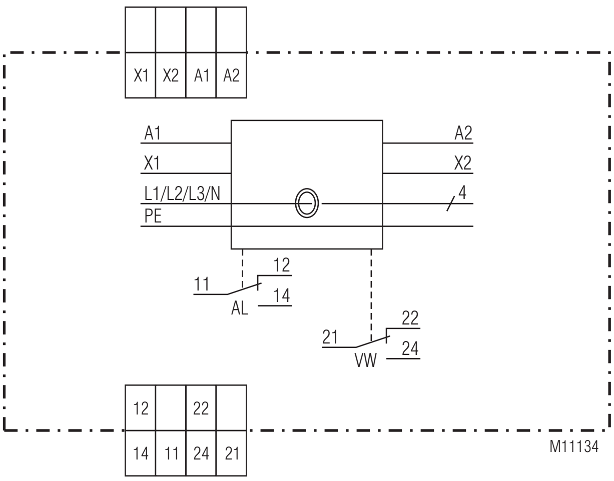
Note

If time is set to 0 and a pulsating fault current is flowing (e.g. 1-way rectified) the output relay may flicker because of the short reaction time. By increasing the time delay this effect can be avoided.

Circuit Diagrams

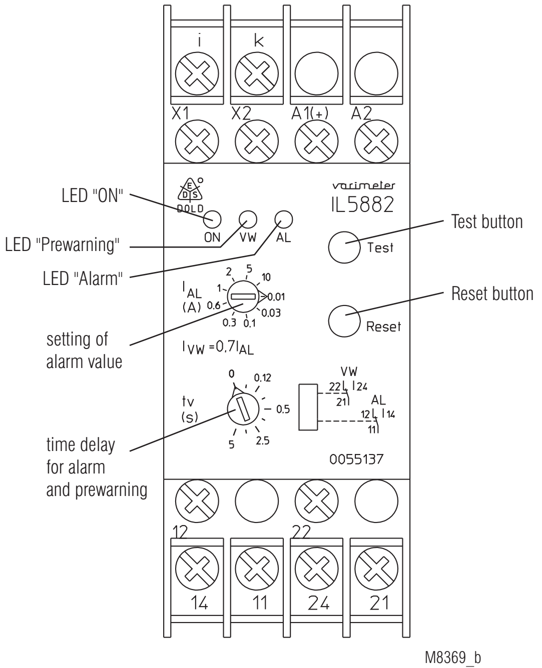


IL /SL 5882



IR 5882

Setting



Technical Data

Input

Auxiliary voltage U_H:	AC/DC 12 V, AC/DC 24 ... 230 V
Voltage range:	
AC:	0.8 ... 1.1 U_N
DC:	0.9 ... 1.25 U_N
Nominal frequency U_H:	50 ... 400 Hz
Nominal consumption	
AC 230 V:	4 VA
AC 24 V:	1.6 VA
DC 24 V:	1 W
Measuring value adjustable via rotational switch:	AC 0.01; 0.03 A; 0.1 A; 0.3 A; 0.6 A 1 A; 2 A; 5 A; 10 A or AC 0.01 A, 0.03 A; 0.1 A; 0.3 A; 0.6 A 1 A; 2 A; 7 A; 30 A
Frequency range:	20 Hz ... 2 kHz at failure current < 50 Hz and the function "auto reset", a time delay must be adjusted, so that the relay does not buzz before switching
Hysteresis:	approx. 4% of trip value, fixed
Accuracy:	≤ 0 ... -30 %
Repeat accuracy:	≤ ± 1 %
Temperature drift:	≤ ± 0.05 % / K
Reaction time:	10 ... 40 ms
Response delay t_v:	0 ... 5 s adjustable (logarithmic scale in order to allow also short time delay to be adjusted without problems)

Output

Contacts:		
IL / SL / IR 5882.38:	1 changeover contact for Prewarning, 1 changeover contact for Alarm	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	2 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	3 x 10^5 switching cycles	EN 60 947-5-1
Short circuit strength max. fuse rating:	4 A gL	EN 60 947-5-1
Mechanical life:	≥ 10^8 switching cycles	

General Data

Operating mode:	Continuous	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 25 ... + 70°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
supply / contacts:	4 kV / 2	IEC 60 664-1
supply / Measuring Circuit:	corresponding to CT	
EMC		
Surge voltages:	class 3 (5 kV / 0.5 J)	DIN VDE 0435-303
HF-interference:	class 3 (2.5 kV)	DIN VDE 0435-303
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		IEC/EN 61 000-4-3, EN 50 121-3-2
80 MHz ... 1 GHz:	20 V / m	
1 GHz ... 2,7 GHz:	10 V / m	
Fast transients:	4 kV (class 4)	IEC/EN 61 000-4-4
Surge voltages:	1 kV (class 3)	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0-behaviour according UL subject 94	

Technical Data

Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 03	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 5882:	approx. 125 g	
SL 5882:	approx. 150 g	
IR 5882:	approx. 300 g	

Dimensions

Width x height x depth:	
IL 5882:	35 x 90 x 63 mm
SL 5882:	35 x 90 x 100 mm
IR 5882:	105 x 90 x 63 mm (inner diameter current transformer: 21.5 mm or 28 mm)

Standard Types

IL 5882.38 AC/DC 24 ... 230 V 50 / 60 Hz 10 A 5 s
Article number: 0055138
- De-energized on trip
- Auxiliary voltage U_H: AC/DC 24 ... 230 V
- Measuring range: 10 A
- Response delay t_v: 5 s
- Width: 35 mm

SL 5882.38 AC/DC 24 ... 230 V 50 / 60 Hz 10 A 5 s
Article number: 0055515
- De-energized on trip
- Auxiliary voltage U_H: AC/DC 24 ... 230 V
- Measuring range: 10 A
- Response delay t_v: 5 s
- Width: 35 mm

IR 5882.38 AC/DC 24 ... 230 V 50 / 60 Hz 10 A 5 s
Article number: 0066743
- Internal residual current transformer (Ø 28 mm)
- De-energized on trip
- Auxiliary voltage U_H: AC/DC 24 ... 230 V
- Measuring range: 10 A
- Response delay t_v: 5 s
- Width: 105 mm

ND 5016/024
Article number: 0066009
- Residual current transformer for IL/SL 5882
- Diameter: 24 mm
- DIN-rail mounting: waagrecht oder senkrecht
- Screw mounting: M4

Variant

IL 5882.12/002: with 2 changeover contacts for alarm and no pre-warning

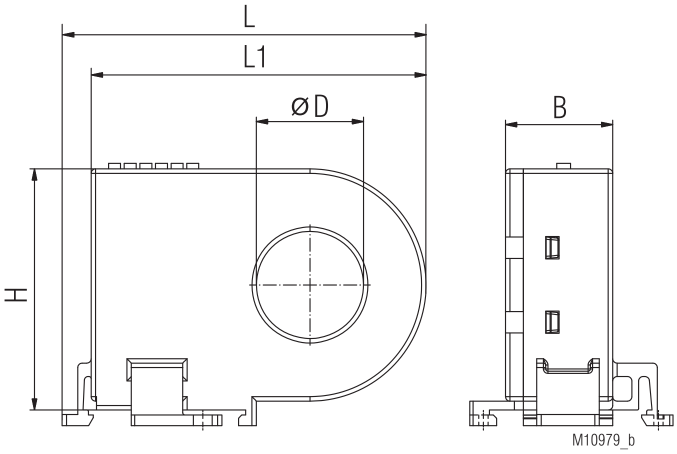
Ordering example for variant

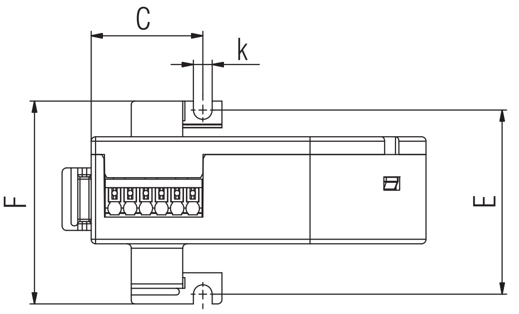
IL 5882 .38 /_ _ _ AC/DC 24 ... 230 V 50/60 Hz 10 A 5 s

Response delay
Measuring range
Frequency range
Auxiliary voltage
Variant, if required
Contacts
Type

Accessories

Residual Current Transformer ND 5016/024, ND 5016/035





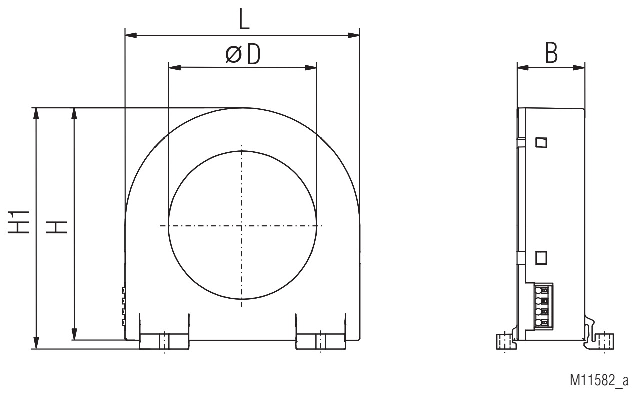
for DIN rail mounting or screw mounting

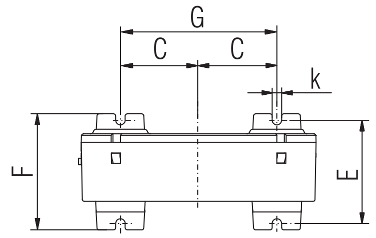
ND 5016/024	øD	L	L1	B	H	C	E	F	k
Dimension/mm	24	82	75	24	54	25	42*	46	4,2
Weight / g	approx. 80								

ND 5016/035	øD	L	L1	B	H	C	E	F	k
Dimension/mm	35	88	81	24	67	25	42*	46	4,2
Weight / g	approx. 90								

*) Drill tolerance for screw mounting: ± 0.5 mm

Residual Current Transformer ND 5016/070





for DIN rail mounting or screw mounting

ND 5016/070	øD	L	H	H1	B	C	F	k	E	G
Dimension/mm	70	111	110	115	32	37	55	4,2	50*	74*
Weight / g	approx. 220									

*) Drill tolerance for screw mounting: ± 0.5 mm

Technical Data Residual Current Transformer ND 5016, ND 5018

Ambient temperature
ND 5016: - 20 ... + 60°C / 253 K ... 333 K
ND 5019: - 10 ... + 50°C / 263 K ... 323 K
Inflammability class: V0 according to UL94

Nominal insulation voltage acc. to IEC 60 664-1: AC 630 V
Rated impulse voltage / pollution degree: 6 kV/3
Voltage test acc. to IEC/EN 60 255: AC 3 kV

Transformation ratio: 500 /1

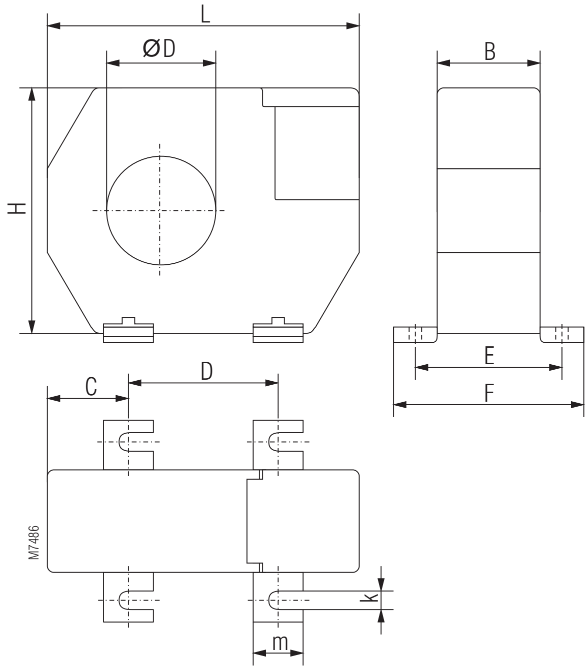
Length of connection wires
Type of wire:
Single wire: up to 1 m
Single wire Twisted pair: up to 10 m
Screened wire; screen on terminal k: up to 25 m
Wire cross section
ND 5016: 0.2 ... 1.5 mm²
ND 5019: 0.75 mm²
Stripping length: 8 mm
Wire fixing
ND 5016: Terminals with spring connection and direct (Push in) technology
ND 5019: Box terminals
Screw connection:
ND 5016: M3 or M4
ND 5019: M5
Fixing torque: 0.8 Nm
DIN rail mounting:
ND 5016/024, /035: integrated clips for vertical and horizontal mounting
ND 5016/070: integrated clips for horizontal mounting
ND 5019: using mounting adapter ET 5018

Mounting instructions for screw mounting

High forces when mounting may damage the current transformer fixtures. The fixing clips are designed to support the current transformer. Forces that are applied by the cable running through the current transformer can only be tolerated within limitations.
During installation and afterwards please make sure that the wires are led through the current transformer without applying pressure and remain stable in that position.

Accessories

Residual Current Transformer ND 5019

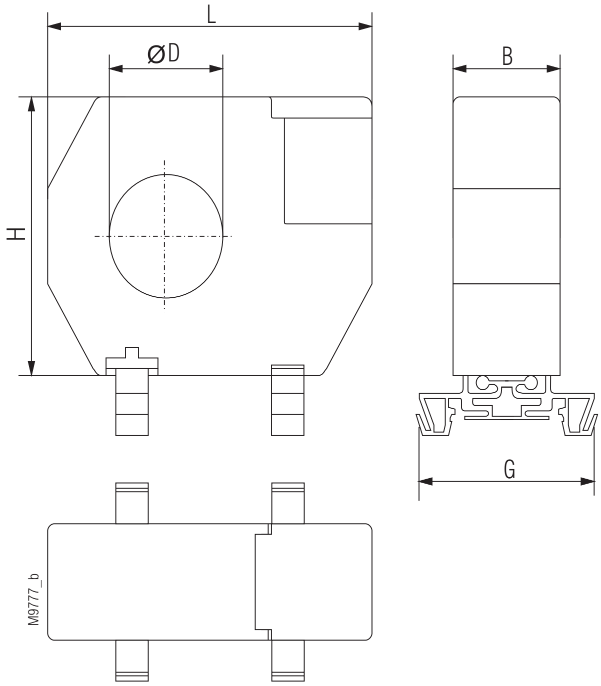


for Screw connection

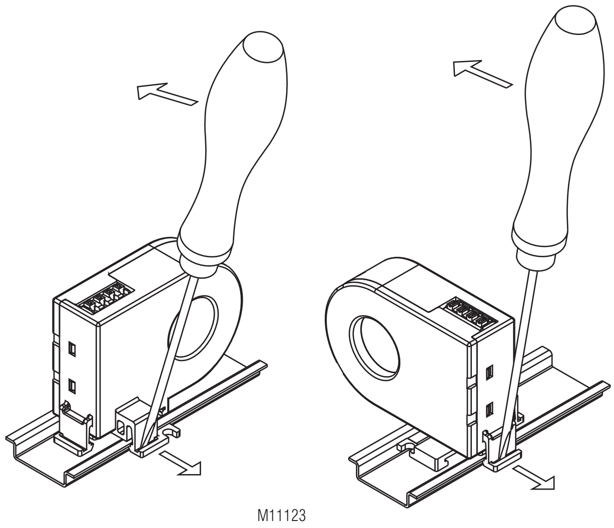
Dimensions in mm	
	ND 5019/105
Art-Nr.	0055118
øD	105
L	170
B	33
H	146
C	38
D	94
E	46
F	61
k	6,5
m	16

Weight	
	ND 5019/105
kg	0,5

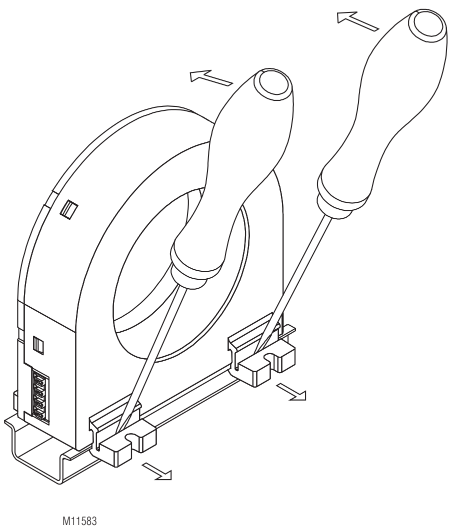
The residual current transformer ND 5019/105 can also be mounted on DIN-rail. To do this the metal screw fixings have to be removed and have to be replaced by 2 mounting clips (ET5018: art.no. 0058754; set with 2 pcs)



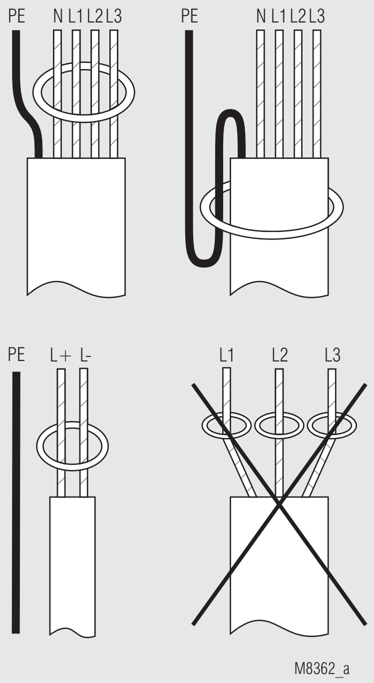
Disassembling ND 5016/024 and ND 5016/035



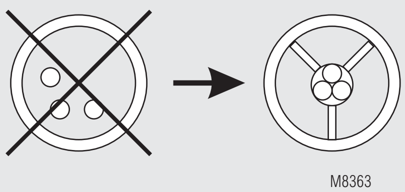
Disassembling ND 5016/070



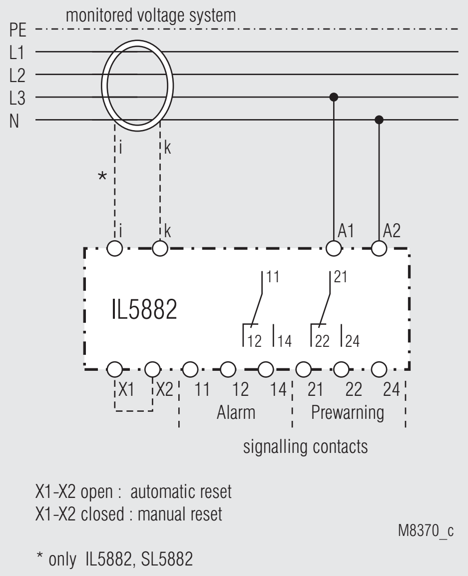
Installation of Wires



To Avoid Interference with High Starting Currents



Connection Example



Attention:
As the auxiliary supply has no galvanic separation, the secondary circuit of the CT must not be connected to ground.
A ground connection will lead to a damage of the unit!

VARIMETER RCM
Residual Current Monitor, Type B for AC and DC Systems
RN 5883

DOLD

RN 5883 ND 5015/035 ND 5015/070

0272374

Your Advantage

- Preventivefire and system protection
- Increasing the availability of plants by early fault detection
- Universal usage at AC/DC mains
- Protection against manipulation by sealable transparent cover over setting switches

Features

- According to IEC/EN 62 020, VDE 0663
- For AC and DC systems Type B, according to IEC/TR 60755
- To detect earth faults in grounded voltage systems
- 4 setting ranges from 10 mA to 3 A
- Manual reset, with alarm and pre-warning
- With adjustable switching delay
- Energized or de-energized on trip
- LED indicator for operation, pre-alarm and alarm
- With test function
- LED-chain indicates fault current
- As option with analogue output
- Broken wire detection
- Width: 52.5 mm

Product Description

The AC/DC sensitive residual current monitor RN 5883 allows an early detection of insulation faults and detects differential currents with AC as well as DC components in grounded voltage systems (type B). The measurement takes place via an external current transformer.

Contrary to an RCD the residual current monitor RN 5883 does not disconnect the mains when detecting a fault but only indicates it. Besides the easy to read LED chain indicating the actual current several LEDs display operation, pre-alarm and alarm. The 4 measuring ranges cover 10 to 3 A. Additional features are broken wire detection, test function and adjustable pre-alarm.
The residual current monitor RN 5883 provides early information for precise and cost effective maintenance before the plant stops.

Approvals and Markings

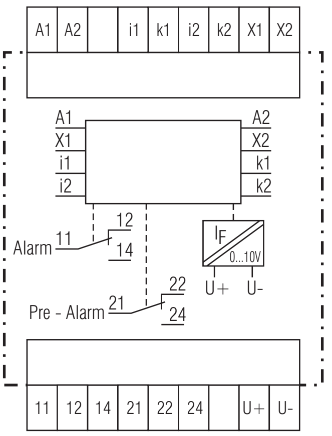
CE	1) c UL us LISTED Canada / USA	2) c RU us Canada / USA

1) RN 5883 Variant /61; 2) ND 5015

Application

The residual current monitor type B is designed to monitor DC systems and AC systems up to 250 Hz.

Circuit Diagram



M11213

Indication

green LED „ON“:	On, when auxiliary supply connected
yellow LED „Pre-Alarm“:	Flashes during time delay t_v On, when pre-alarm active
red LED „Alarm“:	Flashes during time delay t_v On, when alarm active
yellow and red LED:	Flashes on broken wire or extremely high input signal
yellow LED-chain:	LED chain indicates fault current in % of adjusted alarm value

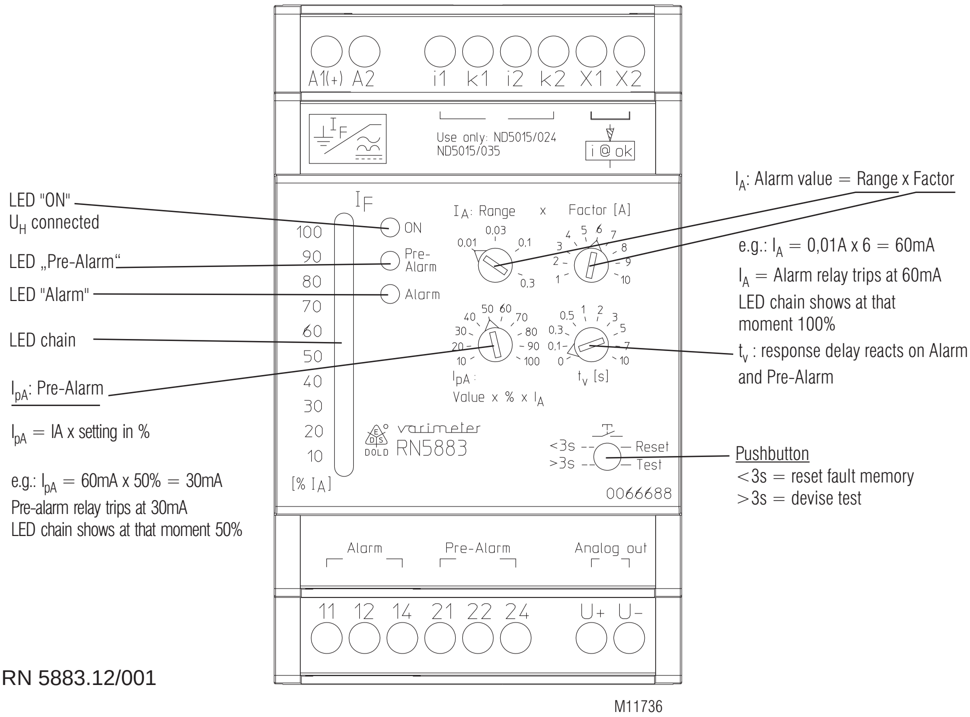
Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage U_H
i1, k1, i2, k2	Connection of an external residual current transformer
X1, X2	Parameterization input energized or de-energized on trip
11, 12, 14	Contacts alarm signal
21, 22, 24	Contacts pre-alarm signal
U-, U+	Analogue output (option)

Notes

The devices measure AC and DC current (AC / DC sensitive. Due to the measurement principle they also detect magnetic fields in the next to the current transformer.
When planning a panel with AC/DC sensitive residual current monitors please make sure that no components are placed next to the CT that create a magnetic field, e.g. contactors, transformers etc.
If an influence is detected, also a rotation of the CT by 90° could positively reduce the influence.

Set-up and Adjustment Facilities



RN 5883.12/001

It is of advantage to keep the range small and the Factor high.
Example: Setting 300 mA: Range 0,1 x Factor 3 = 300 mA

Function

The Measuring circuit includes an external residual current transformer. All conductors of a voltage system are fed through the transformer except the ground wire. In a healthy system the sum of all flowing currents is zero, so that no voltage is induced in the CT. If an earth fault occurs, sourcing a current flowing to ground, the current difference induces a current in the CT that is detected by the RN 5883.

If an earth fault occurs, sourcing a current flowing to ground, the current difference induces a current in the CT that is detected by the RP 5883.

On broken sensor wires and broken CT coils the unit goes into alarm state and the LEDs for pre-alarm (yellow) and alarm (red) flashes.

The unit has 2 changeover output contacts. One for alarm 11, 12, 14 and 21, 22, 24 and one for pre-alarm.

4 Setting Ranges can be slected from 10 mA to 3 A. The fine adjustment is made via potentiometer „Factor“
Measuring range = Range x Factor.
The alarm relay switches at 100 % of the adjusted response value.

The pre-alarm can be set in 10% steps between 10 and 100% of the alarm value.

Potentiometer t_v sets the switching delay between 0 and 10 seconds. The delay reacts on pre-alarm and alarm.

The different CT sizes require a correct adaption of the residual current monitor. 3 models are available:

Type	Suitable residual current transformer	Frequeny range
RN 5883.12/61	ND 5015/024 ND 5015/035	DC + AC up to 250 Hz
RN 5883.12/010/61	ND 5015/070	DC + AC up to 180 Hz
RN 5883.12/020	ND 5018/105 ND 5018/140 ND 5018/210	DC + AC up to 60 Hz

An external link on X1-X2 allows the change between energized and de-energized on trip. A change of the function will only be valid after interruption of the supply voltage.

Terminal X1 / X2:	external link =	De-energized on trip,
	open =	Energized on trip

De-energized on trip: In the case of groundfault or missing auxiliary supply the relays are de-energized,
the NC contacts 11/12; 21/22 are closed

In fault free state the relays are energized,
the NO contacts 11/14; 21/24 are closed

Energized on trip: In the case of groundfault the relays are energized,
the NO contacts 11/14; 21/24 are closed

in fault free state the relays are de-energized,
the NC contacts 11/12; 21/22 are closed

If an adjusted value is reached on the measuring input (alarm or pre-warning)at the standard type RN 5883 the signal is stored. Reset is made by pressing the button „Test/Reset“ for < 3 s s or by disconnecting the auxiliary supply (approx. 30 s).

If the „Test/Reset“ button is pressed for > 3 s, a test of the unit is made. The time delays run, the pre-warning and alarm is activated.

An LED chain shows the fault current between 10 and 100 % of the adjusted alarm value.
An analogue output 0 ... 10 V indicates also the fault current. 10 V corresponds to 100 % of the adjusted alarm value.

Technical Data

Input

Auxiliary voltage U_H:	AC/DC 24 ... 80 V, AC/DC 80 ... 230 V	
Voltage range		
at U_H = AC/DC 24 ... 80 V:	DC 19 ... 110 V, AC 19 ... 90 V,	
at U_H = AC/DC 80 ... 230 V:	DC 64 ... 300 V, AC 64 ... 265 V	
Nominal frequency U_H:	AC 50 / 60 Hz	
Nominal consumption		
at AC:	5 VA	
at DC:	2.5 W	
Measuring range:	10 ... 100 mA, 30 ... 300 mA, 100 ... 1000 mA, 300 ... 3000 mA (3 ... 30 mA on request)	
Measuring range fine adjustment:	1 ... 10	
Überlastbarkeit:	with overload protection	
Alarm:	100 % of the adjusted measuring range	
Pre-alarm:	10, 20, 30, 40, 50, 60, 70, 80, 90, 100 % of the adjusted alarm value	
Frequency range:	DC and AC to 250 Hz	
Repeat accuracy:	≤ ± 3 %	
Temperature drift:	≤ ± 0.1 % / K	
Reaction time:	200 ms	
Switching delay		
Pre-alarm / alarm:	0 ... 10 s	

Output

Contacts:	1 changeover contact for pre-alarm, 1 changeover contact for alarm	
Thermal current I_{th}		
up to 30 °C:	5 A	
up to 40 °C:	4 A	
up to 60 °C:	2 A	
Switching capacity		
at AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	3 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 10^8 switching cycles	

Analogue Output (option)

Terminal U+ / U-:	0 ... 10 V; 5 mA variant RN 5883/_ _1 Screened wire; screen one end grounded at device to PE

General Data

Operating mode:	Continuous	
Temperature range		
Operation:	- 40 ... + 60°C - 20 ... + 60°C (variant /_1_ and /_2_)	
Storage:	- 40 ... + 70°C	
Altitude:	< 2,000 m	
Insulation coordination according to IEC 60664-1:		
RN 5883 cennected with current transformer ND 5015, ND 5018		
Rated impuls voltage / pollution degree:		
Auxiliary voltage / Meas. circuit:	6 kV / 2	
Auxiliary voltage / Contacts:	6 kV / 2	
Auxiliary voltage / Analoge output:	6 kV / 2	
Contacts / Analoge output:	6 kV / 2	
Meas. circuit / Analoge output:	6 kV / 2	
Contacts 11,12,14 / 21, 22, 24:	4 kV / 2	
EMC		
Surge voltages:	Class 3 (5 kV / 0.5 J)	DIN VDE 0435-303
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 2,7 GHz:	20 V / m (class 3)	IEC/EN 61 000-4-3
HF-wire guided:	10 V (class 3)	IEC/EN 61 000-4-6
Fast transients:	2 kV (class 3)	IEC/EN 61 000-4-4
Surge voltages:	1 kV class 3)	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0-behaviour according UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	40 / 60 / 03	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Fixed screw terminals		
Cross section:	0.5 ... 4 mm² (AWG 20 - 10) solid or 0.5 ... 4 mm² (AWG 20 - 10) stranded wire without ferrules 0.5 ... 2.5 mm² (AWG 20 - 10) stranded wire with ferrules	
Stripping length:	6.5 mm	
Wire fixing:	Cross-head screw / M3 box terminals	
Fixing torque:	0.5 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 160 g	

Dimensions

Width x height x depth:	52.5 x 90 x 71 mm

UL-Data RN 5883

These devices only monitor residual currents and are not intended to be used as Ground Fault Circuit Interrupter (GFCI) in accordance with UL1053 / UL943.

These devices have been investigated to be used with external differential current transformers manufactured by E. Dold & Söhne KG, Cat. Nos. ND5015/024/61, ND5015/035/61 or ND5015/070/61.

Supply voltage U_N:	AC/DC 24-80V single or double phase 50/60 Hz; AC/DC 80-230V single or double phase 50/60 Hz
Switching capacity relays	
Ambient temperature 30°C:	5A, 250Vac G.P. 250 Vac, 2A pilot duty 250 Vac, 1/2hp
Ambient temperature 40°C:	4A, 250Vac G.P. 250 Vac, 2A pilot duty 250 Vac, 1/2hp
Ambient temperature 60°C:	2A, 250Vac G.P.
Analogue output	
(only at variant/__1):	0 .. 10V, 5mA
Max. measuring frequency:	DC, AC (0 – 250Hz)
Wire connection:	AWG 20 - 12 60°C / 75°C copper conductors only

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Standard Type

RN 5883.12/61 AC/DC 80 ... 230 V 50 / 60 Hz
Article number: 0066451

- For residual current transformer ND 5015/024 and ND 5018/035
- Alarm und Pre-alarm
- Energized or de-energized on trip
- Without analogue output
- Auxiliary voltage U_H: AC/DC 80 ... 230 V
- Width: 52.5 mm

ND 5015/035/61
Article number: 0066841

- Residual current transformer for RN 5883
- Diameter: 35 mm

Variants

For residual current transformer ND5015/024 und ND5015/035:

RN 5883.12/001/61: With analogue output 0 ... 10 V

RN 5883.12/800/61: Fixed values, without analogue output

RN 5883.12/802/61: Fixed values, without analogue output;
with bridge on X1/X2:
- Alarm: Energized on trip
- Pre-alarm: De-energized on trip
without bridge:
- Alarm: De-energized on trip
- Pre-alarm: Energized on trip

Für residual current transformer ND5015/070:

RN 5883.12/011/61: with analogue output 0 ... 10 V

For residual current transformer ND5018/105, ND5018/140, ND5018/210:

RN 5883.12/021: with analogue output 0 ... 10 V

Ordering example for variants

RN 5883 .12 /_ _ _ /61 AC/DC 80 ... 230 V 50 / 60 Hz

Nominal frequency
Auxiliary voltage
UL approval
Variant, if required
Contacts
Type

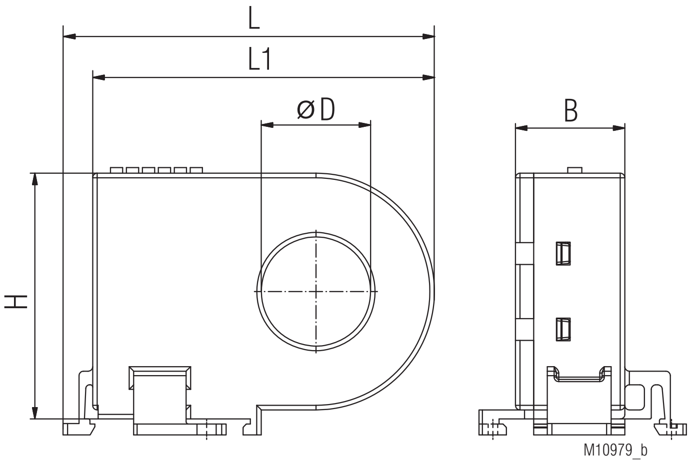
UL-Daten ND 5015

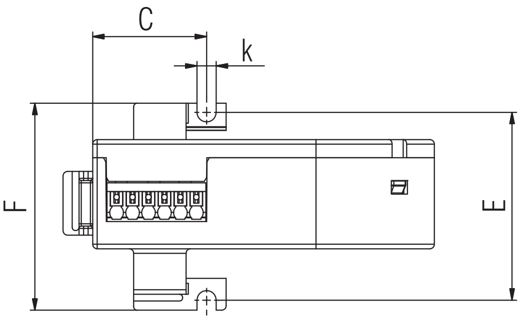
Wire connection: AWG 24 - 16
60°C / 75°C copper conductors only

Technical data that is not stated in the UL-Data, can be found in the technical data section.

Accessories

Residual Current Monitor ND 5015/024, ND 5015/035





for DIN rail mounting or screw mounting

ND 5015/024	øD	L	L1	B	H	C	E	F	k
Dimensions/mm	24	82	75	24	54	25	42*	46	4.2
Weight / g	approx. 80								

ND 5015/035	øD	L	L1	B	H	C	E	F	k
Dimensions/mm	35	88	81	24	67	25	42*	46	4.2
Weight / g	approx. 90								

*) Drill tolerance for screw mounting: ± 0.5 mm

Technical Data Residual Current Monitor ND 5015, ND 5018

Ambient temperature: - 40 ... + 60°C / 233 K ... 333 K
Inflammability class: V0 according to UL94

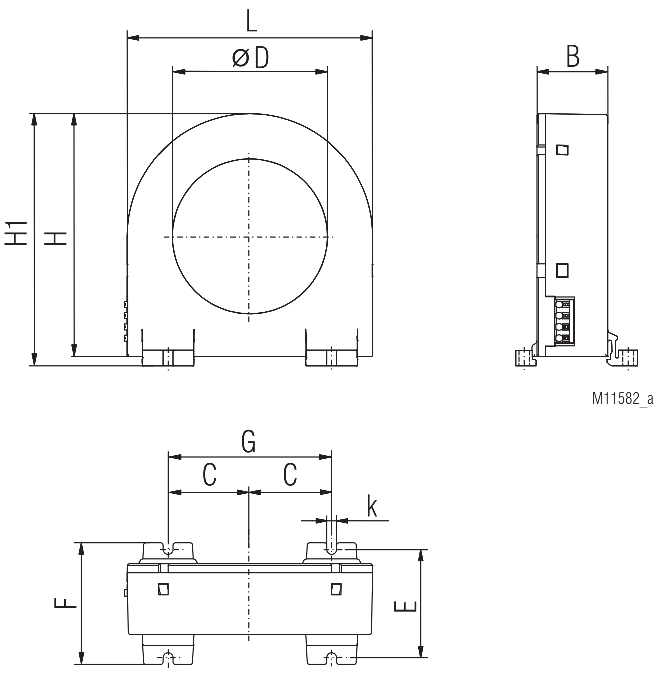
Insulation coordination according to IEC 61869-1

Highest rated operating voltage U_m: AC 720 V
Rated impulse voltage: 3 kV

Length of connection wires
Type of wire to CT, e.g.
Single wire: up to 1 m
Single wire twisted pair (pair 1: i1 - k1; pair 2: i2 - k2): up to 10 m
Screened wire; screen one end grounded at device to PE: up to 25 m
Wire cross section: 0.2 ... 1.5 mm²
Stripping length: 8 mm

ND 5015:
Wire fixing: Terminals with spring connection and direct (Push in) technology
Actuation power: 40 N max.
DIN rail mounting: integrated clips for vertical and horizontal mounting
Screw fixing: M3 or M4
Fixing torque: max. 0.8 Nm
ND 5018:
Wire fixing: Flat terminals with self-lifting clamping piece
DIN rail mounting: using mounting adapter ET 5018
Screw fastening: (only at ND 5018/105, ND 5018/140, ND 5018/210) M 5

Residual Current Monitor ND 5015/070



for DIN rail mounting or screw mounting

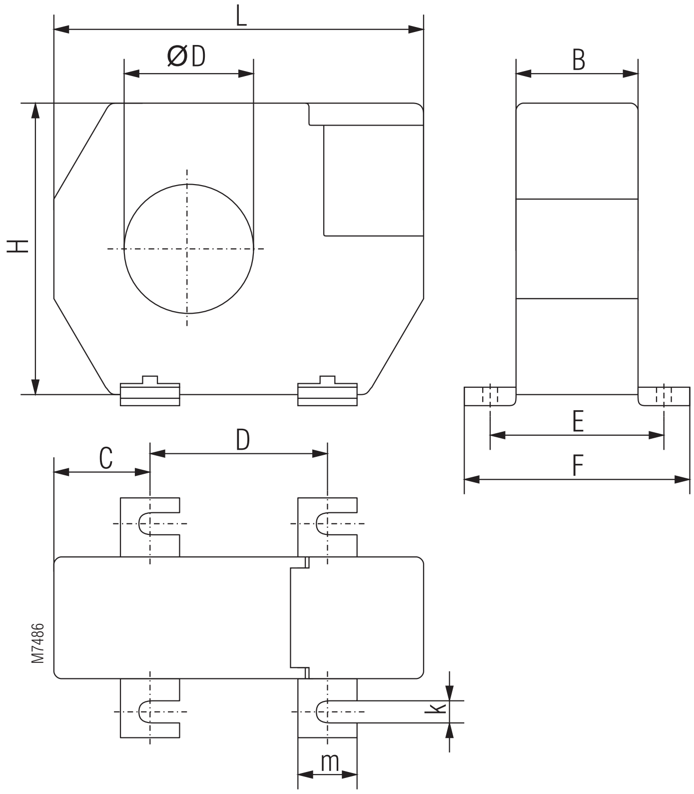
ND 5015/070	øD	L	H	H1	B	C	F	k	E	G
Dimensions/mm	70	111	110	115	32	37	55	4,2	50*	74*
Weight / g	approx. 220									

*) Drill tolerance for screw mounting: ± 0.5 mm

Mounting instructions for screw mounting

High forces when mounting may damage the current transformer fixtures. The fixing clips are designed to support the current transformer. Forces that are applied by the cable running through the current transformer can only be tolerated within limitations.
During installation and afterwards please make sure that the wires are led through the current transformer without applying pressure and remain stable in that position.

Residual Current Monitor ND 5018/105, ND 5018/140, ND 5018/210,



for screw mounting

ND 5018/105	øD	L	B	H	C	D	E	F	k	m
Dimensions/mm	105	170	33	146	38	94	46	61	6.5	16
Weight / g	530									

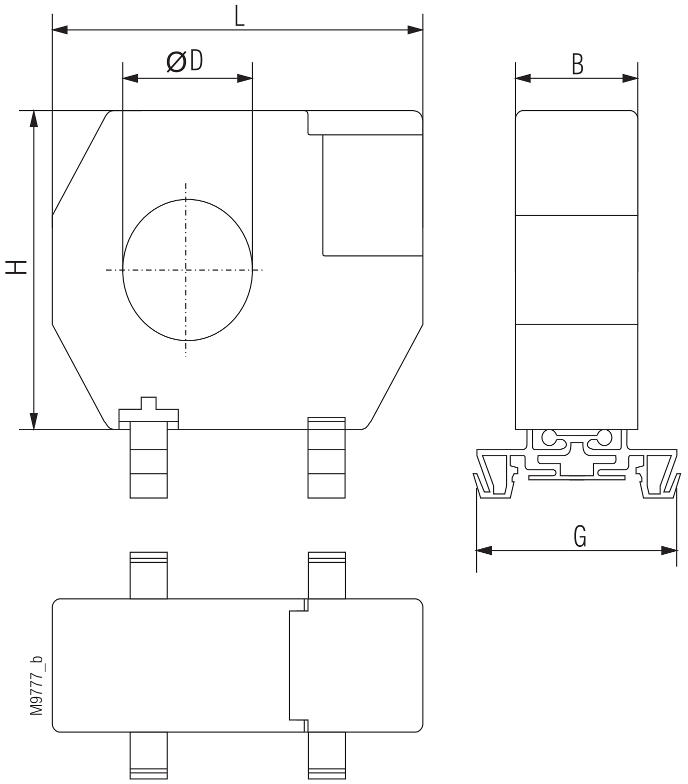
ND 5018/140	øD	L	B	H	C	D	E	F	k	m
Dimensions/mm	140	220	33	196	48.5	123	46	61	6.5	16
Weight / g	1250									

ND 5018/210	øD	L	B	H	C	D	E	F	k	m
Dimensions/mm	210	299	33	284	69	161	46	61	6.5	16
Weight / g	2100									

The residual current transformer ND 5018/105 can also be mounted on DIN-rail. To do this the metal screw fixings have to be removed and have to be replaced by 2 mounting clips
(ET5018: art.no. 0058754; set with 2 pcs)

Accessories

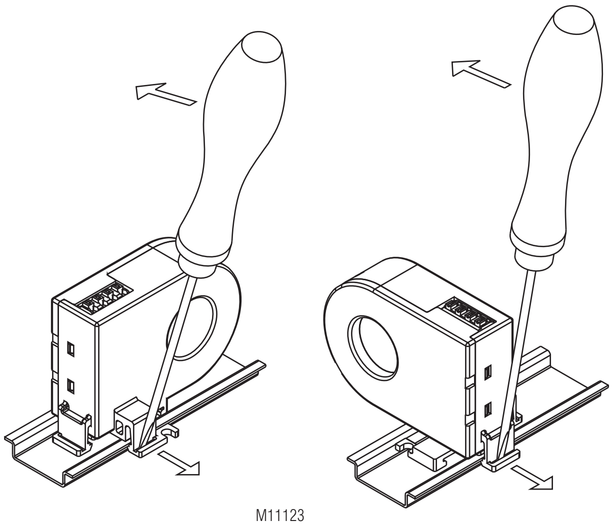
Residual Current Monitor ND 5018/105



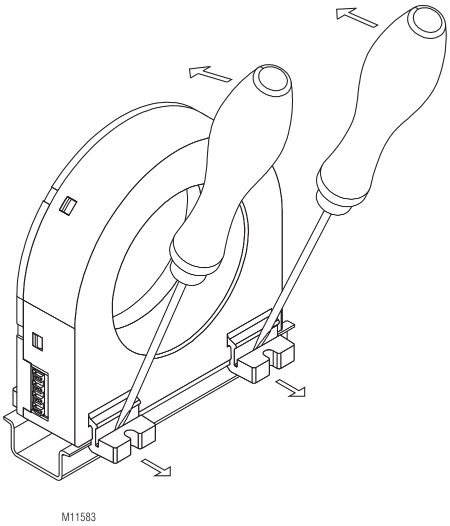
for DIN rail mounting

ND 5018/105	øD	L	B	H	G
Dimensions/mm	105	170	33	146	55
Weight / g	530				

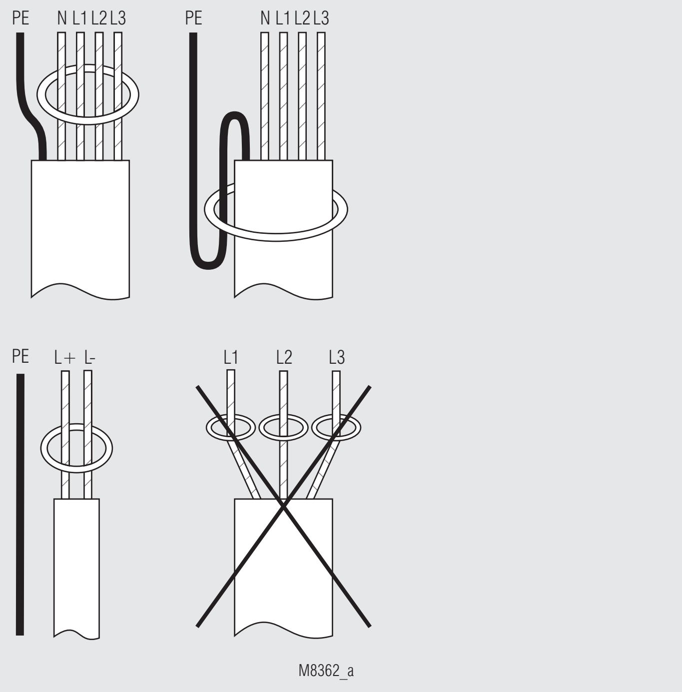
Disassembling Residual Current Monitor ND 5015/024 and /035



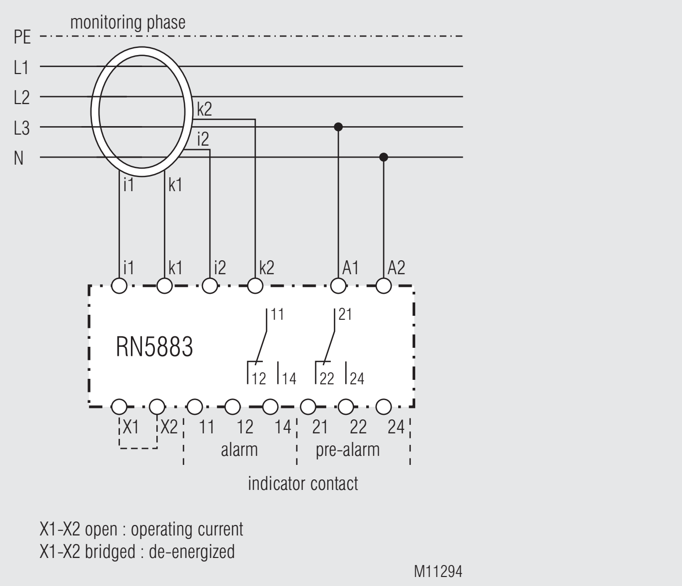
Disassembling Residual Current Monitor ND 5015/070



Installation of Wires



Connection Example



VARIMETER PRO
Multifunction Measuring Relay
MK 9300N, MH 9300

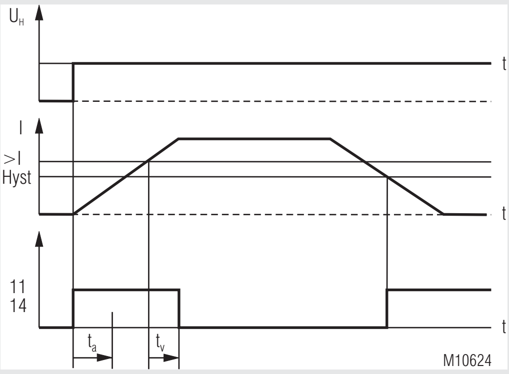
DOLD

MK 9300N MH 9300

Product Description

The universal measuring relays MK 9300N / MH 9300 of the VARIMETER PRO series monitor up to 9 parameters simultaneously. These are under-, over-voltage, voltage range, voltage asymmetry, under-, overcurrent, cos phi, effective-, apparent- and reactive power, frequency and phase sequence, The measurement in 3-phase or single-phase systemes is very simple and without extensiv wiring. Because of the menue structure the multifunctional measuring relays can be used easyly and intuitively.
The early detection of up-coming break downs and preventive maintenance avoid expensive damages. As user you profit from the reliability and availability of your plant.

Function Diagram



Example: overvoltage monitoring with closed circuit operation

Your Advantage

- Min-, Max. value or window monitoring
- Simultaneous monitoring of up to 9 different parameters
- Simple configuration and fault diagnostic
- Different fault indications
- Large measuring range 3 AC 24 ... 690 V
- Auxiliary voltage ranges DC 24 V, AC 230 V or AC/DC 110 ... 400 V
- Early detection of irregular states
- Space and cost saving
- Reduced wiring

Features

- Multifunction measuring relay acc. to EN 60255-1
- Voltage monitoring (1- and 3-phase)
- Current monitoring
- Frequency monitoring
- Power factor cos phi
- Phase sequence, phase failure, asymmetry
- Effective-, reactive- and apparent power
- Start up delay, on delay
- Adjustable hysteresis 0.2 ... 50 % of response value
- Manual reset
- LCD for indication of the measuring values

- Relay output
  MK 9300N: 1 changeover contact
  MH 9300: 2 x 1 changeover contacts
- Relay function selectable (energized/de-energized on trip)
- As option with plugable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- MK 9300N: Width 22,5 mm
  MH 9300: Width 45 mm

More Information

- **MK 9300N**
  The MK9300N has 1 relay output.
  Monitoring parameters can be set independently

- **MH 9300**
  The MH 9300 has 2 relay outputs.
  Monitoring parameters can be set independently
  Each monitoring function can be assigned ro relay 1 and /or relay 2

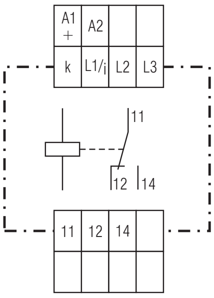
Approvals and Markings

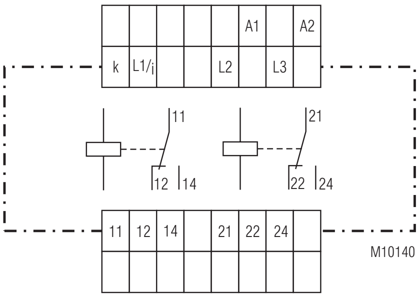
CE

Applications

- Monitoring of single and 3-phase loads
- Emergency power supplies
- Voltage dependent switching at under- or overvoltage
- Voltage monitoring of portable equipment
- Motor protection on Phase failure
- Transformer protection on asymmetric load
- Frequency monitoring on inverter outputs

Circuit Diagrams





MK 9300N.11 MH 9300.12

Connection Terminals

Terminal designation	Signal designation
A1 (+), A2	Auxiliary voltage AC or DC
L1/i, L2, L3	Voltage measuring input AC
L1/i , k	Current measuring path AC
11, 12, 14	Indicator relay (C/O contact)
21, 22, 24	Indicator relay (C/O contact)

Function

After connecting the auxiliary supply to terminals A1-A2 the startup delay disables the monitoring function so that changes on the input have no influence on the relay output of the VARIMETER PRO. The device is in display (RUN) mode and continuously measures the actual values. The buttons ↑ and ↓ toggle between the different values. Pressing Esc for more than 3 sec starts the input mode.

One or more measuring values can be assigned to the relay output. If the setting value of at least one function is exceeded the relay switches and the display indicates this state. The display is inverted, flashes and shows measuring function and fault.

The fault memory is selectable
With button ↵ the fault memory can be deleted.

On the unit MH 9300 it is possible to assign different values to the different relays so one can be used as pre-warning and the other as alarm output. Relay output 1 switches when actual value exceeds the pre-warning setting of at least one assigned measuring function.
If a second setting assigned to relay output 2 with the same measuring function the unit gives an Alarm signal.

Remarks

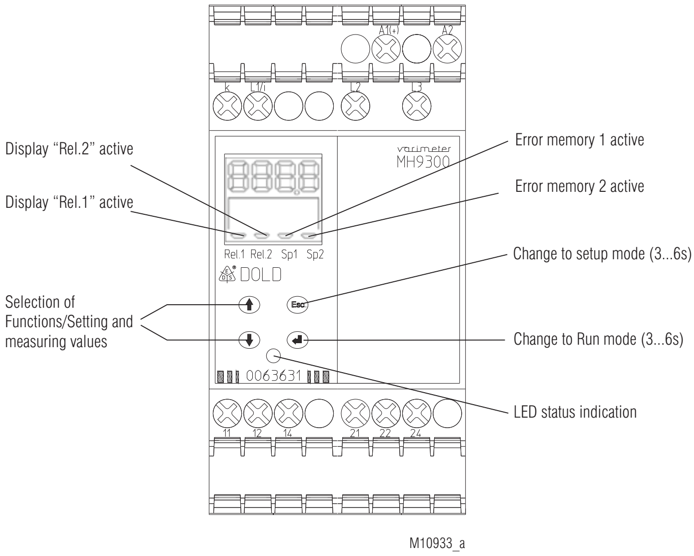
To provide correct function the measuring voltage on L1/L2 has to be at least 20 V.

Due to the measuring principle a symmetric load on all 3 phases as you have it usually with motors.

The unit can also be used for single phase monitoring by bridging terminals L2 and L3. The display shows U instead of U_{min} / U_{max}.

Overload within the current range is indicated by fast flashing of the LED.

Setting

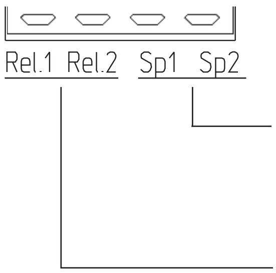


Indicators

The LED indicate the state.

green LED U_N :	on, when auxiliary voltage present
red LED (flashes)	at overload at current path
orange LED:	No measurement, unit in input mode

Cursor LCD Display



Active manual reset
Manual reset activated: flashes when memory mode is ON and relay in failure state.
Reset with button "↵"

Contact state of the output relays

Operating

↑ UP / ↓ DOWN

Display (Run) - Mode

After power up the relay is in display (Run) mode.

↑ ↓ Scrolls the display to show one of the 10 possible values.

If a values exceeds the setting, the values is indicated flashing on inverted display. In the case of a fault display the display always returns to the fault value after pressing ↑ ↓ . If voltage is missing on the measuring input some values cannot be calculated and a no value is shown.

Input-Mode

The measurement is interrupted, the relays are in failure state and the indicator LED has orange color

↑ ↓ Selection of parameters and setting of thresholds.

↵ ENTER

Display (Run) - Mode:

Manual reset, when manual reset is selected for output relay

Reset works only when fault is removed

Input-Mode:

- Shifts cursor to the right
- Saves the value no-voltage safe
- Pressing for more than 3 sec: Change to display (Run) mode.

Esc Esc

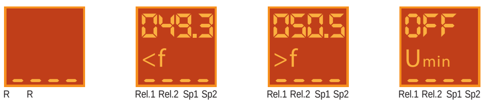
Display (Run) - Mode

- Pressing for more than 3 sec: Change to input mode

Input-Mode:

- Shifts cursor to the left
- Leave setting without saving

LCD-Display



Setting of response values

<	Fault, when value drops under set point
>	Fault, when value exceeds set point
OFF	measurement disabled

If the adjusted threshold of at least one measuring function is exceeded, the corresponding relay output switches after the selected time delay tv and the fault is indicated on the display.

Manual reset can be activated or de-activated and is operated with ↵ on the unit.

Adjustable Parameter

Limit values for Rel.1 and Rel.2 Selectable with buttons ↑ ↓.		Factory setting
U_{min}:	Response value undervoltage, Lowest phase to phase voltage (Undervoltage relay)	OFF
U_{max}:	Response value overvoltage, Highest phase to phase voltage L1, L2 or L3 (Overvoltage relay)	440 V
Asym:	Response value voltage asymmetry, Percentage of highest to lowest phase to phase voltage (Asymmetry relay)	20 %
I:	Response value current at current path L1 (< under- / > overcurrrent)	> 8.00 A
Cos-φ:	Response value phase displacement between current and voltage (< under- / > overload monitor)	OFF
P:	Response value effective power 3-phase Independent of phase sequence switches at adjusted value also at reverse power (< under- / > overload)	OFF
S:	Response value apparent power 3-phase (< / >)	OFF
Q:	Response value reactive power (< / >)	OFF
f:	Response value frequency (range 1 ... 400 Hz) (< under / > overfrequency)	OFF
Hyst:	Hysteresis 0.2 ... 50 % of response value	4.0 %
t_v:	On delay for relays (0 ... 10 sec)	0 s
Phseq:	Monitoring phase sequence (ON / OFF)	ON
A / R:	Seting open- / closed circuit operation	R
Sp:	Error storage (ON / OFF)	OFF

Response values can be deactivated. (OFF)

Further Setting Parameter

Selectable with buttons ↑ ↓.		Factory setting
t_a:	Start up delay, when auxiliary voltage connected (0.2 ... 10 sec) in steps of 0.1 s	0.2 s

Restore Factory Settings

(Restore factory settings)

Before auxiliary voltage connected press button Esc .

During start press and hold.

Indicator output

Monitoring parameters can be set independently.

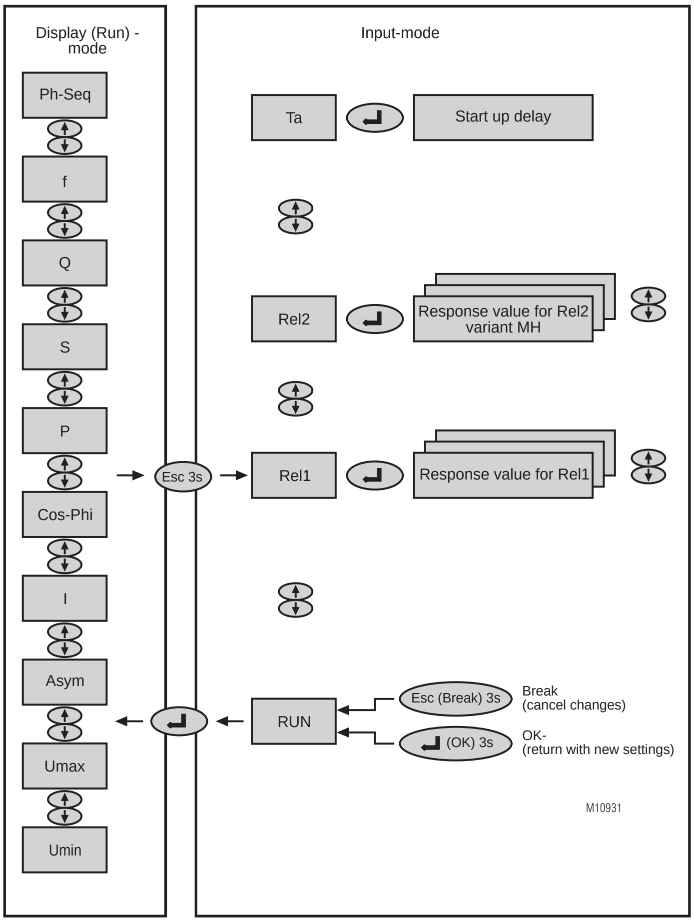
The MK9300N has 1 relay output.

The MH 9300 has 2 relay outputs.

Each monitoring function can be assigned to Relay 1 and/or to Relay 2.

The switching mode energized or de-energized on trip can be set in input mode.

Operating



After connecting the auxiliary supply A1/A2 the unit is in display (Run) mode**:**

The display is inverted when a measured value is exceeds the settings.

With button the fault memory is reset.

The actual measured values can be toggled with the buttons.

Pressing button Esc for more than 3 sec the unit changes to input mode.

In input mode the measurement is disabled, the relays are in failure mode and the indicator LED is orange.

With the buttons the different setting values can be chosen.

Move cursor position

One character to the right

Esc One character to the left

Back to the Display (Run)-Mode

Press button 3 s OK New values stored

or

Press button Esc 3 s; Break Values unchanged

R N on the display confirm with to change to display (Run) mode.

Display (RUN) Mode	Input-Mode
Display inverted when the actual value is in failure state.	Measurement interrupted, relays are in failure state, indicator LED orange color
Scroll display between the 10 different measuring values.	Chose Rel1, Rel2, T_a and RUN As option address for RS485 Bus Chose parameter Change and set response values for Rel1 and Rel2.
Reset fault memory:	Esc Shift cursor to the left Shift cursor to the right
Esc For more the 3 sec, change to input mode	For more than 3 sec, change to display mode

Operating - Display - Menü (RUN) Mode

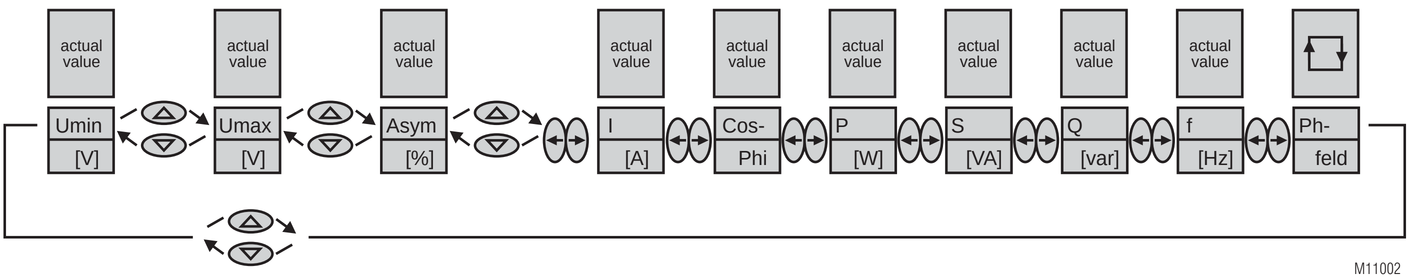
Cursor-display

R1 R2 relay 1 energized

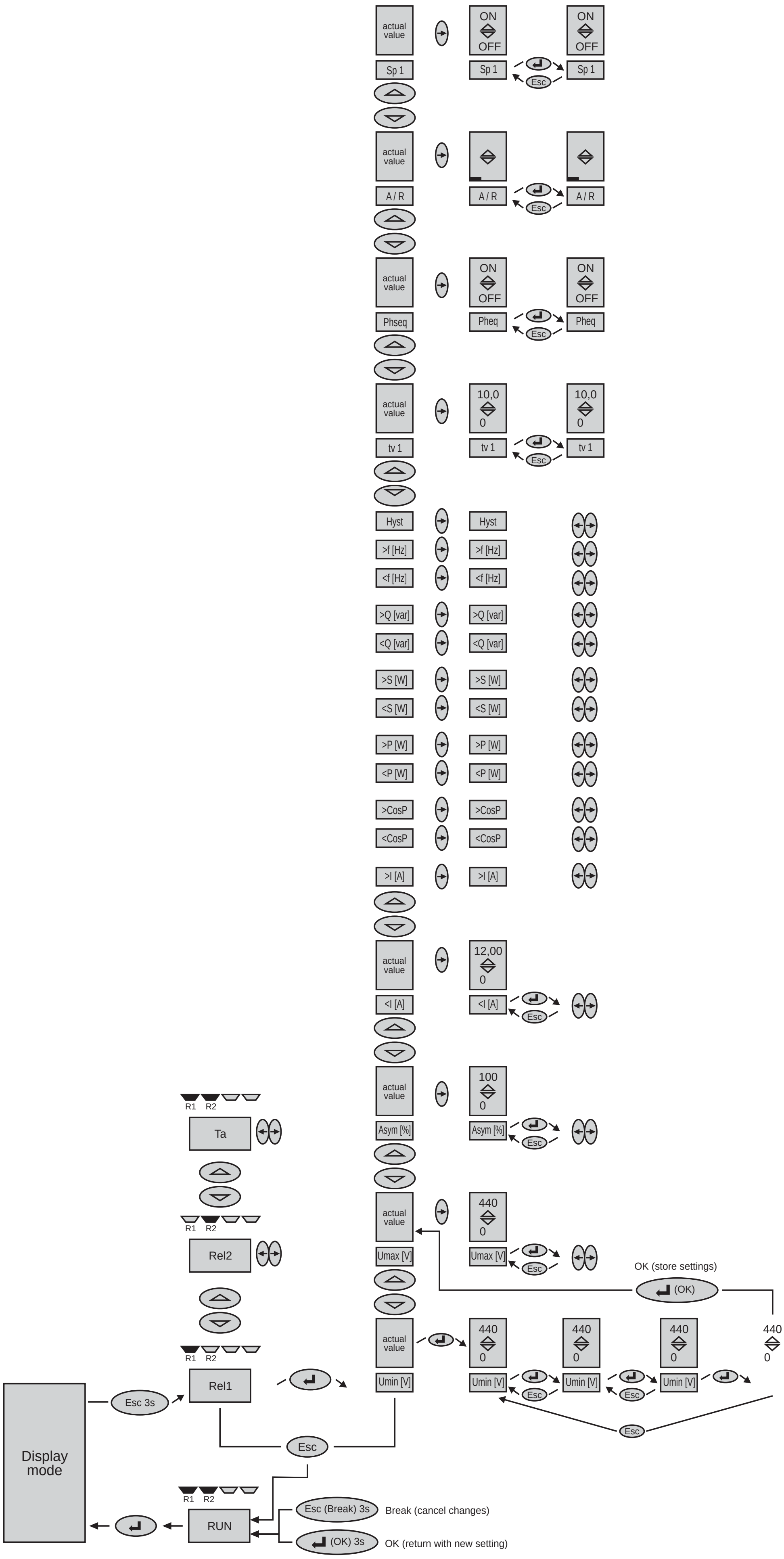
R1 R2 relay 2 energized

R1 R2 relay 1 and 2 energized

Cursor flashes during time delay tv

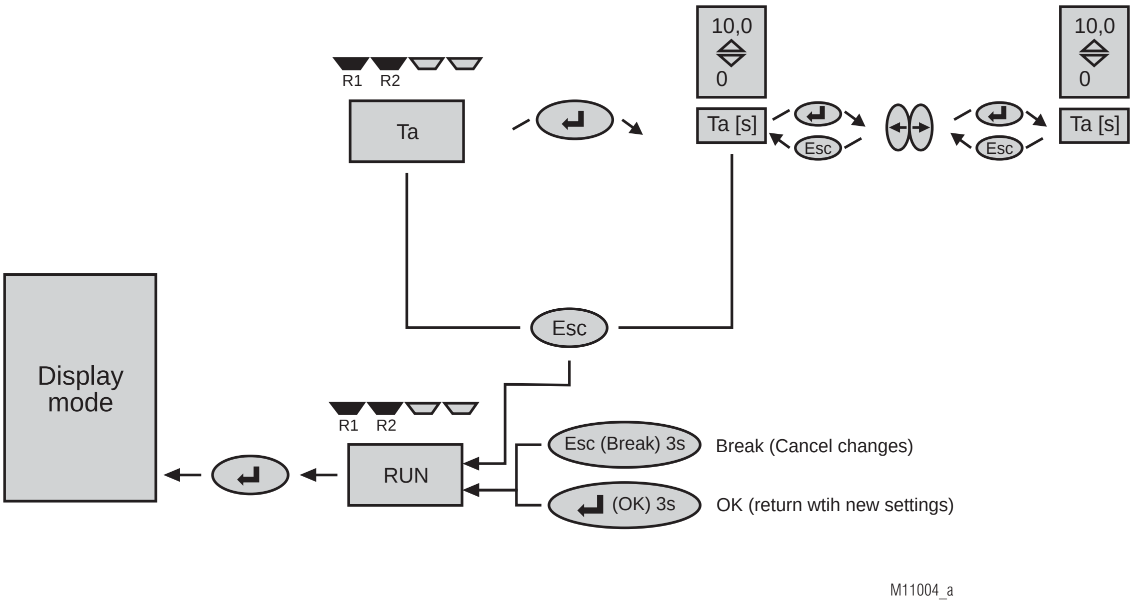


The menu for relay 2 is identically



Operating - Setting valid for both relays -

Start up delay t_a: 0 ... 10 s in steps of 0.1 s



Technical Data

Auxiliary Voltage A1/A2

Nominal auxiliary voltage U_H	
MK 9300N:	DC 24 V (0.9 ... 1.1 x U_H)
MH 9300:	AC 110, 230 V, 400 V (0.8 ... 1.1 x U_H)
	AC/DC 110 ... 400 V (0.8 ... 1.1 x U_H)
	DC 24 V (0.9 ... 1.1 x U_H)*)
	*) for measuring range 3 AC 24 ... 400 V
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 400 Hz
Input current	
at DC 24 V:	50 mA
at AC 230 V:	15 mA

Voltage Measuring Input L1/L2/L3

MK 9300N:	
Nominal voltage:	3 AC 400 V
Measuring range U_M:	3 AC 24 ... 400 V
	(0,8 ... 1,1 x U_M)
MH 9300:	
Nominal voltage:	3 AC 400 V / 690 V
Measuring range U_M:	3 AC 24 ... 400 V, 24 ... 690 V
	(0,8 ... 1,1 x U_M)
Nominal frequency:	50 / 60 Hz
Frequency range:	1 ... 400 Hz

Current Measuring Input i / k

Nominal current:	AC 12 A
Measuring range:	AC 100 mA ... 12 A
Max. overload	
continuously:	16 A
short time < 10 s:	max. 25 A
	If current range is overloaded, the LED flashes fast
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 400 Hz

Setting Range (absolute, via button and LCD-display)

Measuring accuracy at nominal frequency	
(in % of setting value):	± 4 %
Hysteresis	
(in % of setting value):	0.2 ... 50 % of response value
Reaction time:	< 350 ms (f > 10 Hz)
Adjustable on delay t_v:	0 ... 10 s (in steps of 0.1 s)
Adjustable start up delay t_a:	0.2 ... 10 s (in steps of 0.1 s)

Output Circuit (Rel1: 11/12/14; Rel2: 21/22/24)

Contacts:		
MK 9300N:	1 changeover contact	
MH 9300:	1 changeover contact (Rel1) and	
	1 changeover contact (Rel2)	
Thermal current I_{th}:	2 x 4 A	
Switching capacity		
to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 3 A, AC 230 V:	2 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Permissible switching frequency:	1800 / h	
short circuit strength		
Max. fuse rating:	4 A gG / gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

Technical Data

General Data

Nominal operating mode: continuous operation
Temperature range
Operation: - 20... + 60 °C
(at range 0 ... - 20 °C limited function of the LCD display)
Storage: - 20... + 60 °C
Altitude: < 2,000 m
Clearance and creepage distance rated impulse voltage / pollution degree

Auxiliay voltage / meas. input:	6 kV / 2	IEC/EN 60 664-1
Auxiliay voltage / contacts:	6 kV / 2	IEC/EN 60 664-1
Measuring input / contacts:	6 kV / 2	IEC/EN 60 664-1
Contacts 11,12,14 / 21,22,24:	4 kV / 2	IEC/EN 60 664-1
Overvoltage category:	III	

EMC

Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation 80 MHz ... 2.7 GHz	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6

Interference suppression: Limit value class A*)
*) The device is designed for the usage under industrial conditions (Class A, EN 55011).
When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.

Degree of protection

Housing:	IP 40	DIN EN 60 529
Terminals:	IP 20	DIN EN 60 529

Housing: thermoplastic with VO behaviour according to UL Subject 94
Vibration resistance: Amplitude 0.35 mm, frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 EN 60 068-1
Wire connection DIN 46 228-1/-2/-3/-4
Screw terminal (fixed): 1 x 4 mm² solid or
1 x 2.5 mm² stranded ferruled (isolated) or
2 x 1.5 mm² stranded ferruled (isolated) or
2 x 2.5 mm² solid
Insulation of wires or sleeve length: 8 mm
Terminal block with screw terminals
Max. cross section: 1 x 2.5 mm² solid or
1 x 2.5 mm² stranded ferruled (isolated)
Insulation of wires or sleeve length: 8 mm
Terminal block with cage clamp terminals
Max. cross section: 1 x 4 mm² solid or
1 x 2.5 mm² stranded ferruled (isolated)
Min. cross section: 0.5 mm²
Insulation of wires or sleeve length: 12 $^{\pm 0.5}$ mm
Wire fixing: Plus-minus terminal screws M3,5 box terminals with wire protection or cage clamp terminals
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715
Weight:
MK 9300N: approx. 140 g
MH 9300: approx. 250 g

Dimensions

Width x height x depth:
MK 9300N: 22.5 x 90 x 97 mm
MH 9300: 45 x 90 x 97 mm

Standard Types

MK 9300N.11/022 3 AC 20 ... 440 V AC 12 A DC 24 V
Article number: 0063630
- Measuring voltage: 3 AC 20 ... 440 V
- Measuring current: AC 12 A
- Auxiliary voltage U_H: DC 24 V
- Output: 1 changeover contact
- Width: 22,5 mm

MH 9300.12/022 3 AC 20 ... 440 V AC 12 A AC 230 V
Article number: 0063631
- Measuring voltage: 3 AC 20 ... 440 V
- Measuring current: AC 12 A
- Auxiliary voltage U_H: AC 230 V
- Output: 1 changeover contact (Rel1) and 1 changeover contact (Rel2)
- Width: 45 mm

Ordering Example

MK 9300N .11 _ _ /022 3 AC 20 ... 440 V AC 12 A DC 24 V

Auxiliary voltage U_H
Measuring current U_M
Measuring voltage
Type of terminals
without indication: terminal blocks fixed with screw terminals
PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
PS (plug in screw): pluggable terminal blocks with screw terminals
Contacts
Type

Options with Pluggable Terminal Blocks

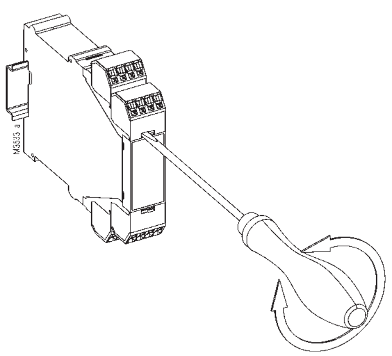

Screw terminal (PS/plugin screw)


Cage clamp terminal (PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Safety notes

Dangerous voltage.
Electric shock will result in death or serious injury.

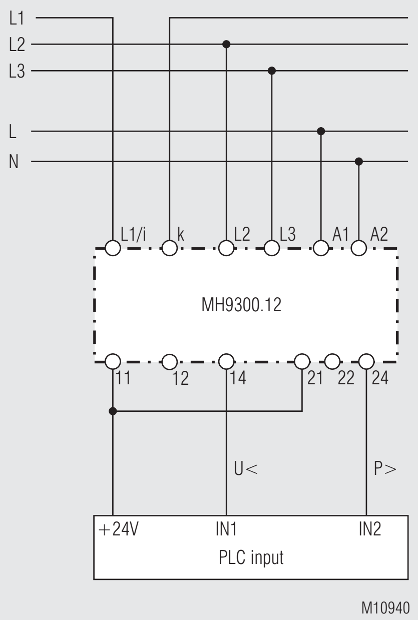
Disconnect all power supplies before servicing equipment.

- Faults must only be removed when the relay is disconnected
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety).
- Settings must only be changed by trained staff taking into account the safety regulations. Installation work must only be done when power is disconnected.
- Observe proper grounding of all components

Set Up Procedure

The connection has to be made according to the connection examples. To connect the current of L1 the Terminals I and k are available. If the current to be measured exceeds the maximum continuous current of the input and external current transformer has to be used. If current is not measured input k remains unconnected.

Connection Example



VARIMETER PRO
Phase monitor
RL 9877, RN 9877

DOLD

0273498

RL 9877 RN 9877

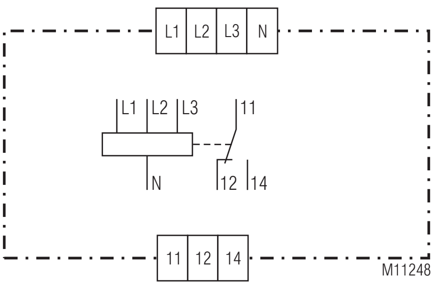
Your Advantages
- Preventive maintenance
- For better productivity
- Always right directions of motors and pumps
- Safe monitoring of motors and plants with phase failure detection
- High repeat accuracy
- Wide measuring voltage range
- Selectable monitoring function
- Easy setting

Features
- According to IEC/EN 60 255-1
- For monitoring of AC 3- and single-phase with 50 /60 Hz
- Detection of
  - Overvoltage
  - Undervoltage
  - Voltage range excess
  - Phase failure
  - Phase asymmetry
  - missing neutral e.g. broken neutral wire
  - and phase sequence in 3-phase systems
- With or without neutral
- No separate auxiliary necessary
- Output: 1 changeover contact
- De-energized on trip
- Adjustable hysteresis for reset
- Adjustable switching delay
- Fast fault detection
- Width:
  - RL 9877:   35 mm
  - RN 9877: 52.5 mm

Product Description

The measuring relays RN 9877 and RL 9877 of the VARIMETER series monitor overvoltage, undervoltage, voltage range, phase asymmetry and phase sequence in 3-phase or single-phase systems. The measurement is very simple and without extensive wiring as there is no auxiliary power supply necessary. The monitoring functions are easily selectable using a single turn switch without complex menu structure. The early detection of up-coming break downs and preventive maintenance avoid expensive damages. As user you profit from the reliability and availability of your plant.

Circuit Diagram



Approvals and Markings

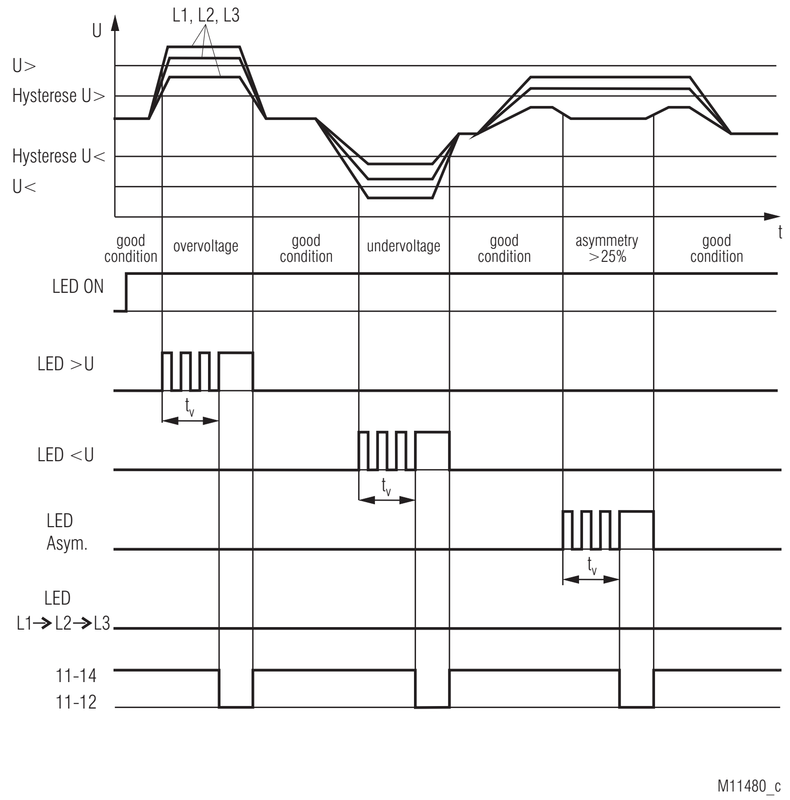
Canada / USA

Connection Terminals

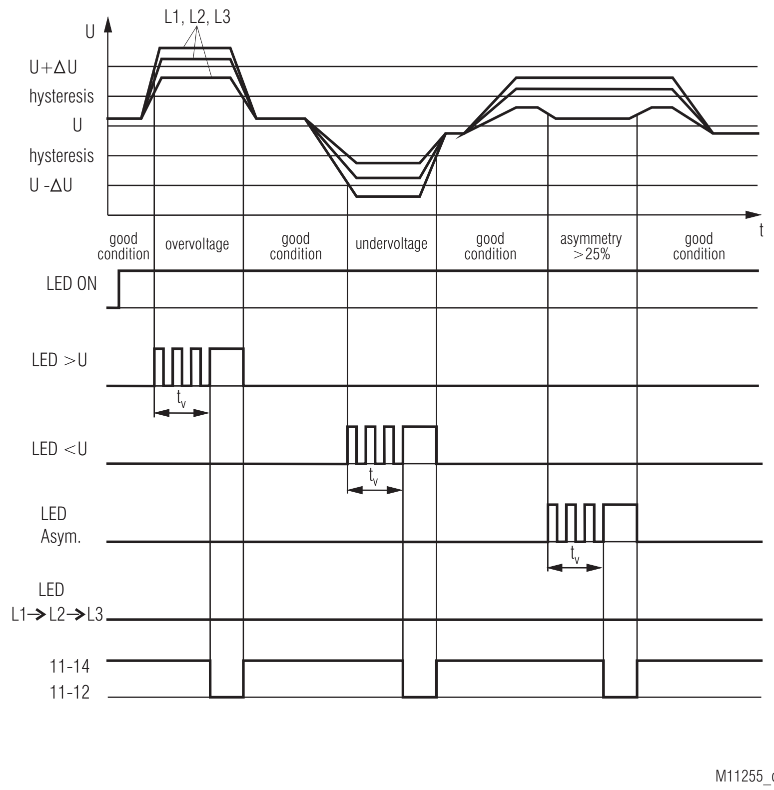
Terminal designation	Signal designation
L1	Phasen voltage L1
L2	Phasen voltage L2
L3	Phasen voltage L3
N	Neutral
11, 12, 14	Changeover contact (outputrelays)

Application

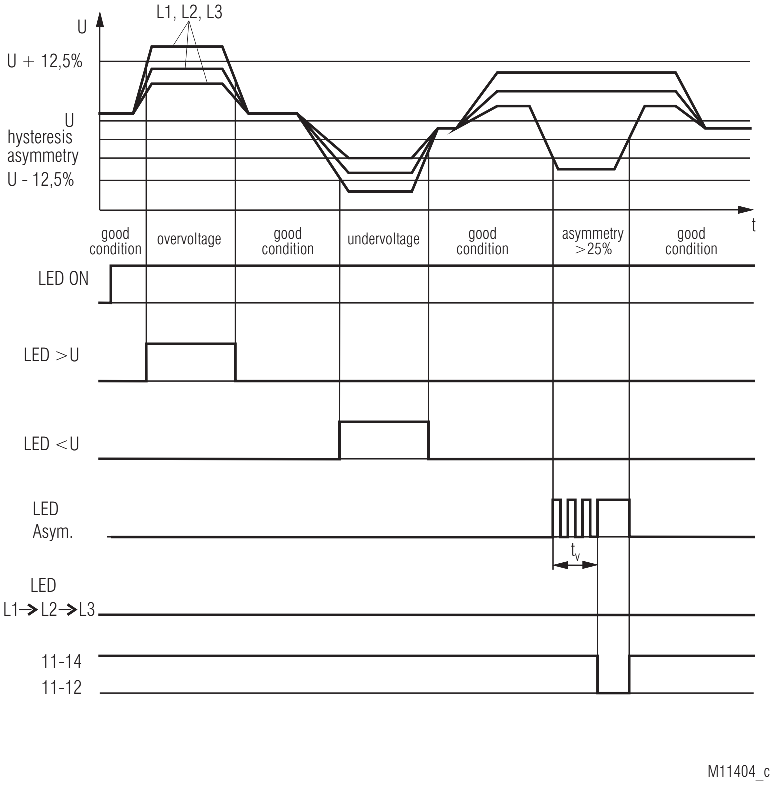
- Monitoring of three-phase voltage systems to identify overvoltage and undervoltage
- Indication of phase sequence in 3-phase systems, phase failure and voltage asymmetry
- Monitoring of voltage systems with motors
- Changeover to emergency supply after failure detection



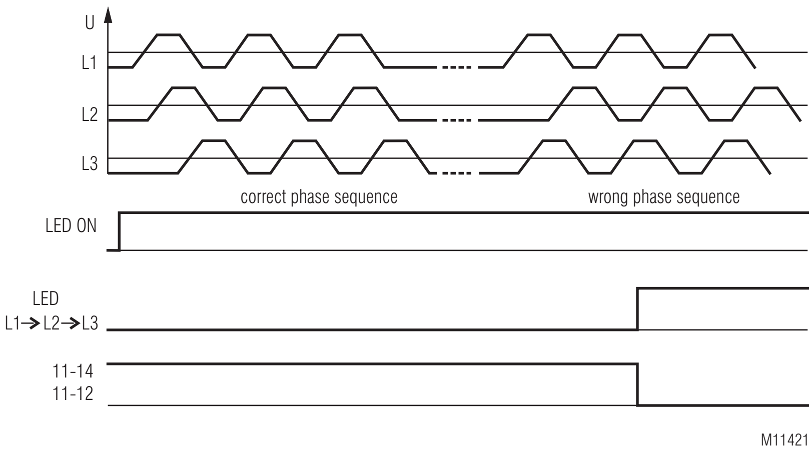
Monitoring function: 3 AC / 1 AC-overvoltage / undervoltage; rotary switch: „U>“ / „U<“



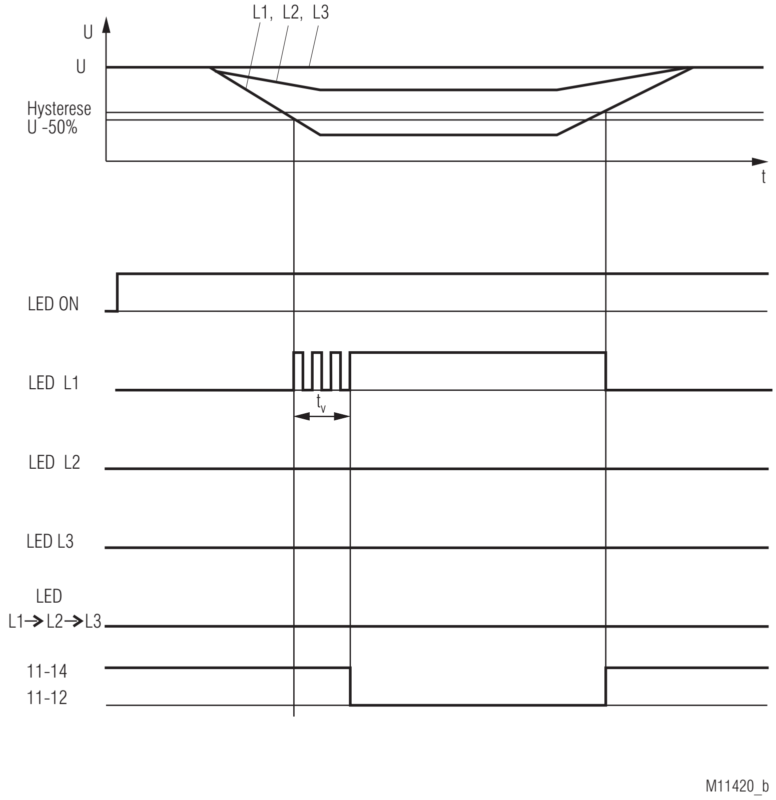
Monitoring function: 3 AC / 1 AC-voltage range; rotary switch: „U<>“



Monitoring function: 3 AC-Asymmetrie; rotary switch: „Asym.“



Monitoring function: 3 AC-phase sequence; rotary switch: any



only at variant RN9877/120 e.g. RL9877/120:
Monitoring function: Phase failure

Functions

In 3-phase systems all three phases are measured against neutral. In the monitoring modes overvoltage, undervoltage and voltage range the excess of the switching voltage U by one or more phase voltages is indicated by blinking of the corresponding LED. After the switching delay time has expired the voltage LED is on permanently and the output relay releases. If the phase voltage which has triggered the alarm falls below the nominal voltage U, the voltage LED switches off immediately whereas the output relay is energized.

The output relay operates in closed circuit mode i.e. in case of good condition the relay energized whereas in fault condition it is de-energized.

In the voltage range monitoring mode the nominal voltage range U ± △U is adjustable. An alarm is triggered in case a phase voltage leaves this monitoring range. The hysteresis for switching back into good condition is half the value set by the potentiometer △U.

In the voltage monitoring operation modes an excess of the voltage asymmetry between the three phases of more than 25 % is indicated by the asymmetry LED turning on. In this terminology asymmetry means the relative difference of the maximum phase voltage and the minimum phase voltage. Fall back into good condition occurs with a hysteresis of ca. 6 %. In this case the asymmetry LED turns off and the output relay energizes.

In the asymmetry monitoring operation mode the trigger level for asymmetry excess in 3-phase systems is adjustable. The hysteresis for falling back into good condition is exactly half of the set value for asymmetry. In this monitoring mode activation and deactivation of the output relay is done using the same timing parameters as in the voltage monitoring mode except that the control is governed by asymmetry excess rather than voltage excess. In this function mode a difference of the phase voltage to the adjusted voltage value of more then 25% is indicated by the corresponding voltage LED. Again fall back into good condition is done with a hysteresis of approx. 6 %.

In all monitoring modes of a 3-phase system a correct phase sequence is monitored. In case of a wrong phase sequence the phase sequence LED turns on permanently and the output relay remains de-energized. This state is on hold until the unit is restarted with correct phase sequenze. After the phase sequence is correct again the LED is turned off immediately.

A missing or broken neutral is indicated by the asymmetry LED and the phase sequence LED being switched on permanently.

In 3-phase systems without neutral the delta voltages UA, UB and UC are calculated via virtual star voltages by means of vector addition. The monitoring modes are the same as with devices with neutral. The following relationships between triangle voltages and device terminals are to be taken into account:

UA = L1 - L2; UB = L1 – L3; UC = L2 – L3;

The variant RN9877/120 is especially suitable to detect phase failures.

While the neutral is connected and a phase drops under 50% of the phase voltage the corresponding LED signals the failure. The percentage between minimum and maximum phase voltage is measured.
When the neutral is missing, the phases are measured in relation to a virtual internal neutral.

After elaps of the switching delay the phase failure LED is continuously on and the output relay switches off (de-energised on trip). The reset takes place with a hysteresis of 6.25% then then LED goes off immediately and the output relay energises.

Indicator

green LED „ON“:	on, when supply connected
red LED „U“:	on, when overvoltage
red LED „<U“:	on, when undervoltage
yellow LED „Asym.“:	indicates a voltage asymmetry in 3-phase systems or loss of neutral
yellow LED „L1→L2→L3“:	indicates wrong phase sequence in 3-phase systems or loss of neutral

Variant /120:

green LED „ON“:	on, when supply connected
red LED „L1“:	on, when phase failure at phase 1
red LED „L2“:	on, when phase failure at phase 2
red LED „L3“:	on, when phase failure at phase 3
yellow LED „L1→L2→L3“:	indicates wrong phase sequence in 3-phase systems

Notes

During initialisation the relay recognises automatic the mains frequency (50 Hz or 60 Hz) and Netzform (3AC- or 1AC- systems).

On 3-phase connection all 3-phase voltages are criteria to return into good state, therefore the hysteresis should be chosen as low as possible for undervoltage or overvoltage mode (max. 10%). For the voltage range mode a higher hysteresis should be selected (min.10%).

Depending on the voltage system different monitoring functions can be selectet on a selector switch:

Function select	Type of voltage	Monitoring
U>	3AC / 1AC	Overvoltage
U<	3AC / 1AC	Undervoltage
U<>	3AC / 1AC	Voltage range
Asym.	3AC	Phase asymmetry

Technical Data

Input

Operating voltage U_B:		
RL 9877:	3/N AC 80 … 230 V / 45 ... 130 V 1- or 3-phase without / with neutral	
RN 9877:	3/N AC 175 … 525 V / 100 ... 300 V 1- or 3-phase without / with neutral	
Voltage rated operating U_e:		
RL 9877:	3/N AC 94 … 209 V / 53 ... 118 V	
RN 9877:	3/N AC 205 … 477 V / 118 ... 273 V	
Operating voltage U_B:		
RL 9877:	3 AC 80 ... 230 V 3-phase without neutral	
RN 9877:	3 AC 175 ... 525 V 3-phase without neutral	
Voltage rated operating U_e:		
RL 9877:	3 AC 94 ... 209 V	
RN 9877:	3 AC 205 ... 477 V	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 … 65 Hz	
Max. asymmetry:	50 %	
Nominal consumption:	approx. 7 VA	

Output

Contact:	1 changeover contact	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	5 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A, AC 230 V:	typ. 3 x 10^5 switching cyles	
Short circuit strength		IEC/EN 60 947-5-1
max. fuse rating:	5 A gL	
Mechanical life:	> 30 x 10^6 switching cyles	

Measuring circuit

Measuring voltage:	infinite adjustable
RL 9877:	3/N AC 80 … 230 V/ 45 ... 130 V
RN 9877:	3/N AC 175 … 525 V/ 100 ... 300 V
RL 9877:	3 AC 80 ... 230 V
RN 9877:	3 AC 175 ... 525 V
Voltage range:	0.85 U_N ... 1.1 U_N
Hysteresis:	infinite adjustable 4 ... 20 %
Response value for **Phase asymmetry:**	infinite adjustable 4 … 20 %
Switching delay t_v:	infinite adjustable instantaneuos, 2 … 30 s
Repeat accuracy:	± 2 %
Temperature influence:	± 1 % **Attention:** **The combination of adjusted switching voltage U and hysteresis △U must be within the measuring range.**

General Data

Operating mode:	continuous operation	
Temperature range		
Operation:	- 20 ... + 55 °C	
Storage:	- 25 ... + 65 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
Rated impuls voltage/ Pollution degree:	6 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	12 V / m	IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4

Technical Data

Surge between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Enclosure:	Thermoplastic with V0 behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Class I	IEC/EN 60 255-21
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Fixed screw terminals		
Cross section:	0.2 ... 4 mm² (AWG 24 - 12) solid or 0.2 ... 2.5 mm² (AWG 24 - 12) stranded wire with and without ferrules	
Stripping length:	7 mm	
Fixing torque:	0.6 Nm	EN 60 999-1
Wire fixing:	Captive slotted screw / M2.5	
Fixed **High-voltage terminals**		
Cross section:	0.2 ... 6 mm² (AWG 24 - 10) massiv oder 0.2 ... 4 mm² (AWG 24 - 10) stranded wire without ferrules 0.25 ... 4 mm² (AWG 24 - 10) stranded wire with ferrules	
Stripping length:	8 mm	
Fixing torque:	0.7 Nm	EN 60 999-1
Wire fixing:	Captive slotted screw / M3	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
RL 9877:	approx. 105 g	
RN 9877:	approx. 125 g	

Dimensions

Width x height x depth:	
RL 9877:	35 x 90 x 71 mm
RN 9877:	52.5 x 90 x 71 mm

UL-Data

ANSI/UL 60947-1, 5th Edition
ANSI/UL 60947-5-1, 3rd Edition

CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition
CAN/CSA-C22.2 No. 60947-5-1-14, 1st Edition

Switching capacity:	Pilot duty B300 5A 240Vac Resistive, G.P. 5A 30Vdc Resistive or G.P. 5A 250Vac G.P.
Wire connection:	60°C / 75°C copper conductors only
RL 9877:	AWG 24 - 12 Sol/Str Torque 0.6 Nm
RN 9877 for terminals 11, 12, 14:	AWG 24 - 12 Sol/Str Torque 0.6 Nm
for terminals L1, L2, L3, N:	AWG 30 - 10 Sol/Str Torque 0.7 Nm

i n o **Technical data that is not stated in the UL-Data, can be found in the technical data section**

Standard Types

RL 9877.11   3/N 80 … 230 V / 45 ... 130 V   4 ... 20 %   0 ... 30 s
Article number: 0066426
- Output: 1 changeover contact
- Measuring voltage: 3/N AC 80 ... 230 V / 45 ... 130 V
- Hysteresis: 4 ... 20 %
- Switching delay: 0 ... 30 s
- Width: 35 mm

RN 9877.11   3/N 175 … 525 V / 100 ... 300 V   4 ... 20 %   0 ... 30 s
Article number: 0066425
- Output: 1 changeover contact
- Measuring voltage: 3/N AC 175 ... 525 V / 100 ... 300 V
- Hysteresis: 4 ... 20 %
- Switching delay: 0 ... 30 s
- Width: 52.5 mm

Variant

RN 9877.11/120: to detect phase failure, indications of the missing phase via LED; can be used with or without neutral

Ordering example for variant

R_ 9877 .11 /_ _ _ 3/N 175 … 525 V / 100 ... 300 V   4 ... 20 %   0 ... 30 s

Switching delay
Hysteresis
Operating voltage

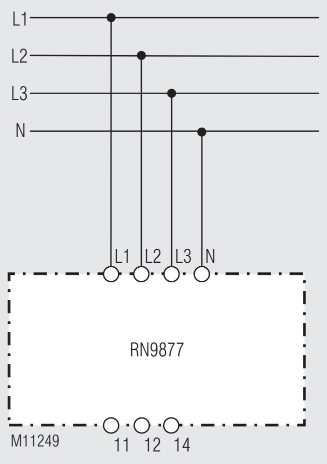
Operation mode/Outputsge
0: De-Energized on trip
1: Energized on trip

Neutral
0: With Neutral
1: Without Neutral
2: With / without Neutral
(only Phase monitoring

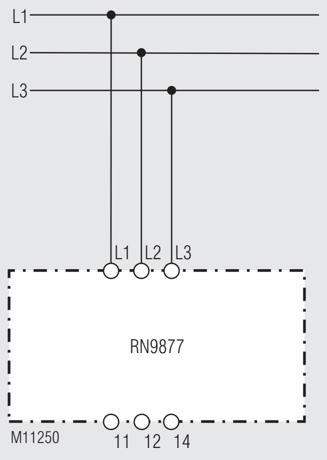
Monitoring function
0: Voltage monitoring
1: Phase monitoring

Contacts
L: 35 mm Width
N: 52.5 mm Width

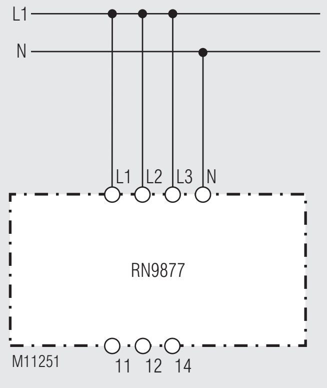
Connection Examples



3-phase connection with neutral



3-phase connection without neutral



Single-phase connection

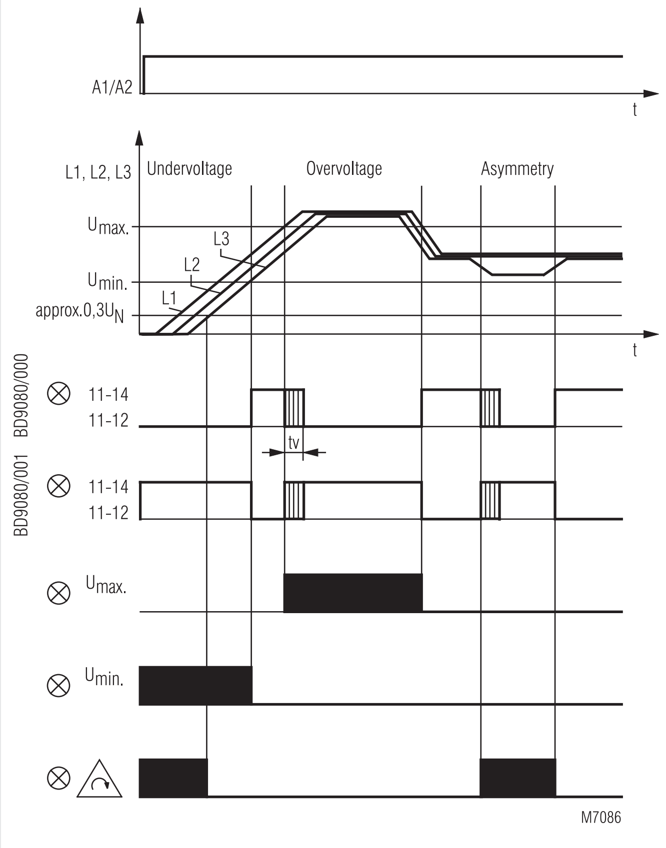
Monitoring Technique

VARIMETER PRO
Phase Monitor
BD 9080

0221554

- According to IEC/EN 60255-1
- Monitoring of
  - Under- and overvoltage
  - Asymmetry
  - Phase failure
  - Phase sequence
- Adjustable time delay between 0.1 ... 5 s
- One LED in each case for:
  - Auxiliary voltage A1/A2
  - Overvoltage $U_{max.}$
  - Undervoltage $U_{min.}$
  - Asymmetry / Phase sequence / Power failure
  - Contact position
- Closed circuit operation
- 2 changeover contacts
- As option available with open circuit operation
- Width 45 mm

Function Diagram



Approvals and Markings

*
Canada / USA
*
A025518

*) see variants

Applications

For monitoring three-phase networks for undervoltage, overvoltage, phase sequence, asymmetry, power failure.

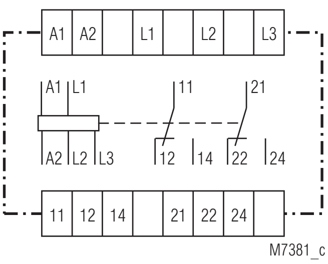
Indication

1. LED A1 / A2:	on, when operating voltage present
2. LED U_{max}:	on, in event of overvoltage
3. LED U_{min}:	on, in event of undervoltage
4. LED Δ:	on, in event of:
	- asymmetry
	- incorrect phase sequence
	- power failure
5. LED:	on, when output relay activated

Notes

Measurement procedures: arithmetical mean value measurement over several half-waves of rectified phase voltages L1/L2 and L2/L3. Reference phase is L3. Networks with or without neutral can be monitored. The auxiliary voltage to be applied to A1/A2 can also be taken from the three-phase network which is to be monitored. This reduces to 0.8 - 1.1 U_H the permitted range of voltage of the network to be monitored.

Circuit Diagram



Technical Data

Input Circuit

Nominal voltage U_N		
L1 / L2 / L3:	3 AC 230, 400, 690 V (other voltages on request)	
Setting range:	0.7 ... 1.3 U_N	
Overload capacity of U_N:	1.5 U_N / 2 U_N (10 s) max. 1 000 V	
Nominal frequency of U_N:	50 / 60 Hz	
Frequency range of U_N:	45 ... 65 Hz	
Accuracy:	$\leq \pm$ 0.5 % of U_N	
Power consumption with U_N:	L1 approx. 0.5 mA L2 approx. 0.5 mA L3 approx. 0.8 mA	
Hysteresis:	$\leq$ 5 % x U_A (U_A = response value)	
Asymmetry detection		
Voltage:	$U_A \pm$ 8 ... 20 %	
Fault angle:	approx. 120° $\pm$ 15°	
Temperature influence:	$\leq$ 0.08 % / K	

Auxiliary Circuit

Auxiliary voltage U_H	
A1 / A2:	AC 110, 230, 400 V AC/DC 24 ... 80 V, AC/DC 80 ... 230 V (other voltages on request)
Voltage range of U_H:	0.8 ... 1.1 U_H
Nominal frequency of U_H:	50 / 60 Hz
Frequency range of U_H:	45 ... 500 Hz
Nominal consumption:	2.4 VA

Output Circuit

Contacts:	2 changeover contacts	
Response-/Release time:	approx. 900 / 150 ms	
Time delay t_V:	0.1 ... 5 s	
Thermal current I_{th}:	6 A (see continuous current limit curve)	
Switching capacity		
to AC 15		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life:		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:		
NO contact:	2.5 x 10^5 switching cycles	
Permissible switching frequency:	20 switching cycles / s	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	$\geq$ 50 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 20 ... + 60°C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
auxiliary voltage:	6 kV / 2	IEC 60 664-1
Contact / contact:	4 kV / 2	IEC 60 664-1
Overvoltage category:	III	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Wire connection:		DIN 46 228-1/-2/-3/-4
Fixed screw terminals		
Cross section:	0.1 ... 4 mm² (AWG 28 - 12) solid or 0.1 ... 2.5 mm² (AWG 28 - 12) stranded wire with ferrules	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Wire fixing:	Cross-head screw / M3,5 box terminals	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	325 g	

Dimensions

Width x height x depth:	45 x 74 x 133 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

UL-Data

Switching capacity:	Pilot duty B300

Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Thermal current I_{th}:	5 A

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

BD 9080.12 3 AC 400 V AC 230 V

Article number:	0045382
• Output:	2 changeover contacts
• Nominal voltage U_N:	3 AC 400 V
• Auxiliary voltage U_H:	AC 230 V
• Closed circuit operation	
• Width:	45 mm

Variants

BD 9080.12/61: with UL-approval on request
BD 9080: with CCC-approval on request
BD 9080.12/001: open circuit operation
BD 9080.12/020: output relay
indicates only under- and overvoltage
BD 9080.12/200: with extended temperature range of
- 40 ... + 70 °C

Remark

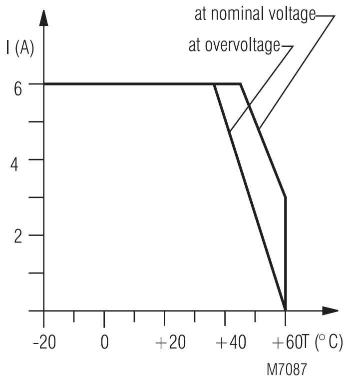
At an ambient temperature of + 70°C the device has to be mounted with 2 cm space to the neighbour units and the necessary air circulation must be provided.
The contact current must not be more then 2 A.
The life of the product may be reduced by the higher ambient temperature!

Ordering example for variant

BD 9080 .12 /_ _ _ 3 AC 400 V 50/60 Hz AC 230 V 50/60 Hz

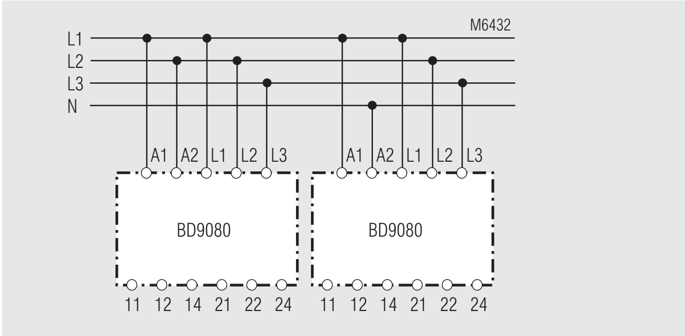
- Nominal frequency of U_H
- Auxiliary voltage U_H
- Nominal frequency of U_N
- Nominal voltage U_N
- Variant, if required
- Contacts
- Type

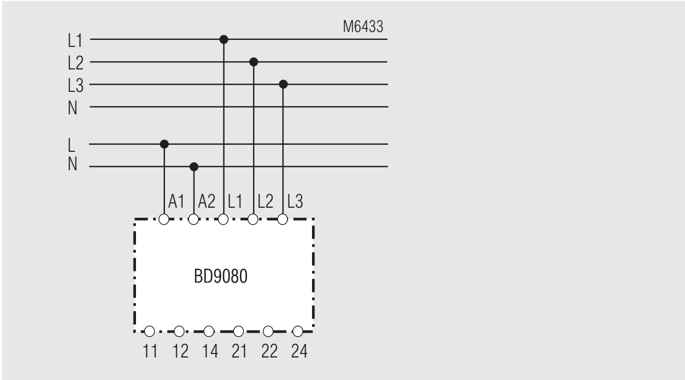
Characteristic



Continuous current limit curve

Connection Examples





VARIMETER PRO
Phase Monitor with thermistor motor protection
IL 9086, SL 9086

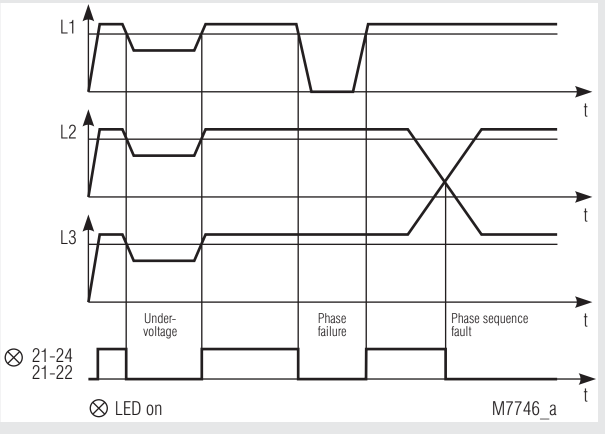
DOLD

0235397

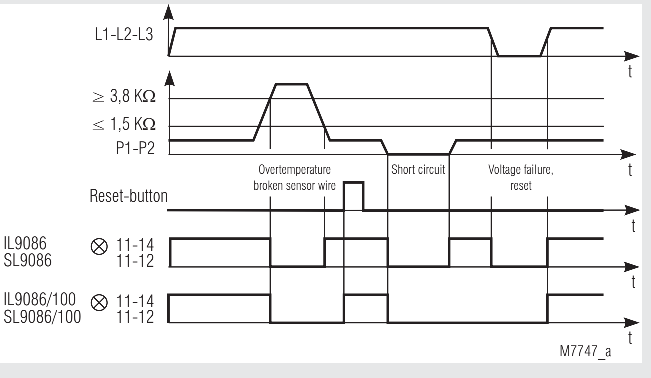
IL 9086 SL 9086

- According to IEC/EN 60 255-1, IEC/EN 60 947-8 (pr EN 60 947-8) and part 303
- Monitoring of
  - Undervoltage 3 phase
  - Phase failure
  - Phase sequence
  - Loss of neutral
  - Phase asymmetry
  - Overtemperature
  - Broken wire in thermistor circuit
  - Short circuit in thermistor circuit
- Without auxiliary supply
- 1 sensing input for 1 ... 6 thermistors
- LED indication
  - Supply voltage
  - Measuring voltage
  - Temperature
- As option with manual reset on temperature fault
- 2 x 1 changeover contact
- **Devices available in 2 enclosure versions:**
  IL 9086: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9086: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

Function Diagrams



Voltage



Temperature

Approvals and Markings

CE

Applications

Monitoring of 3-phase Motor systems with temperature sensing of the Motor thermistors, e.g. for elevators.

Function

When the voltage of the system and the temperature of the load is correct all three LED are on. The device has 2 separate relay outputs. If a temperature fault is detected relay 1 trips (deenergises on fault). If a voltage fault occurs relay 2 trips. The unit can be used for 3p 3w and 3p 4w systems. If connected to a 3 wire system the N-terminal remains unconnected.

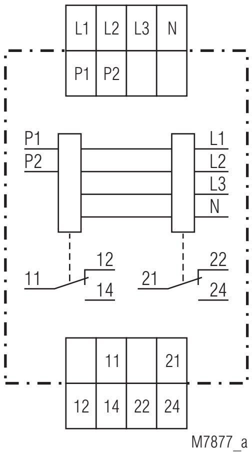
Indicators

Left green LED:	on when supply connected
Right green LED:	on when measured voltage is correct
Middle green LED ϑ:	on when temperature correct

Notes

A short circuit between P1 - P2, i. e. between the senor lines, will be detected. This is independent of the numer of sensors. If more then one thermistors are connected in series, a short circuit across one sensor cannot be detected. The PTC input is galvanically separated from the supply and measuring voltage as well as from the output contacts.

Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
L1, L2, L3, N	Measuring- or supply input
P1, P2	Thermistor input
11, 12, 14; 21, 22, 24	Changeover contacs

Technical Data

Measuring Input Voltage

Measuring voltage		
L1 / L2 / L3 / N:	3 / N AC 400 / 230 V (other voltages on request)	
Voltage range:	0.8 ... 1.1 U_N	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Undervoltage detection:	approx. 0.7 ± 0.15 x U_N	
Asymmetry detection:	approx. 20° angle asymmetrie	
Hysteresis:	≤ 6 % x U_N	
Response delay:	100 ... 300 ms	
Operate delay:	15 ... 30 ms (0V ⇒ U_N)	

Measuring Input Thermistor (P1,P2)

Temperature sensor:	PTC-sensor acc. to DIN 44 081/082
Number of sensors:	1 ... 6 piece in series
Response value:	3.2 ... 3.8 kΩ
Reset value:	1.5 ... 1.8 kΩ
Short circuit in sensor line:	10 ... 30 Ω
Load on sensor circuit:	< 5 mW (at R = 1.5 kΩ)
Broken sensor circuit:	> 3.8 kΩ
Measuring voltage:	≤ 2 V (at R = 1.5 kΩ)
Measuring current:	≤ 1 mA (at R = 1.5 kΩ)
Voltage on P1,P2 on open sensor circuit:	approx. DC 12 V
Short circuit current on sensor circuit:	approx. DC 1.5 mA

Relay Output

Contacts		
IL/SL 9086.38:	1 changeover contact (phase failure, contact 21-22-24) 1 changeover contact (temperature fault, contact 11-12-14)	
Contact material:	AgNi 0.15 + 0.3 µm AU	
Thermal current I_{th}:	2 x 4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life:		
to AC 15 at 1 A, AC 230 V:	6 x 10^5 switching cycles	IEC/EN 60 947-5-1
Switching voltage:	min. 10 V ; max. DC 120 V / AC 250 V	
Switching current:	min. 0.1 A ; max. 5 A	
Switching load:	min. 1 W, 1 VA; max. 120 W, 1250 VA	
Short circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60947-5-1
Mechanical life:	> 10^8 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Altitude:	< 2.000 m	
Input current		
L1:	approx. 7 mA	
L2:	approx. 7 mA	
L3:	approx. 1.5 mA	
Nominal consumption:	approx. 3.5 VA	
Clearance and creepage distances		
Rated impulse voltage / pollution degree		
Input/Output:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Wire connection		
max. cross section:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Stripping lentgh:	10 mm	
Fixing torque:	0,8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9086:	185 g	
SL 9086:	230 g	

Dimensions

Width x height x depth	
IL 9086:	35 x 90 x 59 mm
SL 9086:	35 x 90 x 98 mm

Standard Type

IL 9086.38   3 AC 400 V and 3 / N AC 400 / 230 V

Article number:	0053087
• Output:	1 changeover contact (phase failure) 1 changeover contact (temperature fault)
• Nominal voltage U_N:	3 AC 400 V and 3 / N AC 400 / 230 V
• Width:	35 mm

SL 9086.38   3 AC 400 V and 3 / N AC 400 / 230 V

Article number:	0054751
• Output:	1 changeover contact (phase failure) 1 changeover contact (temperature fault)
• Nominal voltage U_N:	3 AC 400 V and 3 / N AC 400 / 230 V
• Width:	35 mm

Variant

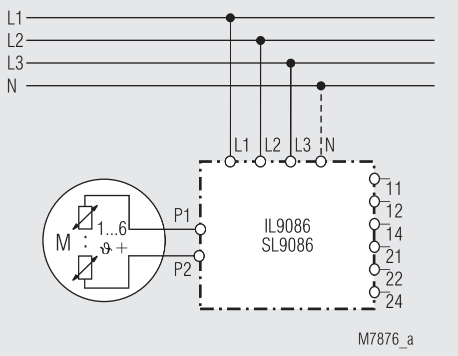
IL 9086.38/100	with manual reset after detection of overtemperature or short circuit in the sensor circuit. The output can be reset by pressing the reset button or by disconnecting the voltage for a short period after the temperature returned to good value.

Ordering example vor variant

IL 9086   .38   /_ 00 3/N AC 400/230 V   50/60 Hz

- Nominal frequency
- Measuring voltage
- 1 with manual reset
- Contacts
  1 changeover contacts
  phase failure
  1 changeover contact
  temperature fault
- Type

Connection Examples



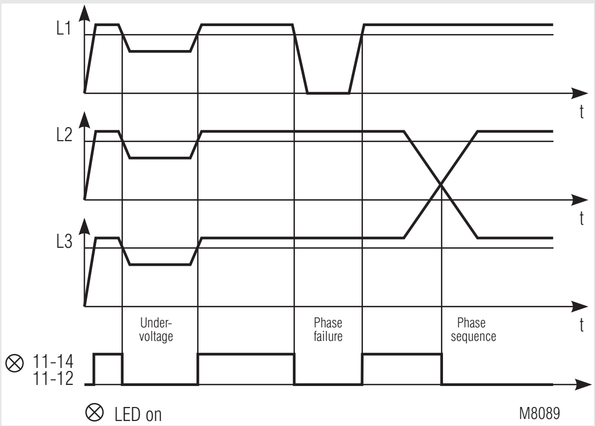
VARIMETER PRO
Phase Monitor
IL 9087, SL 9087

0237783

IL 9087 SL 9087

- According to IEC/EN 60 255-1
- Monitoring of phase failure
  - Undervoltage 3-phase 3 or 4 wire
  - Phase failure
  - Phase sequence
  - Loss of neutral
  - Phase asymmetry
- Without auxiliary supply
- De-energized on trip
- LED indication
  - Supply voltage
  - Phase failure
- 1 or 2 changeover contacts
- Devices available in 2 enclosure versions:
  IL 9087: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9087: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

Function Diagram



Voltage

Approvals and Markings

CE

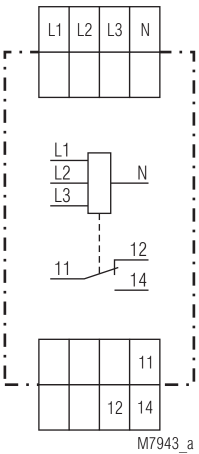
Applications

Monitoring of 3-phase systems with motors, e. g. for elevators.

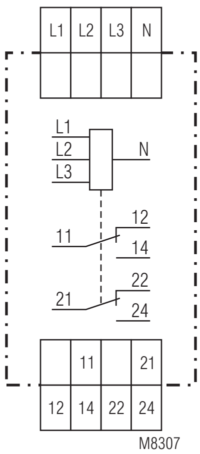
Function

On a healthy voltage system both LEDs are on. If a voltage failure occurs the contact 11-14, 21-24 opens. In 3-phase voltage systems with unbalanced load the unit can also detect the loss of neutral on the input line of the system. If a neutral is not used the N-terminal remains unconnected.

Circuit Diagrams



IL 9087.11,
SL 9087.11



IL 9087.12,
SL 9087.12

Indicators

left green LED: on when voltage connected
right green LED: on when measuring voltage correct

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3, N	Measuring- or supply input
11, 12, 14; 21, 22, 24	Changeover contacs

Technical Data

Input

Nominal voltage U_N:	3 / N AC 400 / 230 V (other voltages on request)	
Voltage range:	0.8 ... 1.1 U_N	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Undervoltage detection:	approx. 0.7 ± 0.15 x U_N	
Asymmetry detection:	approx. 20° phase asymmetry	
Hysteresis:	≤ 6 % x U_N	
Response delay:	100 ... 300 ms	
Operate delay:	15 ... 30 ms (0V ⇒ U_N)	

Output

Contacts		
IL/SL 9087.11:	1 changeover contact	
IL/SL 9087.12:	2 changeover contacts	
Contact material:	AgNi 0.15 + 0.3 µm AU	
Thermal current I_{th}:	2 x 4 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life:		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	6 x 10^5 switching cycles	
Switching voltage:	min. 10 V ; max. DC 120 V / AC 250 V	
Switching current:	min. 0.1 A ; max. 5 A	
Switching capacity:	min. 1 W, 1 VA; max. 120 W, 1250 VA	
Short circuit strength		
max. fuse rating:	4 A gG / gL	IEC/EN 60947-5-1
Mechanical life:	> 10^8 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Altitude:	< 2.000 m	
Input current		
L1:	approx. 7 mA	
L2:	approx. 7 mA	
L3:	approx. 1.5 mA	
Nominal consumption:	approx. 3.5 VA	
Clearance and creepage distances		
Rated impulse voltage / pollution degree		
Input/Output:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL Subj. 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Wire connection		
max. cross section:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Stripping lentgh:	10 mm	
Fixing torque:	0,8 Nm	

Technical Data

Mounting:	DIN-rail	IEC/EN 60 715
Weight		
IL 9087:	185 g	
SL 9087:	230 g	

Dimensions

Width x height x depth	
IL 9087:	35 x 90 x 59 mm
SL 9087:	35 x 90 x 98 mm

Classification to DIN EN 50155 for SL 9087

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Types

IL 9087.12 3 AC 400 V and 3 / N AC 400 / 230 V
Article number: 0054502
- Output: 2 changeover contacts
- Nominal voltage U_N: 3 AC 400 V and 3 / N AC 400 / 230 V
- Width: 35 mm

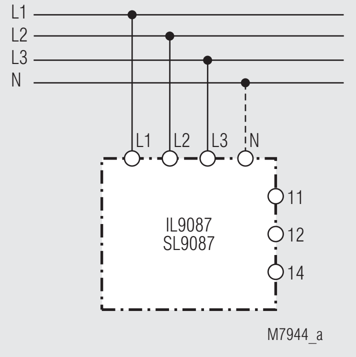
SL 9087.12 3 AC 400 V and 3 / N AC 400 / 230 V
Article number:
- Output: 2 changeover contacts
- Nominal voltage U_N: 3 AC 400 V and 3 / N AC 400 / 230 V
- Width: 35 mm

Ordering Example

IL 9087 .11 3/N AC 400 / 230 V 50 / 60 Hz

- 50 / 60 Hz: Nominal frequency
- 3/N AC 400 / 230 V: Measuring voltage
- .11: Contacts
- IL 9087: Type

Connection Examples



VARIMETER PRO
Over- and Undervoltage Relay
IL 9077, IP 9077, SL 9077, SP 9077

0222093

- According to IEC/EN 60 255-1
- Identification of overvoltage, undervoltage and phase failure
- With asymmetry identification as an option
- Mains fault diagnostics with a number of LEDs
- Setting values for overvoltage and undervoltage can be set separately
- Large Setting Ranges 0.9 ... 1.3 U_N and 0.7 ... 1.1 U_N
- Time delay variable between 0.1 ... 20 s
- Closed circuit operation
- No auxiliary voltage
- Independant of phase sequence
- As option with phase sequence detection
- Single-phase connection possible
- Optionally for 3P3W Systems
- 2 changeover contacts, at IP/SP 9077 2 x 2 changeover contacts
- Devices available in 2 enclosure versions:
  I-model: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  S-model: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- IL 9077, SL 9077: width 35 mm
  IP 9077, SP 9077: width 70 mm

Approvals and Markings

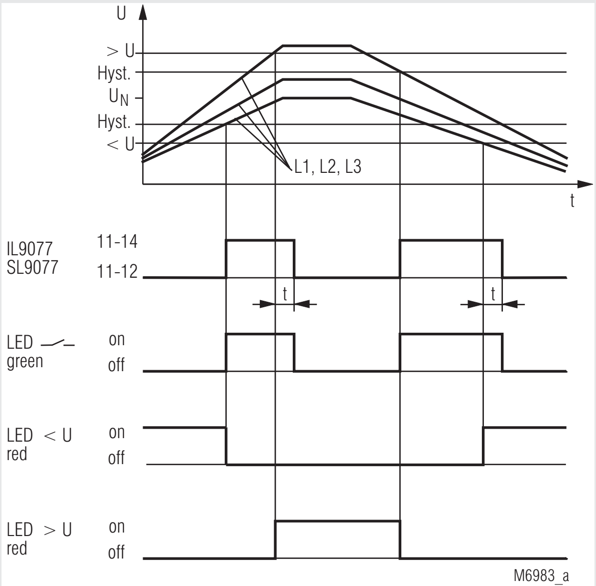
A025518 *)

*) only IL 9077

Applications

Monitoring of three-phase voltage systems to identify overvoltage and undervoltage, e.g. to monitor in-house generation equipment in accordance with VDE 0100.

Function Diagram IL 9077

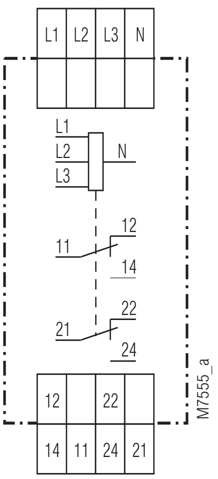


Function

All 3 phase voltages are measured with N (L1 and L2 are measured against L3 in the case of equipment without an N connection). If they are in the acceptable range, a green LED goes on and the output relay is activated. If at least one phase exceeds the setting value for overvoltage (variable between 0.9 ... 1.3 U_N) or if at least one phase falls short of the setting value for undervoltage (variable between 0.7 ... 1.1 U_N), the output relay releases after the set time delay and the green LED goes off (fault state). 2 red LEDs then indicate the cause of the fault:
- Undervoltage " < U"
- Overvoltage " > U"

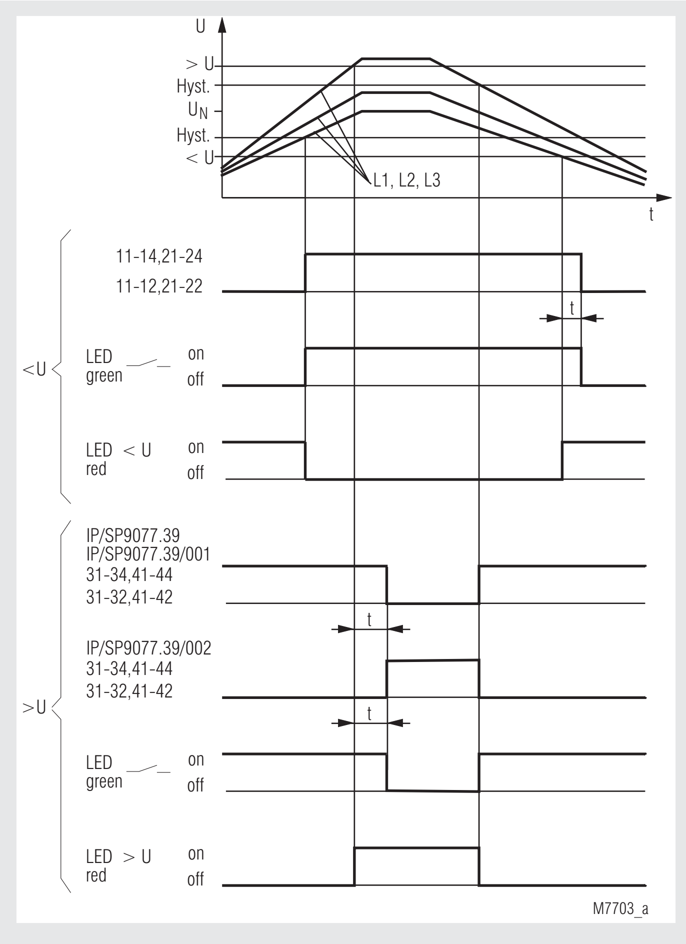
When all 3 phase voltages are below the chosen setting value for overvoltage and above the chosen setting value for undervoltage again, the relevant red LED goes out, the output relay is activated again and the green LED goes on again (acceptable state).
When the system returns to an acceptable state, there is a hysteresis of about 4 % of the set value with both the set voltage thresholds.
On the unit with phase sequence detection IL/SL 9077/003 (only available without neutral) the wrong phase sequence is handled like undervoltage: The red LED "<U" is active and the output relay switches off.
The model with asymmetry identification IL/SL 9077/010 monitors the symmetry of the three-phase voltage system as well. When all 3 voltages are in the acceptable range between the two setting values here, but there is voltage asymmetry of more than about 6 ... 8 %, the output relay releases after the set time delay and the LED that is green when the state is acceptable goes red. (This model can, for example, also be used for immediate identification of the regeneration of failed phases by feedback).
The IP/SP 9077.39 is an under- and overvoltage relay with seperate output relays (each with 2 changeover contacts) for undervoltage and overvoltage monitoring. For every output a seperate delay 0.1 ... 20 s is adjustable.

Circuit Diagram

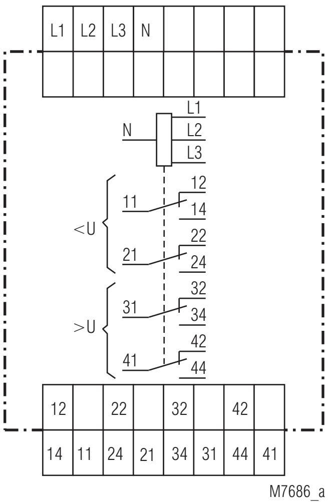


IL 9077.12, SL 9077.12

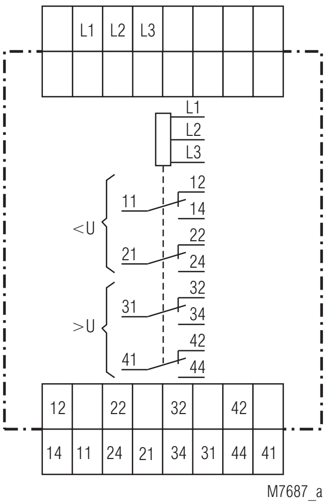
Function Diagram IP 9077



Circuit Diagrams



IP 9077.39, SP 9077.39



IP 9077.39/001, SP 9077.39/001
IP 9077.39/002, SP 9077.39/002

Indicators

green LED ⁄ :	state
green LED goes red:	voltage asymmetry (only IL/SL 9077/010)
red LED " < U":	fault message / undervoltage
red LED " > U":	fault message / overvoltage

Notes

The terminals L1, L2 and L3 have to be bridged if the relay is used in single phase systems. (For 3p3w units L1 and L2 have to be linked).
The maximum fault delay amounts to only about 0.6 s if there is a total failure of phase L3.
The overvoltage output on IP/SP 9077.39/002 can only switch if the voltage between L2 and L3 is > 0.7 U_N as the unit works without auxiliary supply.

Technical Data

Input

Nominal voltage U_N:		
single-phase connection:	AC 100V , 115 V, 220 V, 230 V, AC 400 V, 415 V, 440 V, 500 V	
3-phase without neutral connection::	3AC 100 V, 115 V, 220 V, 230 V, 3AC 400 V, 415 V, 440 V, 480 V, 500 V	
3-phase with neutral connection:	3/N AC 100 V / 58 V; 3/N AC 110 V / 64 V; 3/N AC 200 V / 115 V; 3/N AC 220 V / 127 V; 3/N AC 230 V / 133 V; 3/N AC 400 V / 230 V; 3/N AC 415 V / 240 V; 3/N AC 440 V / 254 V; 3/N AC 480 V / 277 V; 3/N AC 500 V / 290 V	
Voltage range:	0.7 ... 1.3 U_N	
Maximum overload:	1.35 U_N, permanent	
Nominal consumption:	approx. 8 VA (L3-N) (approx. 16 VA for IP 9077)	
Nominal frequency:	50 / 60 Hz	

Setting Ranges

Setting value for overvoltage "> U":	variable between 0.9 ... 1.3 U_N	
Setting value for undervoltage "< U":	variable between 0.7 ... 1.1 U_N	
Hysteresis:	approx. 4 % of the set value in each case	
Time delay:	variable between 0.1 ... 20 s	
Threshold for asymmetry identification		
IL/SL 9077/010:	approx. 6 ... 8 % phase asymmetry	

Output

Contacts		
IL/SL 9077.12:	2 changeover contacts	
IP/SP 9077.39:	2 x 2 changeover contacts	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life:		IEC/EN 60 947- 5-1
to AC 15 at 1 A, AC 230 V:	≥ 1.5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated rated impulse voltage voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	10 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection:	Housing: IP 40	IEC/EN 60 529
	Terminals: IP 20	IEC/EN 60 529
Housing:	Highly non-flammable thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Wire connection:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9077:	110 g	
SL 9077:	137 g	
IP 9077:	210 g	
SP 9077:	259 g	

Dimensions

Width x height x depth

IL 9077:	35 x 90 x 59 mm
SL 9077:	35 x 90 x 98 mm
IP 9077:	70 x 90 x 59 mm
SP 9077:	70 x 90 x 98 mm

Standard Types

IL 9077.12 3/N AC 400 / 230 V 0.1 ... 20 s

Article number: 0045788

- Output: 2 changeover contacts
- Nominal voltage U_N: 3/N AC 400/230 V
- De-energized on trip
- Variable time delay 0.1 ... 20 s
- Width: 35 mm

SL 9077.12 3/N AC 400 / 230 V 0.1 ... 20 s

Article number: 0054758

- Output: 2 changeover contacts
- Nominal voltage U_N: 3/N AC 400/230 V
- De-energized on trip
- Variable time delay 0.1 ... 20 s
- Width: 35 mm

Variants

I_ 9077._ _/001:	3p3w, de-energized on trip
IL 9077.12/003:	3p3w, de-energized on trip with phase sequence detection
IL 9077.12/010:	3p4w, de-energized on trip with asymmetry detection
IL 9077.12/011:	3p3w, de-energized on trip with asymmetry detection
IL 9077.12/800:	with fast respone and high overload at overvoltage. See datasheet IL 9077/800.
IP 9077.39:	3p4w, de-energized on trip
IP 9077.39/002:	3p3w, undervoltage output de-energized on trip, overvoltage output energized on trip

Ordering example for variants

IL 9077 .12 /_ _ _ 3/N AC 400/230 V 50 / 60 Hz 0.1 ... 20 s

- Time delay
- Nominal frequency
- Nominal voltage
- Variant, if required
- Contacts
- Type

VARIMETER
Voltage Relay
RL 9836

DOLD

0273490

Your Advantages
- Preventive maintenance
- For better productivity
- High repeat accuracy
- Wide measuring voltage range
- Easy setting

Features
- According to IEC/EN 60 255-1
- For DC monitoring
- Detection of
  - Overvoltage
  - Untervoltage
  - Voltage range excess in single-phase AC voltage systems
- No separate auxiliary necessary
- Output: 1 changeover contact
- De-energized on trip
- Adjustable switching voltage
- Adjustable hysteresis for reset
- Adjustable switching delay
- Fast fault detection
- Width: 35 mm

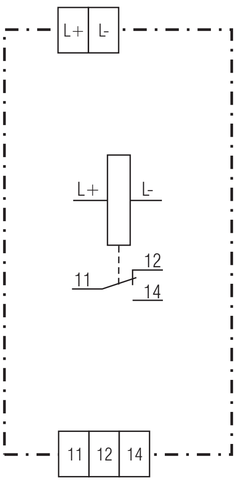
Product Description

The measuring relay RL 9836 of the VARIMETER series monitors overvoltage, undervoltage and voltage range in DC voltage systems. The measurement is very simple and without extensive wiring as there is no auxiliary power supply necessary. The monitoring functions are easily selectable using a single turn switch without complex menu structure. The early detection of up-coming break downs and preventive maintenance avoid expensive damages. As user you profit from the reliability and availability of your plant.

Approvals and Markings

CE c UL US LISTED
Canada / USA

Circuit Diagram



M11433

Application

- For monitoring direct current voltage supply systems to detect undervoltage, overvoltage
- Switch over to emergency supply after fault detection

Function

When monitoring overvoltage, undervoltage and voltage range, the exceeding of the setting values above or below the thresholds is indicated by flashing of the voltage indicating LED. After the time delay the voltage indicating is continuously on and the relay de-energises. If the voltage returns to normal value, the LED goes immediately off and the output relay energises.

The output relay is de-energized on trip.

In the voltage range monitoring mode the nominal voltage range U ± △U is adjustable. An alarm is evoked in case the voltage leaves this monitoring range. The hysteresis for switching back into good condition is half the value set by the potentiometer △U.

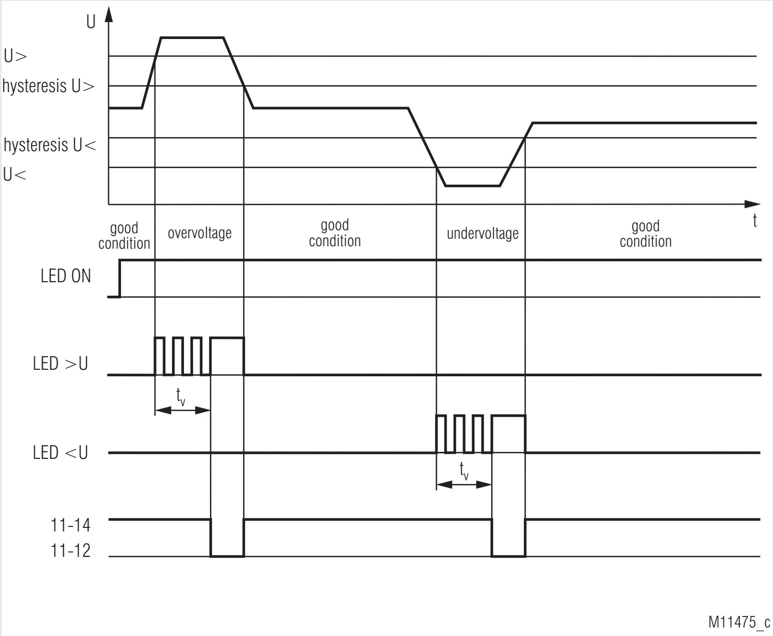
Connection Terminals

Terminal designation	Signal designation
L +	Positiv voltage measuring input
L -	Negative voltage measuring input
11, 12, 14	Changeover contact (outputrelay)

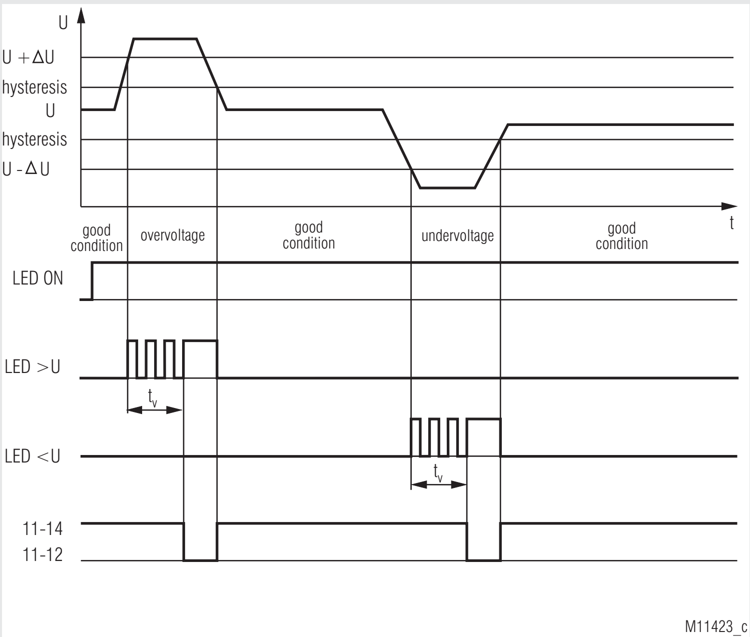
Indicator

green LED „ON“:	on, when supply connected
red LED „>U“:	on, when overvoltage
red LED „<U“:	on, when undervoltage

Function Diagrams



Monitoring function: overvoltage / undervoltage; rotary switch: „U>" / „U<"



Monitoring function: voltage range; rotary switch: „U<> "

Notes

The following monitoring functions are selectable using the 3-step function switch:

Function select	Monitoring function
U>	Overvoltage
U<	Undervoltage
U<>	Voltage range

Technical Data

Input

Operating voltage U_B: DC 24 … 130 V; DC 50 … 250 V
Voltage rated operating U_e: DC 28 … 118 V; DC 59 … 227 V
Nominal consumption: approx. 2 W

Output

Contacts: 1 changeover contact
Contact material: AgNi
Switching voltage: AC 250 V
Thermal current I_{th}: 5 A
Switching capacity
to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V: typ. 3×10^5 switching cycles
Short circuit strength IEC/EN 60 947-5-1
max. fuse rating: 5 A gL
Mechanical life: $> 30 \times 10^6$ switching cyles

Measuring circuit

Measuring voltage: infinite adjustable
DC 24 … 130 V; DC 50 … 250 V
Hysteresis: infinite adjustabler 4 ... 20 %
Switching delay t_v: infinite adjustable
instantaneuos, 2 … 30 s
Repeat accuracy: ± 2 %
Temperature influence: ± 1 %
Attention:
The combination of adjusted switching voltage U and hysteresis △U must be within the measuring range

General Data

Operating mode: continuous operation
Temperature range
Operation: - 20 ... + 55 °C
Storage: - 25 ... + 60 °C
Relative air humidity: 93 % at 40 °C
Altitude: < 2,000 m
Clearance and creepage distances
Rated impuls voltage/
Pollution degree: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF irradiation
80 MHz ... 1 GHz: 12 V / m IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge
between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
HF wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection:
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Enclosure: Thermoplastic with V0 behaviour
acc. to UL subject 94
Vibration resistance: Amplitude 0.35 mm
Class I IEC/EN 60 255-21
Climate resistance: 20 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005

Technical Data

Wire connection: DIN 46 228-1/-2/-3/-4
Fixed screw terminals
Cross section: 0.2 ... 4 mm² (AWG 24 - 12) solid or
0.2 ... 2.5 mm² (AWG 24 - 12)
stranded wire with and without ferrules
Stripping length: 7 mm
Fixing torque: 0.6 Nm EN 60 999-1
Wire fixing: Captive slotted screw / M2.5
Mounting: DIN rail IEC/EN 60 715
Nettogewicht: approx. 105 g

Dimensions

Width x height x depth: 35 x 90 x 71 mm

UL-Data

ANSI/UL 60947-1, 5th Edition
ANSI/UL 60947-5-1, 3rd Edition

CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition
CAN/CSA-C22.2 No. 60947-5-1-14, 1st Edition

Switching capacity: Pilot duty B300
5A 240Vac Resistive, G.P.
5A 30Vdc Resistive or G.P.
5A 250Vac G.P.

Wire connection: 60°C / 75°C copper conductors only
AWG 24 - 12 Sol/Str Torque 0.6 Nm

Technical data that is not stated in the UL-Data, can be found in the technical data section

Standard Type

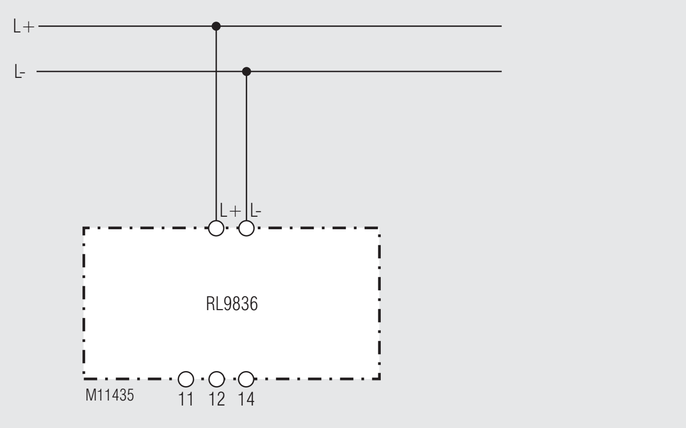
RL 9836.11 DC 50 ... 250 V 4 ... 20 % 0 ... 30 s
Article number: 0066430
- Output: 1 Wechsler
- Operating voltage: DC 50 ... 250 V
- Hysteresis: 4 ... 20 %
- Switching delay: 0 ... 30 s
- Width: 35 mm

Ordering example

RL 9836 .11 /00_ DC 50 ... 250 V 4 ... 20 % 0 ... 30 s

Switching delay
Hysteresis
Operating voltage
DC 50 ... 250 V
DC 24 ... 130 V
Operation mode/Outputs
0: De-Energized on trip
1: Energized on trip
Contacts
Type

Connection Example



Single-phase connection

VARIMETER
Voltage Relay
RL 9854

DOLD

0273496

Your Advantages
- Preventive maintenance
- For better productivity
- High repeat accuracy
- Wide measuring voltage range
- Easy setting

Features
- According to IEC/EN 60 255-1
- For monitoring AC single phase with 50 /60 Hz
- Detection of
  - Overvoltage
  - Undervoltage
  - Voltage range excess in single-phase AC voltage systems
- No separate auxiliary necessary
- Output: changeover contact
- De-Energized on trip
- Adjustable switching voltage
- Adjustable hysteresis for reset
- Adjustable switching delay
- Fast fault detection
- Width: 35 mm

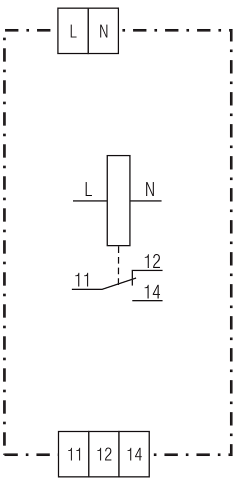
Product Description

The measuring relay RL 9854 of the VARIMETER series monitors over-voltage, undervoltage and voltage range in single-phase systems. The measurement is very simple and without extensive wiring as there is no auxiliary power supply necessary. The monitoring functions are easily selectable using a single turn switch without complex menu structure. The early detection of up-coming break downs and preventive main-tenance avoid expensive damages. As user you profit from the reliability and availability of your plant.

Approvals and Markings

Canada / USA

Circuit Diagram



M11432

Application

- Monitoring of voltage systems to detect over- and undervoltage
- Switch over to emergency supply after fault detection

Function

When monitoring overvoltage, undervoltage and voltage range, the ex-ceeding of the setting values above or below the thresholds is indicated by flashing of the voltage indicating LED. After the time delay the voltage indicating is continuously on and the relay de-energises. If the voltage returns to normal value, the LED goes immediately off and the output relay energises.

The output relay is de-energized on trip.

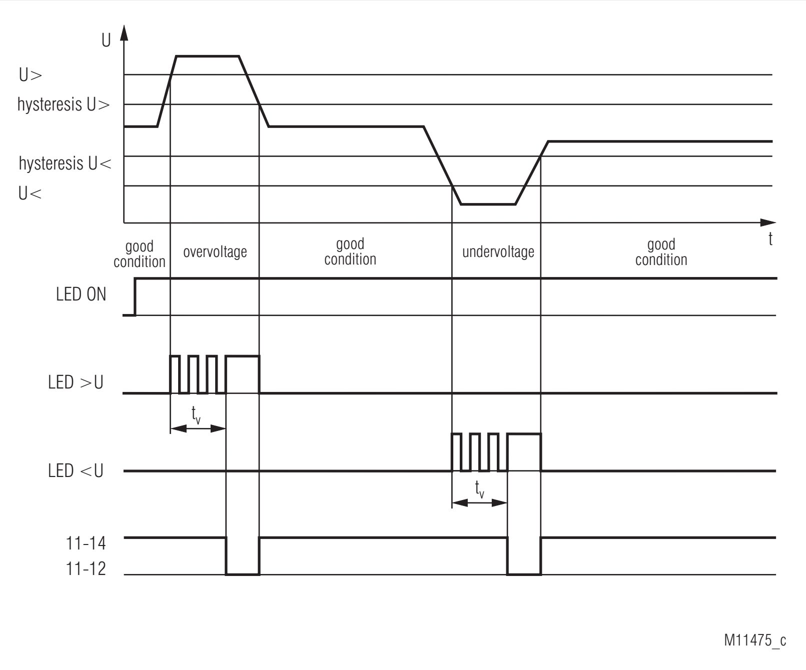
In the voltage range monitoring mode the nominal voltage range U ± △U is adjustable. An alarm is evoked in case the voltage leaves this monitoring range. The hysteresis for switching back into good condition is half the value set by the potentiometer △U.

Connection Terminals

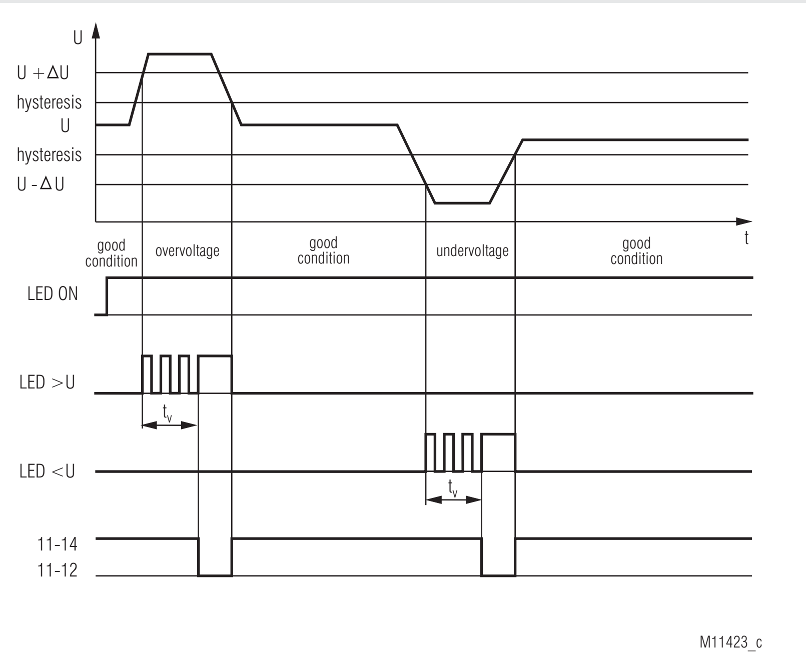
Terminal designation	Signal designation
L	Phase voltage
N	Neutral
11, 12, 14	Changeover contact (outputrelays)

Indicator

green LED „ON“:	on, when supply connected
red LED „>U“:	on, when overvoltage
red LED „<U“:	on, when undervoltage



Monitoring function: overvoltage / undervoltage; rotary switch: „U>“ / „U<“



Monitoring function: voltage range; rotary switch: „U<> “

Notes

During initialisation the relay recognises the mains frequency (50 Hz or 60 Hz).

The following monitoring functions are selectable using the 3-step function switch:

Function select	Monitoring function
U>	Overvoltage
U<	Undervoltage
U<>	Voltage range

Technical Data

Input

Operating voltage U_B:	AC 100 ... 300 V, AC 45 ... 135 V single-phase with neutral	
Voltage rated operating U_e:	AC 118 ... 273 V, AC 53 ... 123 V	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 … 65 Hz	
Nominal consumption:	approx. 7 VA	

Output

Contact:	1 changeover contact	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	5 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A, AC 230 V:	typ. 3 x 10^5 switching cyles	
Short circuit strength		IEC/EN 60 947-5-1
max. fuse rating:	5 A gL	
Mechanical life:	> 30 x 10^6 switching cyles	

Measuring circuit

Measuring voltage:	infinite adjustable AC 100 ... 300 V, AC 45 ... 135 V	
Hysteresis:	infinite adjustable 4 ... 20 %	
Switching delay t_v:	infinite adjustable instantaneuos, 2 … 30 s	
Release delay:	10 s	
Repeat accuracy:	± 2 %	
Temperature influence:	± 1 %	

Attention:
The combination of adjusted switching voltage U and hysteresis △U must be within the measuring range.

General Data

Operating mode:	continuous operation	
Temperature range		
Operation:	- 20 ... + 55 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
Rated impuls voltage/ Pollution degree:	6 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	12 V / m	IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Enclosure:	Thermoplastic with V0 behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Class I	IEC/EN 60 255-21
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		DIN 46 228-1/-2/-3/-4
Fixed screw terminals		
Cross section:	0.2 ... 4 mm² (AWG 24 - 12) solid or 0.2 ... 2.5 mm² (AWG 24 - 12) stranded wire with and without ferrules	
Stripping length:	7 mm	
Fixing torque:	0.6 Nm	EN 60 999-1
Wire fixing:	Captive slotted screw / M2.5	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 105 g	

Dimensions

Width x height x depth: 35 x 90 x 71 mm

UL-Data

ANSI/UL 60947-1, 5th Edition
ANSI/UL 60947-5-1, 3rd Edition

CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition
CAN/CSA-C22.2 No. 60947-5-1-14, 1st Edition

Switching capacity:	Pilot duty B300 5A 240Vac Resistive, G.P. 5A 30Vdc Resistive or G.P. 5A 250Vac G.P.
Wire connection:	60°C / 75°C copper conductors only AWG 24 - 12 Sol/Str Torque 0.6 Nm

Technical data that is not stated in the UL-Data, can be found in the technical data section

Standard Type

RL 9854.11 AC 100 ... 300 V 4 ... 20 % 0 ... 30 s
Article number: 0066429

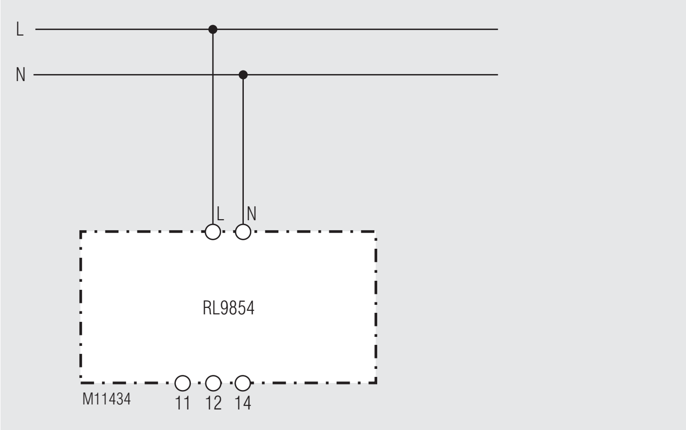
- Output: 1 changeover contact
- Measuring voltage: AC 100 ... 300 V
- Hysteresis: 4 ... 20 %
- Switching delay: 0 ... 30 s
- Width: 35 mm

Ordering Example

RL 9854 .11 /00_ AC 100 ... 300 V 4 ... 20 % 0 ... 30 s

- 0 ... 30 s: Switching delay
- 4 ... 20 %: Hysteresis
- AC 100 ... 300 V: Operating voltage
  - AC 100 ... 300 V
  - AC 45 ... 135 V
- /00_: Operation mode/Outputs
  - 0: De-Energized on trip
  - 1: Energized on trip
- .11: Contacts
- RL 9854: Type

Connection Example



Single-phase connection

VARIMETER
Voltage relay
MK 9064N, MH 9064

DOLD

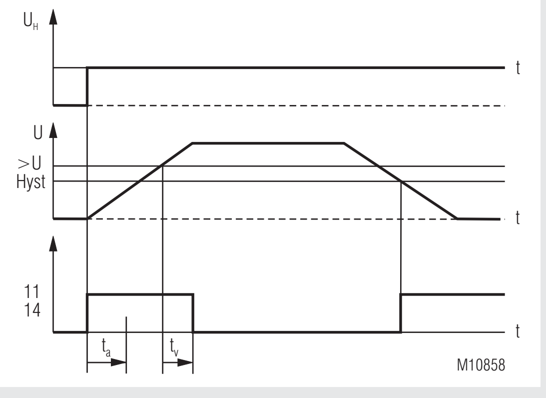
0269462

MK 9064N MH 9064

Your Advantages
- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable
- Min-, Max. value or window monitoring
- Monitoring of AC/DC 0.2 ... 600 V
- Large measuring ranges
- Simple configuration and fault diagnostic
- Auxiliary voltage ranges DC 24 V, AC 230 V or AC/DC 110 ... 400 V
- Space and cost saving

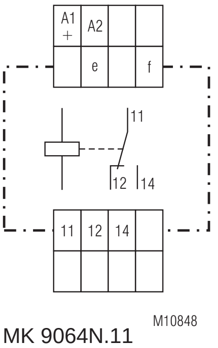
Features
- AC/DC voltage measuring (single-phase)
- Start up delay, on delay
- Manual reset
- LCD for indication of the measuring values
- Relay output
  MK 9064N: 1 changeover contact
  MH 9064: 2 x 1 changeover contacts
- Relay function selectable (energized/de-energized on trip)
- As option with plugable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- With RS485 (on request)
- Width MK 9064N: 22.5 mm
- Width MH 9064: 45.0 mm

Function Diagram

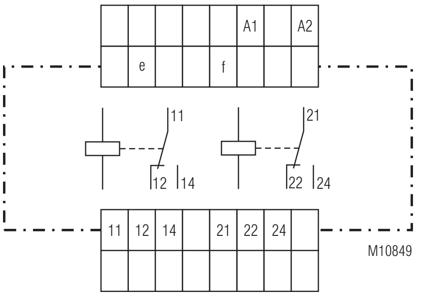


Example: overvoltage monitoring with closed circuit operation

Circuit Diagrams



MK 9064N.11



MH 9064.12

More Information

- **MH 9064**
  The MH 9064 has 2 relay outputs.
  The voltage monitoring can be assigned ro relay 1 and /or relay 2

Approvals and Markings

CE

Applications

- Voltage monitoring AC/DC single-phase
- Voltage dependent switching at under- or overvoltage

Function

The Device is programmable for AC- or DC- measuring.
On AC-measurement the rectified mean value is measured.
On sinusoidal input signals the RMS value is displayed.

After connecting the auxiliary supply to terminals A1-A2 the startup delay disables the monitoring function so that changes on the input have no influence on the relay output of the VARIMETER.
The device is in display (RUN) mode and continuously measures the actual values. Pressing Esc for more than 3 sec starts the input mode.

If the setting value is exceeded the relay switches and the display indicates this state. The display is inverted, flashes and shows the error.

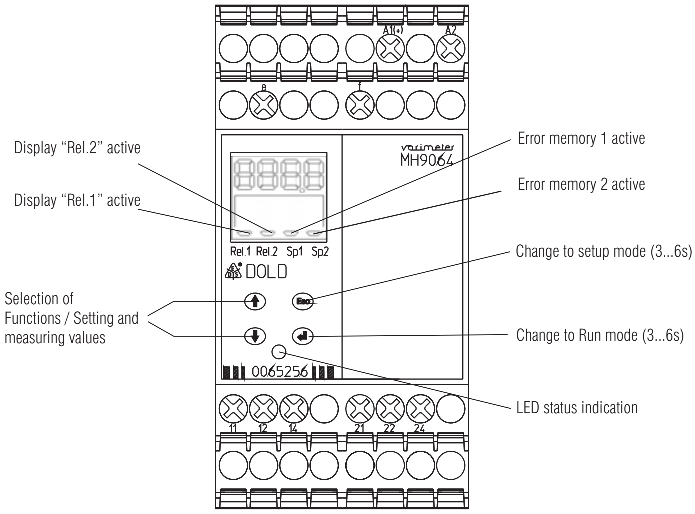
The fault memory is selectable
With button the fault memory can be deleted.

On the unit MH 9064it is possible to assign different functions to the different relays so one can be used as pre-warning and the other as alarm output. Relay output 1 switches when actual value exceeds the pre-warning setting. If a second setting assigned to relay output 2 the unit gives an Alarm signal.

Remarks

The unit needs a connected auxiliary supply.
It is designed for single phase AC/DC measurement.

Setting



M11095

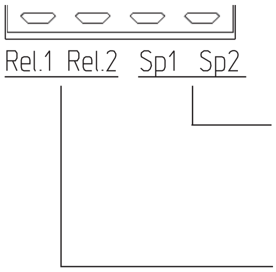
Indication

The LED indicate the state.

green:	on, when auxiliary voltage present
orange (flashes):	No measurement; unit in input mode
red (short On, short Off):	Failure overvoltage

If the measured value is higher then the upper end of scale value, the display shows the fault message "OL"

Cursor LCD Display



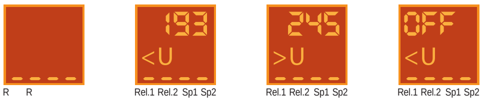
Active manual reset
Manual reset activated: flashes when memory mode is ON and relay in failure state.
Reset with button " "

Contact state of the output relays

Operating

Display (Run) - Mode	Input-Mode
UP / DOWN	
After power up the relay is in display (Run) mode. buttons have no function	The measurement is interrupted, the relays are in failure state and the indicator LED has orange color Selection of parameters and setting of thresholds
ENTER	
Manual reset, when manual reset is selected for output relay Reset works only when fault is removed	- Shifts cursor to the right - Saves the value no-voltage safe - Pressing for more than 3 sec: Change to display (Run) mode.
Esc **Esc**	
- Pressing for more than 3 sec: Change to input mode	- Shifts cursor to the left - Leave setting without saving

LCD-Display



Setting Parameter

< U Fault, when value drops under set point
> U Fault, when value exceeds set point
OFF Measurement disabled

If the adjusted threshold of at least one measuring function is exceeded, the corresponding relay output switches after the selected time delay tv and the fault is indicated on the display.

Manual reset can be activated or de-activated and is operated with on the unit.

Adjustable Parameter

Limit values for Rel.1 and Rel.2 Selectable with buttons .		Factory setting
<U:	Response value undervoltage (Undervoltage relay)	OFF
>U:	Response value overvoltage,, (Overvoltage relay)	*
Hyst:	response value hysteresis	5 %
t_v:	On delay for relays (0 ... 10 sec)	0 s
A / R:	Seting open- / closed circuit operation	R
Sp:	Error storage (ON / OFF)	OFF

Response values can be deactivated. (OFF)
*) dependent to device-variant (measuring range)

Further Setting Parameter

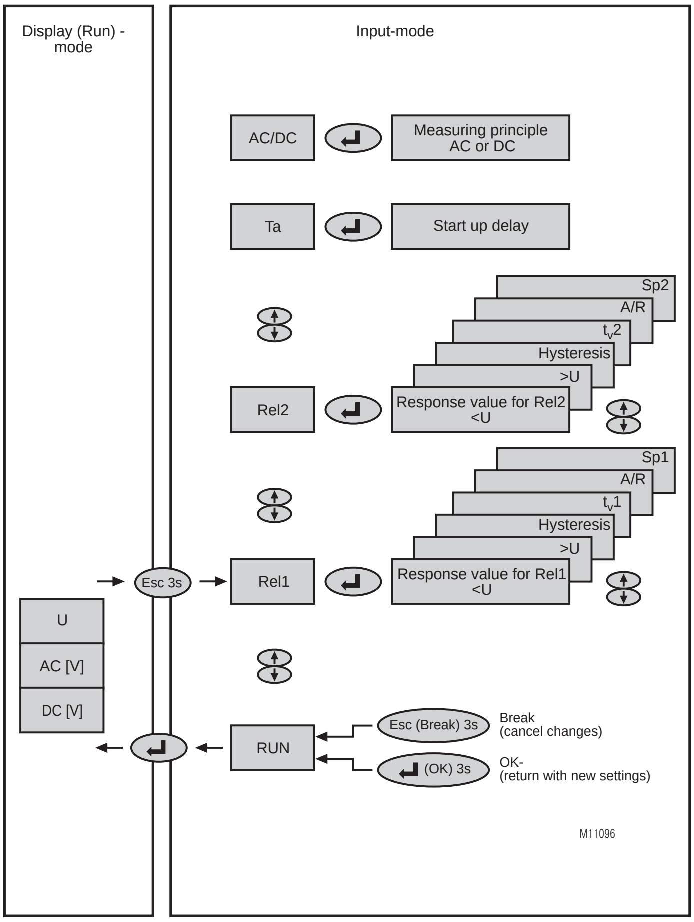
Selectable with buttons .		Factory setting
t_a:	Start up delay, when auxiliary voltage connected (0.2 ... 10 s)	0,2 s
AC/DC	Measuring voltage AC or DC	AC

Restore Factory Settings

(Restore factory settings)
Before auxiliary voltage connected press button Esc .
During start press and hold.

Indicator output

The switching mode energized or de-energized on trip can be set in input mode. The MH 9064 has 2 relay outputs. Monitoring function can be assigned to Relay 1 and/or to Relay 2.



After connecting the auxiliary supply A1/A2 the unit is in display (Run) mode**:**

The actual measured value is displayed continuously (AC or DC)
The display is inverted when a measured value is exceeds the settings..

With button ↵ the fault memory is reset.

Pressing button Esc for more than 3 sec the unit changes to input mode.

In input mode the measurement is disabled, the relays are in failure mode and the indicator LED is orange.

With the buttons ↑ ↓ the different setting values can be chosen.

Move cursor position

↵ One character to the right

Esc One character to the left

Back to the Display (Run)-Mode

Press button ↵ 3 s OK New values stored

or

Press button Esc 3 s; Break Values unchanged

R on the display confirm with ↵ to change to display (Run) mode.

Display (Run) - Modus	Input-Mode
Display inverted when the actual value is in failure state.	Measurement interrupted, relays are in failure state, indicator LED orange color
↑ ↓ no function	↑ ↓ Chose Rel1, Rel2, T_a , AC/DC and RUN As option address for RS485 Bus ↑ ↓ Chose parameter Change and set response values for Rel1 and Rel2.
Reset fault memory: ↵	Esc Shift cursor to the left ↵ Shift cursor to the right
Esc For more the 3 sec, change to input mode	↵ For more than 3 sec, change to display mode

Technical Data

Auxiliary voltage A1/A2

Nominal auxiliary voltage U_H

MK 9064N:	DC 24 V	(0.9 ... 1.1 x U_H)
MH 9064:	AC 230 V	(0.8 ... 1.1 x U_H)
	AC/DC 110 ... 400 V	(0.8 ... 1.1 x U_H)
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 400 Hz	
Input current		
at DC 24 V:	50 mA	
at AC 230 V:	15 mA	

Voltage Measuring Input L+/L

MK 9064N:	
Nominal voltage:	AC/DC 300 V, AC/DC 5 V
Measuring range U_M:	AC/DC 12 ... 300 V, AC/DC 0.2 ... 5 V (0.8 ... 1.1 x U_M)
MH 9064:	
Nominal voltage:	AC/DC 600 V
Measuring range U_M:	AC/DC 24 ... 600 V (0.8 ... 1.1 x U_M)
Nominal frequency:	50 / 60 Hz
Frequency range:	AC 10 ... 400 Hz

Setting Range (absolute, via button and LCD-display)

Measuring accuracy at nominal frequency (in % of setting value):	± 2 % ± 2 Digit
Hysteresis (in % of setting value):	2 ... 50 %
Reaction time:	< 150 ms
Adjustable on delay (t_v):	0 ... 10 s
Adjustable start up delay (t_a):	0.2 ... 10 s

Output Circuit (Rel1: 11/12/14; Rel2: 21/22/24)

Contacts:		
MK 9064N:	1 changeover contact	
MH 9064:	1 changeover contact (Rel1) and 1 changeover contact (Rel2)	
Thermal current I_{th}:	2 x 4 A	
Switching capacity		
to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 3 A, AC 230 V:	2 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Permissible switching frequency:	1800 / h	
Short circuit strength		
Max. fuse rating:	4 A glDIN VDE 0660	
Mechanical life:	30 x 10^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Temperature range:	- 20... + 60°C (at range 0 ... - 20°C limited function of the LCD display)	
Clearance and creepage distance		
rated impulse voltage / pollution degree:	4 kV / 2	
high voltage test:	IEC/EN 60 664-1	
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage:	5 kV / 0.5J	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A	EN 61 000-6-4
Degree of protection		
Housing:	IP 40	DIN EN 60 529
Terminals:	IP 20	DIN EN 60 529
Housing:	thermoplastic with VO behaviour according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	

Technical Data

Climate resistance:	20 / 060 / 04	EN 60 068-1
Wire connection	DIN 46 228-1/-2/-3/-4	
Screw terminal (fixed):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Terminal block with screw terminals		
Max. cross section:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Terminal block with cage clamp terminals		
Max. cross section:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Min. cross section:	0.5 mm²	
Insulation of wires or sleeve length:	$12^{\pm 0.5}$ mm	
Wire fixing:	Plus-minus terminal screws M3,5 box terminals with wire protection or cage clamp terminals	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	EN 60 715
Weight:		
MK 9064N:	approx. 140 g	
MH 9064:	approx. 250 g	

Dimensions

Width x height x depth:	
MK 9064N:	22.5 x 90 x 99 mm
MH 9064:	45 x 90 x 99 mm

Standard Types

MK 9064N.11 AC/DC 12 ... 300 V DC 24 V

Article number:	0065254
• Measuring range:	AC/DC 12 ... 300 V
• Auxiliary voltage U_H:	DC 24 V
• Output:	1 changeover contact
• Width:	22.5 mm

MH 9064.12 AC/DC 24 ... 600 V AC/DC 110 ... 400 V

Article number:	0065256
• Measuring range:	AC/DC 24 ... 600 V
• Auxiliary voltage U_H:	AC/DC 110 ... 400 V
• Output:	1 changeover contact (Rel1) and 1 changeover contact (Rel2)
• Width:	45 mm

Ordering Example

MK 9064N .11 _ _ AC/DC 12 ... 300 V DC 24 V

- Auxiliary voltage U_H
- Measuring range U_M
- Type of terminals
  - without indication: terminal blocks fixed with screw terminals
  - PC (plug in cage clamp): pluggableterminalblocks withcageclampterminals
  - PS (plug in screw): pluggableterminalblocks with screw terminals
- Contacts
- Type

Options with Pluggable Terminal Blocks

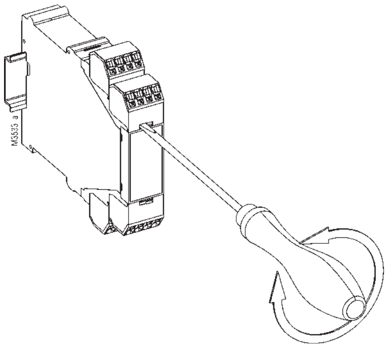
Screw terminal
(PS/plugin screw)

Cage clamp terminal
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Safety notes

Dangerous voltage.
Electric shock will result in death or serious injury.

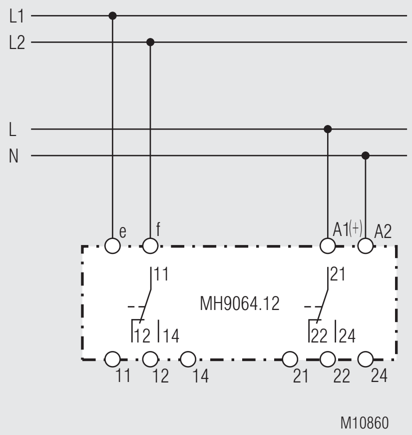
Disconnect all power supplies before servicing equipment.

- Faults must only be removed when the relay is disconnected
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety).
- Settings must only be changed by trained staff taking into account the safety regulations. Installation work must only be done when power is disconnected.
- Observe proper grounding of all components

Set Up Procedure

The connection has to be made according to the connection example.

Connection Example



VARIMETER
Voltage Relay
BA 9054, MK 9054N

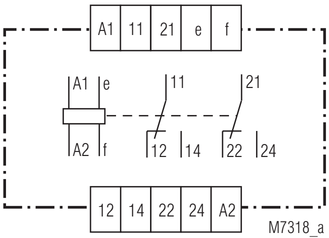
DOLD

0221541

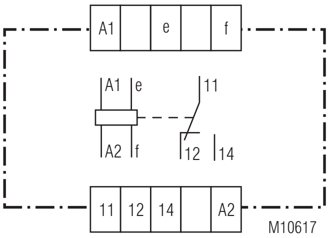
BA 9054

MK 9054N

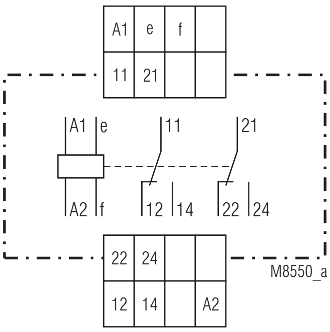
Circuit Diagrams



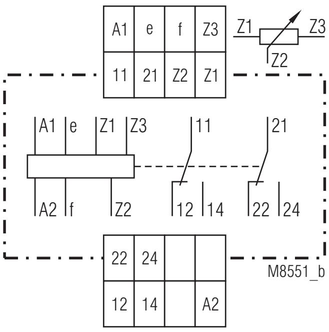
BA 9054



BA 9054/_ 2 _



MK 9054N



MK 9054N/1_ _

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
e, f	Voltage measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact
at MK 9054/1_ _: Z1, Z2, Z3	remote potentiometer for response value

Safety Notes

Please observe when connecting a remote potentiometer to MK 9054N/1_ _:

WARNING

Measuring circuit and remote potentiometer not galvanically separated. The remote potentiometer on terminals Z1, Z2, Z3 is related to terminal "e". Therefore "e" should be connected to "N", "-" or GND, so that the remote potentiometer is not connected to the Phase voltage. The remote potentiometer has to be connected volt- and ground-free.

Your Advantages

- Protection against defect by overvoltage
- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable

Features

- According to IEC/EN 60255-1, IEC/EN 60947-1
- to: monitor DC and AC
- BA 9054 with measuring ranges from 15 mV to 1000 V
- MK 9054N with measuring ranges from 15 mV to 500 V
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between Auxiliary Circuit – measuring ciruit
- Auxiliary supply AC/DC; BA 9054 with AC
- BA 9054 optionally with start-up delay (MK = standard)
- with time delay, up to max. 100 sec
- BA 9054 optionally with safe separation to IEC/EN 61140
- MK 9054N optionally with remote potentiometer
- As option with manual reset
- Option withfixed settings possible
- LED indicators for operation and contact position
- MK 9054N as option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width BA 9054: 45 mm
  Width MK 9054N: 22.5 mm

Approvals and Markings

CE | c UL us Canada / USA * | CCC A025518

* see variants

Applications

- Monitoring voltage in AC or DC systems
- For industrial and railway applications

Function

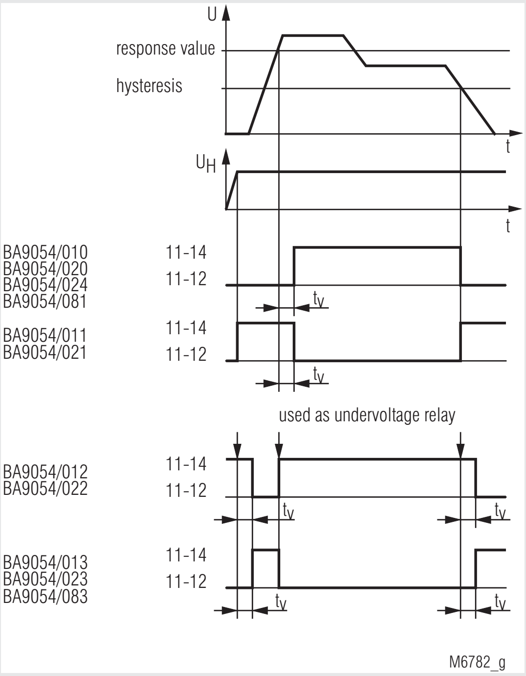
The relays measure the arithmetic mean value of the rectified measuring voltage. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overvoltage relays but can also be used for undervoltage detection. The hysteresis is dependent on the response value.

2 time delays are possible in different variants:
The start up delay t_a operates only when connecting the auxiliary supply. The response delay t_v is active after exceeding a response value. On overvoltage relays the delay is active when the voltage goes over the tripping value, on undervoltage relays when the voltage drops below the hysteresis value.

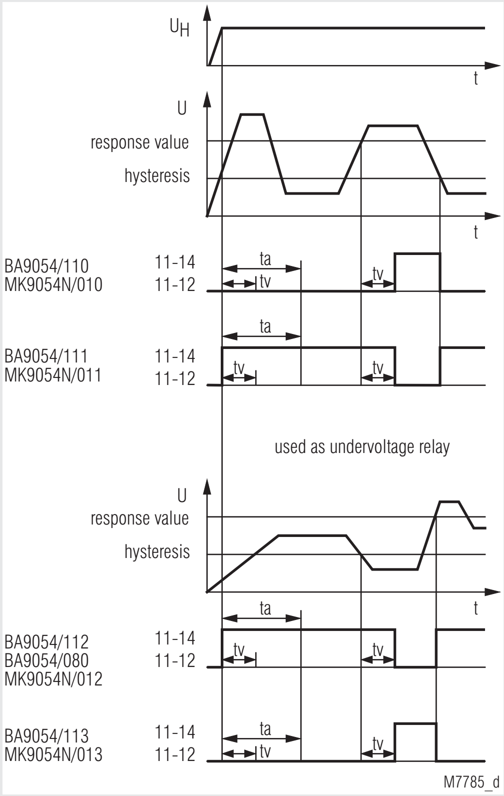
Indicators

green upper LED:	on, when auxiliary supply connected
yellow lower LED:	on, when output relay acitvated

Function Diagram without Start-up Delay



Function Diagram with Start-up Delay



Version BA 9054/_1_: 2 changeover contacts
Version BA 9054/_20, /_21, /_22, /_23, /_24: 1 changeover contact, measuring range ≥ 70 ... 700 V
At version BA 9054/6__ with manual reset the contacts remain in the fault state after detecting a fault or after to has elapsed. The contacts are reset by disconnecting the supply voltage.

Technical Data

Input (e, f)

BA 9054 with 1 Measuring range for AC **a n d** DC			
Measuring range[1]		internal resistance	max. permissible contin. voltage
AC	DC		
6 ... 60 mV	5.4 ... 54 mV	20 kΩ	10 V
15 ... 150 mV	13.5 ... 135 mV	40 kΩ	100 V
50 ... 500 mV	45 ... 450 mV	270 kΩ	250 V
0.5 ... 5 V	0.45 ... 4.5 V	500 kΩ	300 V
1 ... 10 V	0.9 ... 9.0 V	1 MΩ	300 V
5 ... 50 V	4.5 ... 45 V	2 MΩ	500 V[2]
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V[2]
50 ... 500 V	45 ... 450 V	2 MΩ	500 V[2]
70 ... 700 V[3]	63 ... 630 V	3 MΩ	700 V[4]
100 ... 1000 V[3]	90 ... 900 V	3 MΩ	1000 V[4]

[1] DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

[2] at Overvoltage category II: 600 V

[3] only with BA 9054/_20; /_21; /_22; /_23; /_24
(Version: 1 changeover contact)

[4] at overvoltage category II: 1000 V

Please note:
Measuring ranges 6 ... 60 mV only available at variant BA 9054/08_
(Using only for current sensing via shunt!)

MK 9054N with 1 Measuring range for AC **a n d** DC			
Measuring range[1]		internal resistance	max. permissible contin. voltage
AC	DC		
6 ... 60 mV	5.4 ... 54 mV	20 kΩ	10 V
15 ... 150 mV	13.5 ... 135 mV	40 kΩ	100 V
50 ... 500 mV	45 ... 450 mV	270 kΩ	250 V
0.5 ... 5 V	0.45 ... 4.5 V	500 kΩ	300 V
1 ... 10 V	0.9 ... 9.0 V	1 MΩ	300 V
5 ... 50 V	4.5 ... 45 V	2 MΩ	500 V[2]
25 ... 250 V	22.5 ... 225 V	2 MΩ	500 V[2]
50 ... 500 V	45 ... 450 V	2 MΩ	500 V[2]

[1] DC or AC voltage 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

[2] Not suitable for 400 / 690 V-mains (systems)

Please note:
To avoid measuring mistakes, on units with mV input the input must always be terminated. In addition screened wires should be used..

Measuring ranges 6 ... 60 mV + 15 ... 150 mV
(Using only for current sensing via shunt!)

Measuring principle: arithmetic mean value
Adjustment: The AC-devices can also monitor DC-voltage. The scale offset in this case is ($\overline{U}$ = 0.90 U_{eff})
Temperature influence: < 0.05 % / K

Technical Data

Setting Ranges

Setting
Response value: infinite variable 0.1 U_N ... 1 U_N relative scale
Hysteresis
at AC: infinite variable 0.5 ... 0.98 of setting value
at DC: infinite variable 0.5 ... 0.96 of setting value
Accuracy:
Response value at
Potentiometer right stop (max): 0 .... + 8 %
Potentiometer left stop (min): - 10 .... + 8%
Repeat accuracy: ≤ ± 0.5 %
Recovery time
at devices with manual reset
(Reset by braking
of the auxiliary voltage)
BA 9054/6_ _; MK 9054N/6_ _: ≤ 1 s
(dependent to function and auxiliary voltage)
Time delay t_v: infinite variable at logarithmic scale from 0 ... 20 s, 0 ... 30 s, 0 ... 60 s, 0 ... 100 s
setting 0 s = without time delay
Start-up delay t_a:
BA 9054/1 _ _: 1 ... 20 s; 1 ... 60 s; 1 ... 100 s, adjustable on logarithmic scale.
t_a is started when the supply voltage is connected. During elapse of time the output contact is in good state
MK 9054N: 0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

Auxiliary Circuit BA 9054 and MK 9054N

Auxiliary voltage U_H (A1, A2)
BA 9054, Nominal voltage: AC 24, 42, 110, 127, 230, 400 V
Voltage range: 0.8 ... 1.1 U_H
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 %
Nominal consumption: 2.5 VA

BA 9054, MK 9054N:		
Nominal voltage	**Voltage range**	**Frequency range**
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 40 ... 265 V	45 … 400 Hz; DC 48 % W
	DC 40 ... 300 V	W ≤ 5 %

BA 9054		
Nominal voltage	**Voltage range**	**Frequency range**
DC 12 V	DC 10 ... 18 V	battery voltage

Nominal consumption: 4 VA; 1.5 W at AC 230 V Rel. energized
1 W at DC 80 V Rel. energized

Output

Contacts
BA 9054: 2 changeover contacts
MK 9054N: 2 changeover contacts
Thermal current I_{th}
BA 9054: 2 x 5 A
MK 9054N: 2 x 4 A
Switching capacity
BA 9054
to AC 15:
NO contact: 2 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
MK 9054N
to AC 15: 1.5 A / AC 230 V IEC/EN 60 947-5-1
BA 9054, MK 9054N
to DC 13: 1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life IEC/EN 60 947-5-1
BA 9054
to AC 15 at 3 A, AC 230 V: 5 x 10^5 switching cycles
MK 9054N:
to AC 15 at 3 A, AC 230 V: 10^5 switching cycles
Short-circuit strength
max. fuse rating: 6A gG (gL) IEC/EN 60 947-5-1
Mechanical life
BA 9054: 50 x 10^6 switching cycles
MK 9054N: 30 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 40 ... + 60°C (higher temperature with limitations on request)	
Storage:	- 40 ... + 70°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
BA 9054:	6 kV / 2	IEC 60 664-1
MK 9054N	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	40 / 060 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire connection		
BA 9054:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve	
MK 9054N		
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	12 $^{\pm 0.5}$ mm	
Wire fixing		
BA 9054:	Plus-minus terminal screws M3.5 with self-lifting clamping piece	IEC/EN 60 999-1
MK 9054N:	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail	IEC/EN 60 715
Weight		
BA 9054:	AC-device: 280 g AC/DC-fdevice: 200 g	
MK 9054N:	150 g	

Dimensions

Width x height x depth	
BA 9054:	45 x 75 x 120 mm
MK 9054N:	22.5 x 90 x 97 mm

Classification to DIN EN 50155 for BA 9054

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations	
Protective coating of the PCB:	No	

UL-Data

Auxiliary voltage U_H(A1, A2)		
BA 9054:	AC 24, 42, 48, 110, 115, 120 V	
Thermal current I_{th}:		
BA 9054:	2 x 5 A	
MK 9054N:	2 x 4 A	
Clearance and creepage distances		
BA 9054, MK 9054N:	4 kV / 2	IEC 60 664-1
HF irradiation		
BA 9054 (80 MHz ... 2.7 GHz)	10 V/m	IEC/EN 61 000-4-3
Switching capacity:	Pilot duty B150	
Ambient temperature:	- 40 ... + 60°C	

Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Switching capacity		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

BA 9054/010 AC 25 ... 250 V AC 230 V
Article number: 0053639
- for Overvoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC 230 V
- Time delay t_v by $U_{an:}$: 0 ... 20 s
- Width: 45 mm

BA 9054/012 AC 25 ... 250 V AC 230 V
Article number: 0053711
- for Undervoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC 230 V
- Time delay t_v by U_{ab}: 0 ... 20 s
- Width: 45 mm

MK 9054N.12/010 AC 25 ... 250 V AC/DC 80 ... 230 V t_v 0 ... 20 s t_a 0.1 ... 20 s
Article number:
- for Overvoltage monitoring
- Measuring range: AC 25 ... 250 V
- Auxiliary voltage U_H: AC/DC 80 ... 230 V
- Time delay t_v by $U_{an:}$: 0 ... 20 s
- Start up delay t_a: 0.1 ... 20 s
- Width: 22.5 mm

Ordering Example for Variants

BA 9054 /_ _ _ /61 AC 25 ... 250V AC 230 V 0 ... 20 s 1 ... 20 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- With UL-approval
- 10 Overvoltage relay energized on trip time delay at setting value
- 11 Overvoltage relay de-energized on trip time delay at setting value
- 12 Undervoltage relay de-energized on trip time delay at hysteresis value
- 13 Undervoltage relay energized on trip time delay at hysteresis value
- 20 Same as BA 9054/024, but with additional moisture protection
- 21 Same as BA 9054/011, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 22 Same as BA 9054/012, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 23 Same as BA 9054/013, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 24 Same as BA 9054/010, but with measuring range ≥ 70 ... 700 V, 1 C/O contact
- 46 Same as BA 9054/010, reduced reaction-time, measuring range DC 24 ... 35 V, it is necessary to connect power supply before measuring voltage
- 47 Same as 46, but with measuring range DC 60 ... 78 V
- 0 Standard version
- 1 With start up delay t_a
- 2 With safe electrical separation of input- and output circuit accroding to DIN 61140
- 3 With 5 µm gold plated contacts
- 5 With forcibly guided contacts
- 6 With manual reset, resetting by disconnecting the power supply
- Type

MK 9054N _ _ /_ _ _ AC 25 ... 250 V AC/DC 80 ... 230 V 0 ... 20 s 0,1 ... 20 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- 10 Overvoltage relay energized on trip
- 11 Overvoltage relay de-energized on trip
- 12 Undervoltage relay de-energized on trip
- 13 Undervoltage relay energized on trip
- 0 Standard version without remote potentiometer
- 1 Standard version with remote potentiometer (resp. value) Z1, Z2, Z3 for 470 kΩ **at this version there is no potentiometer for the response value**
- 6 General definition with manual reset function
- Type of terminals
  - Without indication: terminal blocks fixed, with screw terminals
  - PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  - PS (plug in screw): pluggable terminal blocks with screw terminals
- Type

Options with Pluggable Terminal Blocks

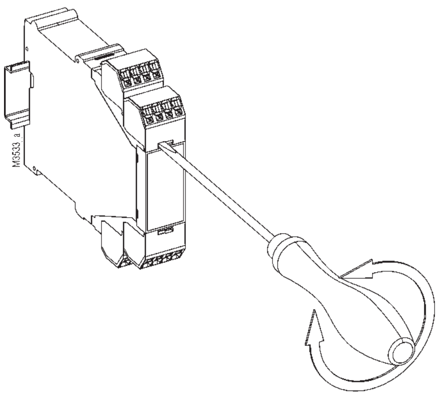
Screw terminal
(PS/plugin screw)

Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Accessories

AD 3:	Remote potentiometer 470 kW Article number: 0050174

Setting

Example:
Voltage relay BA 9054 / MK 9054N AC 25 ... 250 V

AC according to type plate:
i.e. the unit is adjusted to AC voltage
25 ... 250 V = measuring range

Response value AC 150 V
Hysteresis AC 75 V

Settings:

upper potentiometer:	0.6	(0.6 x 250 V = 150 V)
lower potentiometer:	0.5	(0.5 x 150 V = 75 V)

The AC-devices can also monitor DC voltage. The scale offset in this case is: $\overline{U} = 0.9 \times U_{eff.}$

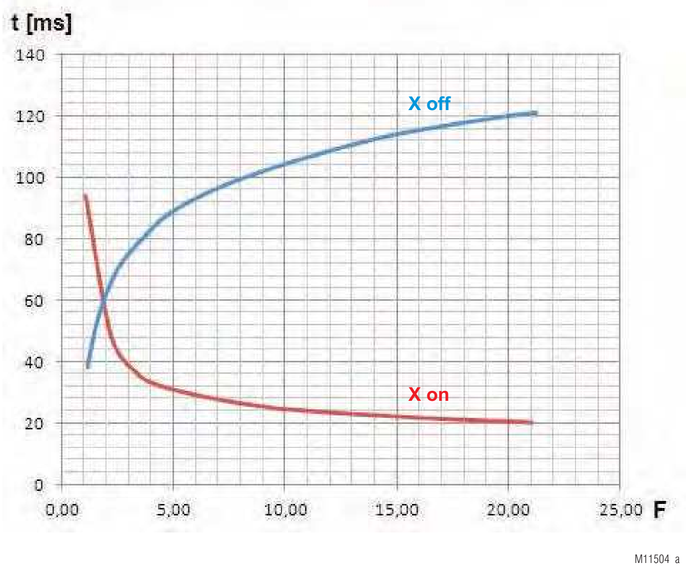
AC 25 ... 250 V is equivalent to DC 22.5 ... 225 V

Response value DC 150 V
Hysteresis DC 75 V

Settings:

upper potentiometer:	0.66	(0.66 x 225 V = 150 V)
lower potentiometer:	0.5	(0.5 x 150 V = 75 V)

Characteristic



Time delay of measuring circuit

X on: Measured value rises $F = \dfrac{\text{Meas. value (after rise of meas. value)}}{\text{Setting value}}$

X off: Measured value drops $F = \dfrac{\text{Meas. value (befor meas. value drops)}}{\text{Setting value (hysteresis)}}$

The diagram shows the typical delay of a standard devices depending on the measured values "X on and X off" at sudden rise or drop of the signal. At slow change of the measured value the delay is shorter.
The total reaction time of the device results from the adjustable delay t_v and the delay created by the measuring circuit.

The diagram shows an average delay. The delay times could differ on the different variants.

Example for "X on" (overvoltage detection with BA9054/010):
Adjusted setting value X on = 230 V.
Caused by a missing neutral the voltage rises suddenly to 400 V

$$F = \frac{\text{Measured value (after rise of meas. value)}}{\text{Setting value}} = \frac{400\text{ V}}{230\text{ V}} = 1{,}74$$

Reading from the diagram:
The output relay switches on after 64 ms at a setting t_v=0.

Example for "X off" (undervoltage detection with BA9054/012):
Adjusted hysteresis setting value is 100 V.
Caused by a broken wire the voltage drops suddenly from 230 V to 0 V.

$$F = \frac{\text{Measured value (befor meas. value drops)}}{\text{Setting value (hysteresis)}} = \frac{230\text{ V}}{100\text{ V}} = 2{,}3$$

Reading from the diagram:
The output relay switches off after 70 ms at a setting t_v=0.

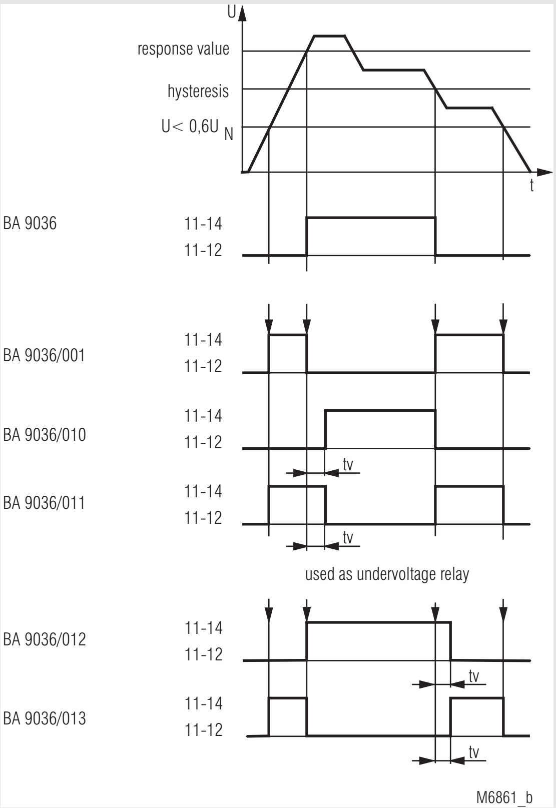
VARIMETER
Voltage Relay
BA 9036

DOLD

0225114

- According to IEC/EN 60255-1, IEC/EN 60255-26
- Single-phase
- Measuring ranges from 24 to 400
- Settable response and release value
- Without auxiliary supply
- optionally available with adjustable time delay
- with LED indicators for operation and state of contacts
- 2 changeover contacts
- Width 45 mm

Function Diagram



Approvals and Markings

Canada / USA | A025518

* see variants

Applications

Monitoring of voltage in DC and AC systems

Indicators

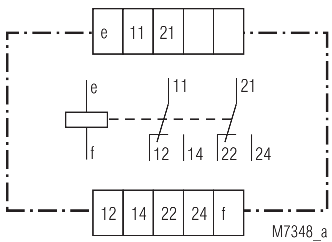
upper LED:	on, when voltage connected
lower LED:	on, when output contact activated

Notes

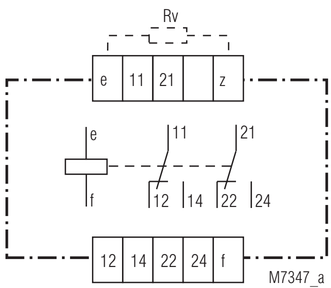
Mounting instruction for units with external series resistor
The external resistor conducts mains voltage and heats up during operation. It has to be mounted at a suitable location in the cabinet so that touch protection is provided. Because of the heat dissipation a suitable distance to neighbour devices has to be kept.

When using a drop resistor the measuring has to be connected to e and f.

Circuit Diagrams



BA 9036
connection diagram for AC voltage



BA 9036
connection diagram for DC voltage

Connection Terminals

Terminal designation	Signal designation
e, f	Nominal voltage
e, z	Series resistor (DC)
11, 12, 14, 21, 22, 24	changeover contact

Technical Data

Input

Nominal voltage U_N:	AC 42, 110, 127, 230, 240, 290, 400 V DC 24, 48, 60 V DC 110*, 127*, 220*, 240 V* *) with external drop resistor DC 110 V*: ZWS 20 SL1.5 kΩ20 W DC 127 V*: ZWS 20 SL1.6 kΩ20 W DC 220 V*: ZWS 35 SL 3.9 kΩ 35 W DC 240 V*: ZWS 35 SL4.7 kΩ35 W *) Replacement RL 9836 without external drop resistor	
Nominal consumption:	6 VA / 10 W	
Nominal frequency:	50 / 60 Hz	
Frequency range:	± 5 %	
Temperature influence:	< 0.05 % / K	
Max. overload:	1.2 U_N continuously	

Setting Ranges

Setting:	0.85 ... 1.05 U_N	
Hysteresis:	0.75 ... 0.95 of setting value	
Setting accuracy:	± 5 %	
Repeat accuracy:	± 0.5 %	
Time delay t_v:	0.5 ... 10 s adjustable (U > 0.6 x U_N)	

Output

Contacts:	2 changeover contacts	
Thermal current I_{th}:	6 A	
Switching capacity		
to AC 15		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical contact life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	≥ 2.5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	6 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	310 g	

Dimensions

Width x height x depth: 45 x 73 x 132 mm

UL-Data

Nominal voltage U_N:	AC 120 V
Switching capacity:	Pilot duty B150

Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

BA 9036 AC 230 V 50 Hz

Article number:	0045288
• Nominal voltage U_N:	AC 230 V
• Width:	45 mm

Variants

BA 9036/61:	with UL approval on request
BA 9036:	with CCC approval on request
BA 9036/001:	overvoltage / closed circuit operation
BA 9036/010:	overvoltage / open circuit operation / time delay
BA 9036/011:	overvoltage / closed circuit operation / time delay
BA 9036/012:	undervoltage / closed circuit operation / time delay
BA 9036/013:	undervoltage / open circuit operation / time delay

Ordering example for variants

BA 9036 /_ _ _ AC 230 V 50 Hz

Nominal frequency
Nominal voltage
Variant, if required
Type

Characteristic

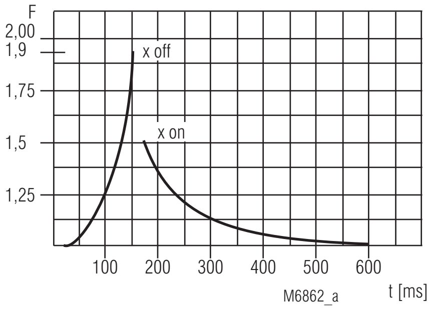


Diagram switching delay

Switching delay t_M:
The characteristic shows the switching delay depending on the values of X_{on} - X_{off} when switching the voltage on or off. A slow voltage change reduces the delay.

Example:

U setting = 200 V
U applied = 230 V

$$F = \frac{230\ V}{200\ V} = 1.1$$

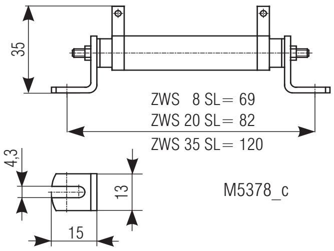
$$F = \frac{U\ applied}{U\ setting}$$

$t_M$on = approx. 300 ms
$t_M$off = approx. 60 ms

Accessories

ZWS 20 SL, ZWS 35 SL

Drop resistor

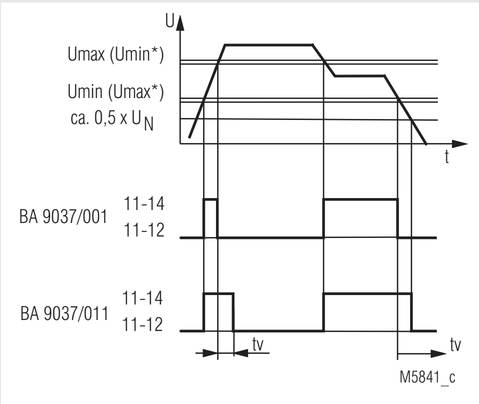


VARIMETER
Voltage Relay
BA 9037

0225113

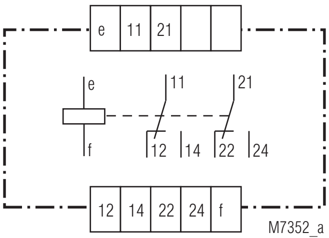
- According to IEC 255, EN 30 255, VDE 0435 part 303
- Single phase
- Measuring ranges from 24 to 660 V
- Response and release value adjustable independent of each other
- Under- and overvoltage detection
- Without auxiliary supply
- Large setting range
- With time delay
- Closed circuit operation
- Insensitive to harmonics
- LED indicators for operation and state of contacts
- Width 45 mm

Function Diagram



* U_{min} and U_{max} can also be exchanged. The hysteresis of the setting values is < 4 % of the response value

Circuit Diagram



BA 9037.12

Approvals and Markings

CE

Applications

Under- and overvoltage detection in AC or DC voltage systems

Indicators

upper LED:	on, when voltage connected
lower LED:	on, when output contact activated

Technical Data

Input

Nominal voltage U_N:	DC 24, 42, 60 V (protected against wrong polarity). These units are calibrated for DC voltage. When AC voltage is connected the setting has an offset of 11 %.
	AC 110, 127, 230, 240, 400, 660, 690 V
Measuring ranges:	0.7 ... 1.3 U_N
Voltage range:	0.6 ... 1.4 U_N
Nominal consumption:	DC 24 V 1 W
	AC 24 V 2 VA
	AC 230 V 5 VA
	AC 500 V 10 VA
Nominal frequency:	50 / 60 Hz
Frequency range:	± 5 %
Temperature influence:	< 0.05 % / K

Setting Ranges

Response value:	U_{min} infinite 0.7 ... 1.3 U_N
	U_{max} infinite 0.7 ... 1.3 U_N
Hysteresis:	at U_{min} bzw. U_{max} < 0.96
Setting accuracy:	< ± 5 %
Repeat accuracy:	< ± 0.5 %

Technical Data

Output

Contacts

BA 9037.12:	2 changeover contacts	
Release delay:	24 V < 20 ms	
	220 V < 150 ms	
	500 V < 150 ms	
Thermal current I_{th}:	5 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switching cycles	
Permissible switching frequency:	6000 switching cycles / h	
Short circuit strength max. fuse rating:	4 AgL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 40 ... + 70°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages:	1 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	240 g	

Dimensions

Width x height x depth: 45 x 73 x 132 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Type

BA 9037.12/001 AC / DC 24 V
Article number: 0030758

- without time delay
- Output: 2 changeover contacts
- Nominal voltage U_N: AC / DC 24 V
- Width: 45 mm

Variant

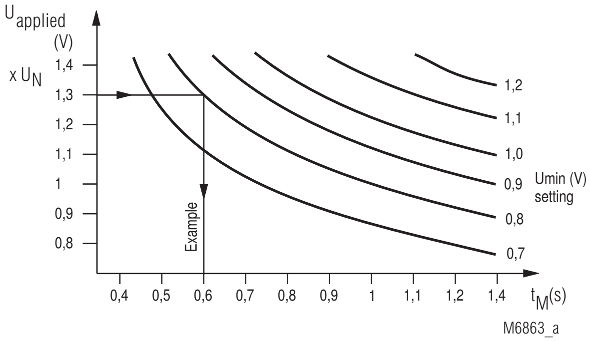
BA 9037.--/011: adjustable time delay t_v 1 ... 20 sec. If the voltage drops below 0.5 U_N the time delay is inactive, and the contacts fall back immediately.

Ordering example for variant

BA 9037 .12 /_ _ _ AC 230 V 50 / 60 Hz

- Nominal frequency
- Nominal voltage
- Variant, if required
- Contact
- Type

Characteristics



Operate delay t_M:

The diagram shows the relation of the operate delay to the applied measuring voltage $U_{applied}$ and the setting of U_{min}, when the voltage is switched on. A slow voltage change reduces the delay.

VARIMETER
Voltage Monitor
IK 9044, IK 9046

DOLD

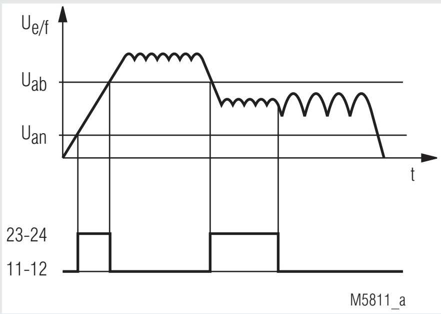
0222124

IK 9044

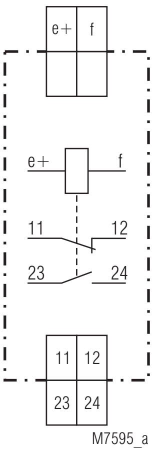
IK 9046

- According to IEC/EN 60 255-1
- For monitoring direct current voltage supply systems to detect undervoltage, overvoltage and residual ripple
- For DC 24 V
- IK 9046 with adjustable residual ripple
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9044

Connection Terminals

Terminal designation	Signal designation
e+, f	Measuring- and supply voltage DC 24 V
11, 12	NC contact
23, 24	NO contact

Approvals and Markings

CE

Application

For monitoring direct current voltage supply systems, e.g. of PLC (three-phase bridges), automobile industry, welding.

Indicator

Yellow LED:	on, when there are no faults in the supply system

Technical Data

Input

Nominal voltage U_N:	DC 24 V	
Maximum overload:	DC 33 V permanent	
	DC 35 V 0.5 s	
	DC 45 V 10 ms	
Nominal consumption:	0.6 W	
Overvoltage		
setting value:	0.82 x U_N	
Undervoltage		
setting value:	1.18 x U_N	
Hysteresis:	< 4 % x U_N	
Residual ripple actuation		
IK 9044:	approx. 15 %	
IK 9046:	0 ... 15 %, adjustable	

Output

Contacts:	1 NC contact, 1 NO contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life:		IEC/EN 60 947-5-1
AC 15 at 1 A, AC 230 V:	5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 AgL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 25 ... + 70°C	
Storage:	- 25 ... + 85 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage/ pollution degree:	4 kV / 2 (basis insulation)	IEC 60 664-1
EMC		
Electrostatic discharge:	6 kV (air)	IEC/EN 61 000-4-2
HF irradiation 80 MHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	25 / 070 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		
Cross section:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Stripping length:	10 mm	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail or screw attachment	IEC/EN 60 715
Weight:	67 g	

Dimensions

Width x height x depth: 17.5 x 90 x 58 mm

Standard Type

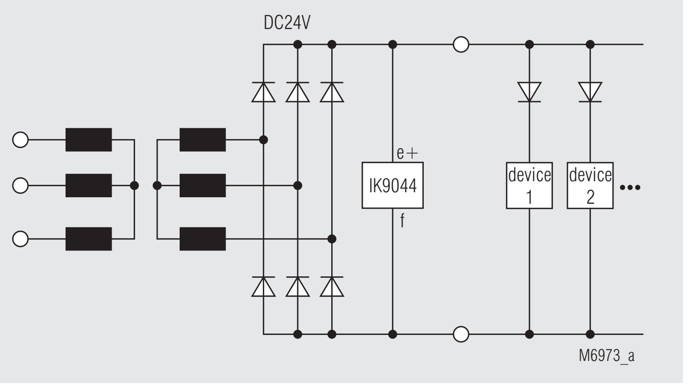
IK 9044 DC 24 V

Article number:	0027841
• Residual ripple actuation:	approx. 15 %
• Nominal voltage U_N:	DC 24 V
• Width:	17.5 mm

IK 9046 DC 24 V

Article number:	0030027
• Residual ripple actuation:	0 ... 15 %, adjustable
• Nominal voltage U_N:	DC 24 V
• Width:	17.5 mm

Connection Example



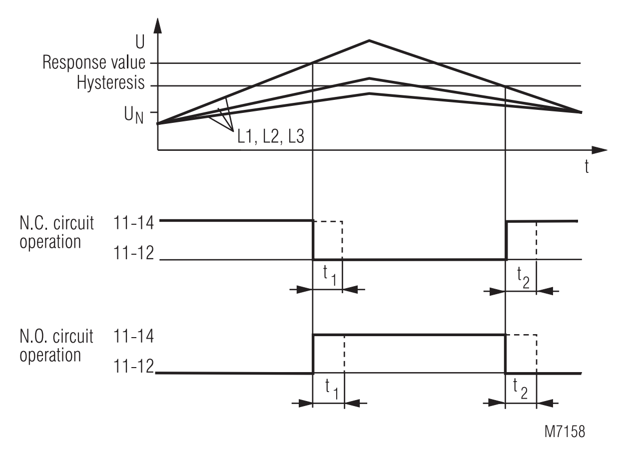
VARIMETER
Overvoltage Relay, 3-phase
IK 9170, SK 9170

DOLD

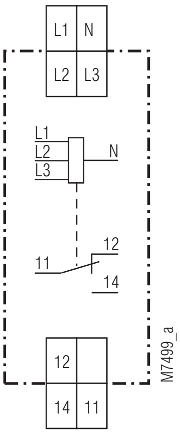
IK 9170 SK 9170

- According to IEC/EN 60 255, DIN VDE 0435-303
- Monitoring of overvoltage in 3-phase systems
- Also for single phase
- Without auxiliary supply
- Settable response value
- N.C. circuit operation (optionally N.O. circuit operation)
- Optionally with or without N
- Optionally with delay t1 on trip
- Optionally with delay t2 on reset
- LED indicator for state of output relay
- Indepenent of phase sequence
- 1 changeover contact
- Devices available in 2 enclosure versions:
  IK 9170: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9170: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9170.11, SK 9170.11

Approvals and Markings

CE

Applications

Monitors overvoltage, in 3-phase voltage systems

Notes

The arithmetic mean value of each phase is measured against N. The variants without N measure L1 and L3 against L2.

Indicators

Yellow LED:	output contact active (11-14 closed)

Technical Data

Input Circuit

Nominal voltage U_N:	3/N AC 400/230 V (with neutral) 3 AC 400 V (without neutral)
Voltage range:	0.7 ... 1.3 U_N
Max. overload:	1.35 U_N, continuously
Nominal consumption:	approx. 4 VA
Frequency range:	45 ... 65 Hz

Setting Ranges

Response value:	adjustable: 0.9 ... 1.3 U_N
Hysteresis:	approx. 4 % of setting value
Time delay t_1 / t_2:	0.5 ... 20 s

Output

Contacts		
IK 9170.11, SK 9170.11:	1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical contact life		IEC/EN 60 947-5-1
at AC 230 V, 1 A (cos φ = 0.5):	≥ 3 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	20 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9170:	65 g	
SK 9170:	83 g	

Dimensions

Width x height x depth

IK 9170:	17.5 x 90 x 59 mm
SK 9170:	17.5 x 90 x 98 mm

Standard Types

IK 9170.11 3/N AC 400/230V 50/60 Hz 0.9 ... 1.3 U_N
Article number: 0048645
SK 9170.11 3/N AC 400/230V 50/60Hz 0.9 ... 1.3 U_N
Article number: 0054743

- Adjustable response value: 0.9 ... 1.3 U_N
- Without time delay
- with N
- Closed circuit operation
- Output: 1 changeover contact
- Nominal voltage U_N: 3/N AC 400/230 V
- Width: 17.5 mm

Variants

IK 9170/001

0 N.C. circuit operation with N
1 N.C. circuit operation without N
2 N.O. circuit operation with N
3 N.O. circuit operation without N

0 without time delay
3 settable time delay t_1
4 settable time delay t_2

0 settable response value

Ordering example for variants

IK 9170 .11 /031 3 AC 400 V 0.9 ... 1.3 U_N 0.5 ... 20 s

Time delay t_1
Setting range
Nominal voltage
Variant, if required
Contact
Type

VARIMETER
Overvoltage Relay, Single Phase
IK 9172, SK 9172

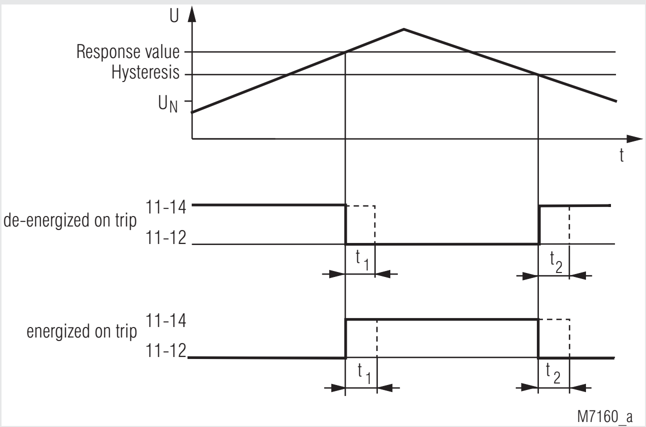
DOLD

0223315

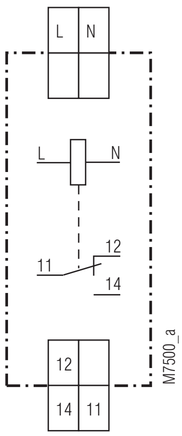
IK 9172 SK 9172

- According to IEC/EN 60 255, DIN VDE 0435-303
- Monitoring of overvoltage
- Without auxiliary supply
- Settable response value
- De-energized on trip
- LED indicator for state of output relay
- 1 changeover contact
- As option energized on trip
- As option with delay t1 on trip
- As option with delay t2 on reset
- **Devices available in 2 enclosure versions:**
  IK 9171: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9171: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9172.11, SK 9172.11

Approvals and Markings

CE

Applications

Monitors overvoltage, in single-phase voltage systems

Function

The arithmetic mean value of the voltage L-N ist measured.

Indicators

Yellow LED: output contact active (11-14 closed)

Technical Data

Input Circuit

Nominal voltage U_N:	AC 24, 42, 110, 230 V DC 24, 48, 60, 110 V
Voltage range:	0.7 ... 1.3 U_N
Max. overload:	1.35 U_N continuously
Nominal consumption:	max. 5 VA / DC 1 W
Frequency range:	45 ... 65 Hz

Setting Ranges

Response value:	adjustable: 0.9 ... 1.3 U_N
Hysteresis:	approx. 4 % of setting value
Time delay t_1 / t_2:	0.5 ... 20 s

Output

Contacts	
IK 9172.11, SK 9172.11:	1 changeover contact
Thermal current I_{th}:	4 A
Switching capacity	
to AC 15	
NO contact:	3 A / AC 230 V IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V IEC/EN 60 947-5-1
Electrical contact life	IEC/EN 60 947-5-1
at AC 230 V, 1 A (cos φ = 0.5)	:≥ 3 x 10^5 switching cycles
Short circuit strength	
max. fuse rating:	4 A gL IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60 °C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	20 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9171:	65 g	
SK 9171:	83 g	

Dimensions

Width x height x depth

IK 9172:	17.5 x 90 x 59 mm
SK 9172:	17.5 x 90 x 98 mm

Standard Types

IK 9172.11 AC 230 V 50/60 Hz 0.9 ... 1.3 U_N
Article number: 0048644
SK 9172.11 AC 230 V 50/60Hz 0.9 ... 1.3 U_N
Article number: 0054745

- Adjustable response value: 0.9 ... 1.3 U_N
- Without time delay
- De-energized on trip
- Output: 1 changeover contact
- Nominal voltage U_N: AC 230 V
- Width: 17.5 mm

Variants

IK 9172/001

- 0 De-energized on trip
- 1 Energized on trip

- 0 Without time delay
- 3 Settable time delay t_1
- 4 Settable time delay t_2

- 0 Settable response value

Ordering example for variants

IK 9172 .11 /_ _ _ AC 230 V 50/60 Hz 0.9 ... 1.3 U_N 0.5 ... 20 s

- Time delay t_1
- Setting range
- Nominal frequency
- Nominal voltage
- Variant, if required
- Contact
- Type

VARIMETER
Undervoltage Relay
BA 9043, AA 9943

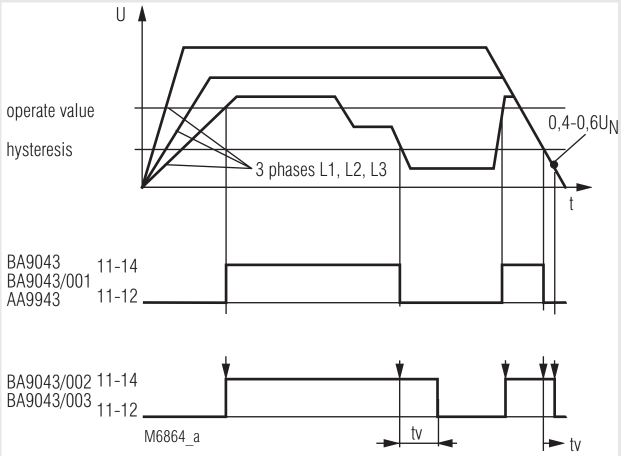
0221539

BA 9043

AA 9943

- According to EC/EN 60255-1
- 3-phase
- For nominal voltage of 3 AC 100 / 57 to 690 / 400 V
- Measures arithmetic mean value
- Adjustable operate and release value
- For 3p3w or 3p4w systems
- BA 9043 with optionally adjustable time delay
- De-energized on trip operation
- LED indicator for operation and state of contact
- Insensitive to harmonics
- Frequency up to 400 Hz
- Width 45 mm

Function Diagram



Approvals and Markings

A025518

*) see variants

Application

- Undervoltage detection in 3 phase systems
- For industrial and railway applications

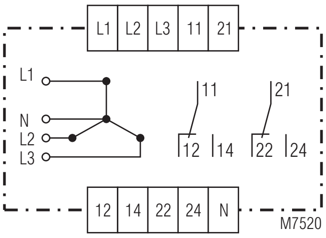
Indicators

upper LED (only BA 9043):	on, when voltage connected
lower LED:	on, when output contact activated

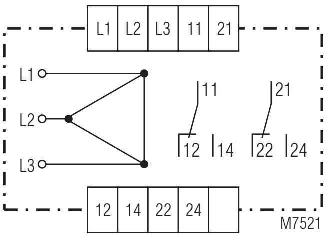
Notes

For determination of the arithmetic mean value of the voltage the 3 phases are measured against N.
The variants without N (/001 and /003) measure L1 and L2 against L3.
delay the delay is only active at U ≥ 0,6 U_N . At < 0.4 U_N the relay switches off without delay.

Circuit Diagrams



BA 9043, BA 9043/002
AA 9943



BA 9043/001, BA 9043/003
AA 9943/001

Technical Data

Input

Nominal voltage U_N	
BA 9043, BA 9043/002	
AA 9943:	3/N AC 100/57 V; 220/127 V; 400/230 V 415/240 V; 440/254 V; 500/290 V
BA 9043, BA9043/002:	3/N AC 690/400 V
BA 9043/001, BA 9043/003, AA 9943/001:	3 AC 100 V; 220 V; 400 V; 415 V, 440 V; 500 V
BA 9043/001, BA 9043/003:	3 AC 690 V
Max. overload	
BA 9043:	1.2 U_N continuously
AA 9943:	1.1 U_N continuously
Nominal consumption:	AC 4 VA
Nominal frequency:	50 ... 400 Hz
Frequency range:	± 5 %
Temperature influence:	< 0.05 % / K

Setting Ranges

Response value:	0.85 ... 1.05 U_N, infinite variable with upper potentiometer
Hysteresis:	0.75 ... 0.95 of operate value
Setting accuracy:	≤ ± 10 %
Switching delay t_M:	see diagram switching delay
Time delay t_V:	infinite variable from 0.5 ... 10 sec for BA 9043/002, BA 9043/003 Between 0.4 and 0.6 U_N the contacts fall back according to the diagram without additional delay

Technical Data

Output

Contacts

BA 9043:	2 changeover contacts	
AA 9943.11:	1 changeover contact	
AA 9943.12:	2 changeover contacts	
Thermal current I_{th}:	6 A; see diagramm Continuous current limit curve	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	3 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 25 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.5 GHz:	3 V/m	IEC/EN 61 000-4-3
2.5 GHz ... 2.7 GHz:	3 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	DIN EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
BA 9043:	310 g	
AA 9943:	300 g	

Dimensions

Width x height x depth

BA 9043:	45 x 73 x 132 mm
AA 9943:	45 x 77 x 127 mm

CCC-Data

Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Classification to DIN EN 50155 for BA 9043

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Type

BA 9043 3/N AC 400 / 230 V 50 ... 400 Hz

Article number:	0039676
• for 3p4w systems	
• Nominal voltage U_N:	3/N AC 400 / 230 V
• Output:	2 changeover contacts
• Width:	45 mm

Variants

AA 9943/001:	without neutral
AA 9943/175:	for nuclear power plants
BA 9043/001:	without neutral
BA 9043/002:	with neutral, adjustable time delay t_v = 0.5 ... 10 sec
BA 9043/003:	without neutral, adjustable time delay t_v = 0.5 ... 10 sec
BA 9043:	with CCC-approval on request

Ordering example for variants

BA 9043 /_ _ _ 3/N AC 400/230 V 50 ... 400 Hz

- Nominal frequency
- Nominal voltage
- Variant, if required
- Type

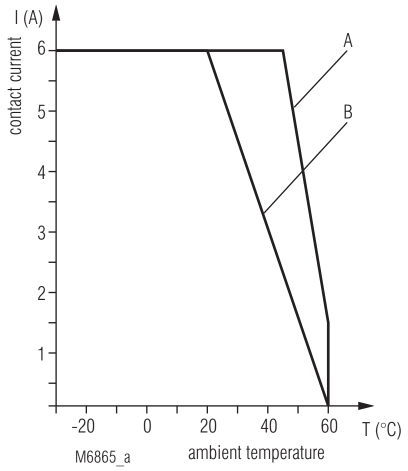
AA 9943 .11 /_ _ _ 3/N AC 400/230 V 50 ... 400 Hz

- Nominal frequency
- Nominal voltage
- Variant, if required
- Contact
- Type

Accessories

AA 9943:	
K 70-34	Cover Article number: 0011790

Characteristics



Continuous current limit curve

A = Devices mounted with 2 cm distance
B = Devices mounted without distance

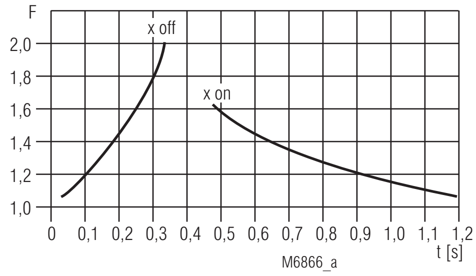


Diagram switching delay

Switching delay t_M:

When the voltage changes fast on the measuring input, the arithmetic mean value can only adjust after a short delay.

Example:

$$F = \frac{U\ \text{applied}}{U\ \text{setting}} \qquad F = \frac{240\ \text{V}}{190\ \text{V}} = 1.26$$

U setting = 190 V
U applied = 240 V

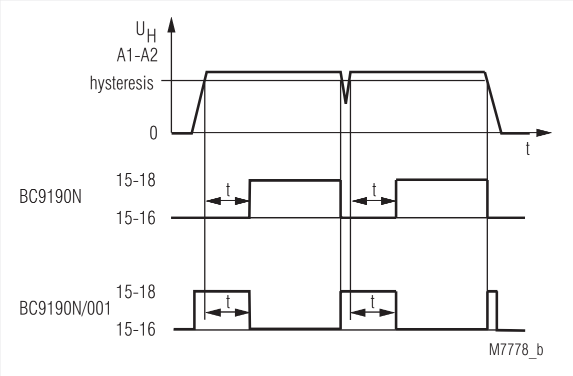
according to diagram:
$t_M$on = approx. 800 ms
$t_M$off = approx. 100 ms

VARIMETER
Voltage Drop Detector
BC 9190N

0233921

- According to IEC/EN 60 255, DIN VDE 0435-303
- Fast detection of undervoltage and phase failure in AC voltage systems
- Detects voltage drops (reaction time ≤ 20 ms)
- Response value 0.8 or 0.7 U_N selectable by wire link
- Without auxiliary supply
- De-energized on trip
- LED indicator for contact position
- Adjustable operate delay after return of voltage
- As option adjustable fleeting on make pulse after return of voltage (variant BC 9190N.11/001)
- 1 changeover contact
- Wire connection: also 2 x 1.5 mm² stranded ferruled (isolated), DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4
- Width 22.5 mm

Function Diagram



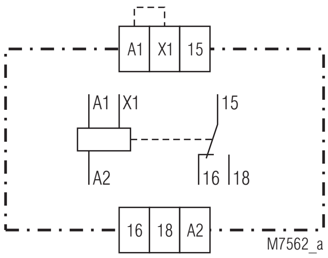
Approvals and Markings

CE

Applications

Monitoring of voltage systems to detect auto reclosing as e.g. generated by the energy supplier in the case of flash-overs or switching procedures. It is possible that in control circuits some of the devices are resetted during auto reclosing and some not. Because of this uncontrollable situations may occur.
By detecting these fast auto reclosings and addition of a certain time delay at reclosing the OFF-time is lengthened and every device has the time to reset. The circuit goes into a defind OFF-state and is automatically resetted after the adjusted time delay or by manual reset if the automatic reset is disabled by an external circuit (see Connection Examples).

Circuit Diagram



Function

If the BC 9190N detects a voltage drop below 0.8 or 0.7 of U_N the yellow LED goes off and the relay de-energises (fault condition). The setting of the response value 0.7 U_N is done by linking terminal X1 to A1. Without link the response value is 0.8 U_N.
If the voltage returns to normal (2 % Hysteresis above response value) the output relay energises after the time delay t and the yellow LED switches on (good condition).
The BC 9190N.11/001 energises the output relay immediately after the voltage returns for an adjustable pulse time. After the time delay the relay is de-energized.

Indication

LED:	on when output relay activated (contacts 15-18 are closed)

Notes

The BC 9190N is designed for mains frequency of 50 Hz. It can also be operated on 60 Hz but the response values are reduced to approx. 0.75 and 0.65 U_N.

Technical Data

Time Circuit

Time ranges:	0.05 ... 1 s	15 ... 300 s
	0.15 ... 3 s	1.5 ... 30 min.
	0.5 ... 10 s	0.15 ... 3 h
	1.5 ... 60 s	0.5 ... 10 h
Time setting:	stepless 1:20	
Recovery time:	≤ 20 ms	
Repeat accuracy:	≤ 0.5 % + 10 ms	
Voltage influence:	≤ 1 %	
Temperature influence:	≤ 0.25 % / K	

Input

Nominal voltage U_N:	AC 110 V, AC 230 V	
Overload:	1.15 U_N	
Nominal consumption:	2.5 VA	
Nominal frequency:	50 Hz	
Frequency range:	± 5 % f_N	
Response value		
without bridge X1-A1:	0.8 U_N	
with bridge X1-A1:	0.7 U_N	
Hysteresis:	approx. 2 %	

Output

Contacts:		
BC 9091N.11:	1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	1.5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	10^8 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or 2 x 2.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1

Technical Data

Mounting:	DIN rail	IEC/EN 60 715
Weight:	80 g	

Dimensions

Width x height x depth:	22.5 x 84 x 97 mm

Standard Type

BC 9190N.11 AC 230 V 0.5 ... 10 s
Article number:

- Adjustable operate delay: 0.5 ... 10 s
- Output: 1 changeover contact
- Nominal voltage U_N: AC 230 V
- Time range: 0.5 ... 10 s
- Width: 22.5 mm

Variant

BC 9190N.11/001 with fleeting on make function

Ordering example for variant

BC 9091N .11 /_ _ _ AC 230 V 50 Hz 0.5 ... 10 s

- Time delay
- Nominal frequency
- Nominal voltage
- Variant, if required
- Contacts
- Type

VARIMETER
Undervoltage Relay, 3-phase
IK 9171, IL 9171, SK 9171, SL 9171

DOLD

0223313

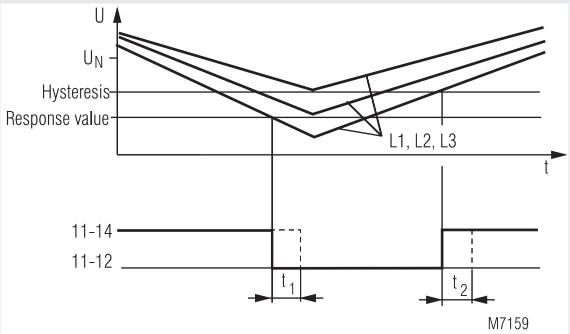
- According to IEC/EN 60 255-1
- Monitoring of undervoltage in 3-phase system
- Also for single phase
- Without auxiliary supply
- Optionally for 3p3w systems
- LED indicator for state of output relay
- Independent of phase sequence
- 1 or 2 changeover contacts
- Optionallyfixed or settable response value
- As option with phase sequence detection
- Optionally with or without N
- Optionally with off-delay t_1
- Opionally with on delay t_2
- Devices available in 2 enclosure versions:
  I-model: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  S-model: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width:
  IK 9171, SK 9171: 17.5 mm
  IL 9171, SL 9171: 35 mm

Approvals and Markings

CE | CCC *) A025518

*) only IL 9171

Function Diagram



Application

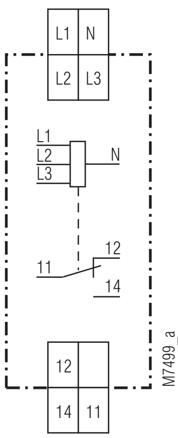
Monitoring of voltage systems on undervoltage. Automatic switching to emergency supply or of emergency light in the case of phase loss according to DIN VDE 0100-710 or DIN VDE 0108.

Variant with t_2 is used in unstable voltage systems, where after phase failure detection the consumers should be energized one after the other. This ist done by setting the operate delay e.g. 0.1 ... 20 s of the different relays to different values.
This variant ist also used where a consumer after only short phase failure should not be started immediately (e.g. compressors).

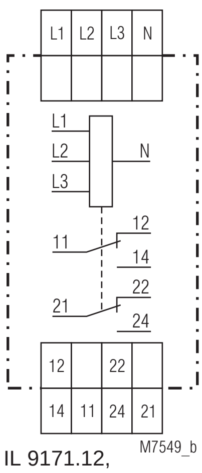
Function

The arithmetic mean value of each phase is measured against N. The variants without N measure L1 and L3 against L2 (IK/SK 9171) and L1 and L2 against L3 (IL/SL 9171).

Circuit Diagrams



IK 9171.11,
SK 9171.11



IL 9171.12,
SL 9171.12

Indicators

Yellow LED: output contact active (11-14 closed)

Notes

To measure single-phase voltage terminals L1, L2, L3 have to be linked together.
The time delay t1 is only active if the voltage L1-N (IK/SK 9171) or L3-N (IL/SL 9171) is at least 0,5 U_N.

Technical Data

Input Circuit

Nominal voltage U_N

3-phase without neutral:	3 AC 100 V, 110 V, 127 V, 220 V, 230 V, 3 AC 240 V, 290 V, 400 V, 415 V, 440 V, 3 AC 480 V, 500 V
3-phase with neutral	3/N AC 100 V / 58 V; 3/N AC 110 V / 64 V; 3/N AC 220 V / 127 V; 3/N AC 230 V / 133 V; 3/N AC 380 V /220 V; 3/N AC 400 V / 230 V; 3/N AC 415 V / 240 V; 3/N AC 440 V / 254 V; 3/N AC 480 V / 277 V; 3/N AC 500 V / 290 V
Max overload:	1.15 U_N continuously
Nominal consumption	
IK/SK 9171.11:	approx. 6 VA
IL/SL 9171.12:	approx. 8 VA
Frequency range:	45 ... 65 Hz

Setting ranges

Response value:	fixed: 0.7 or 0.85 U_N adjustable: 0.55 ... 1.05 U_N
Hysteresis:	approx. 4 % of setting value
Time delay t_1 / t_2:	0.5 ... 20 s
Reaction time:	approx. 100 ms

Output

Contacts

IK/SK 9171.11:	1 changeover contact	
IL/SL 9171.12:	2 changeover contacts	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	4 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	$\geq 3 \times 10^5$ switching cycles	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	$\geq 30 \times 10^6$ switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	20 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	30 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	

Technical Data

Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9171:	65 g	
SK 9171:	83 g	
IL 9171:	110 g	
SL 9171:	137 g	

Dimensions

Width x height x depth

IK 9171:	17.5 x 90 x 59 mm
SK 9171:	17.5 x 90 x 98 mm
IL 9171:	35 x 90 x 59 mm
SL 9171:	35 x 90 x 98 mm

Classification to DIN EN 50155 for IK 9171

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Type

IK 9171.11/200 3/N AC 400/230 V 50/60 Hz 0.85 U_N
Article number: 0049292
SK 9171.11/200 3/N AC 400/230V 50/60Hz 0.85 U_N
Article number: 0054744

- Output: 1 changeover contact
- Nominal voltage U_N: 3/N AC 400/230 V
- Detection of undervoltage at < 0.85 U_N
- Fixed response value: 0.85 U_N
- No time delay
- For 3p3w connection
- Width: 17.5 mm

Variants

I_ 9171/001

- 0 NC circuit operation with N
- 1 NC circuit operation without N

- 0 without time delay
- 3 settable time delay t_1
- 4 settable time delay t_2

- 0 settable response value
- 2 fixed response value

- K width 17.5 mm
- L width 35 mm

IK 9171.11/034:
- with settable time t_1
- NC circuit operation without N
- detection of phase sequence

IL 9171.12/801: as Standard Type /200 but output relay with 5 µm goldplated contacts. This module is also suitable for switching small loads of 1 mVA ... 7 VA, 1 mW ... 7W in the range 0.1 ... 60 V, 1 ... 300 mA. The contacts also permit the maximum switching current (4 A). However, since the gold plating will be burnt off at this current level, the device is no longer suitable for switching small loads after this.

Ordering example for variants

IK 9171 .11 /_ _ _ 3 AC 400 V 50/60 Hz 0.55 ... 1.05 U_N 0.5 ... 20 s

- Time delay t_2
- Response value
- Nominal frequency
- Nominal voltage
- Variant, if required
- Contact
- Type

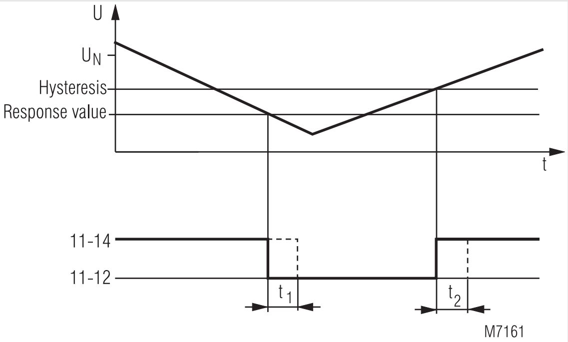
VARIMETER
Undervoltage Relay, Single-Phase
IK 9173, SK 9173

0223316

IK 9173 SK 9173

- According to IEC/EN 60 255, DIN VDE 0435-303
- Monitoring of undervoltage
- Without auxiliary supply
- Optionally fixed or settable response value
- N.C. circuit operation
- Optionally with off-delay t_1
- Optionally with on-delay t_2
- LED indicator for state of output relay
- 1 changeover contact
- Devices available in 2 enclosure versions:
  IK 9173: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9173: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Approvals and Markings

CE

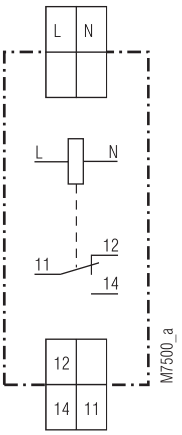
Applications

Monitoring of voltage systems on undervoltage. Automatic switching to emergency supply or of emergency light in the case of phase loss according to DIN VDE 100-710, or DIN VDE 0108.

Variant with t_2 is used in unstable voltage systems, where after phase failure detection the consumers should be energized one after the other. This is done by setting the operate delay of the different relays to different values. This variant is also used where a consumer after only short phase failure should not be started immediately (e.g. compressors).

Suitable for industrial and railway applictions.

Circuit Diagram



IK 9173.11, SK 9173.11

Function

The arithmetic mean value of the voltage L-N is measured.

Indication

yellow LED: output contact active (11-14 closed)

Notes

The time delay for the models with delay t_1 is only active as long as the phase voltage L-N is above 0.5 U_N.

Technical Data

Input Circuit

Nominal voltage U_N:	AC 24, 42, 110, 230 V DC 24, 48, 60, 110, 125 V	
Max. overload:	1.15 U_N continuously	
Nominal consumption:	approx. 6 VA / DC 1 W	
Frequency range:	45 ... 65 Hz	

Setting Ranges

Response value:	fixed: 0.7 or 0.85 U_N adjustable: 0.55 ... 1.05 U_N (0.7 ... 1.0 U_N at DC 24 V)	
Hysteresis:	approx. 4 % of setting value	
Time delay t_1 / t_2:	0.5 ... 20 s	
Reaction time of the measuring input at phase failure:	approx. 100 ms	

Output

Contacts		
IK 9173.11, SK 9173.11:	1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
at AC 230 V, 1 A (cos φ = 0.5):	≥ 3 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60 °C	
Clearance and creepage distances		
rated impulse voltage/ pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	20 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	1 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight		
IK 9173:	65 g	
SK 9173:	83 g	

Dimensions

Width x height x depth	
IK 9173:	17.5 x 90 x 59 mm
SK 9173:	17.5 x 90 x 98 mm

Classification to DIN EN 50155

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Types

IK 9173.11/200, AC 230 V, 0.7 U_N
Article number: 0049812
SK 9173.11/200, AC 230 , 0.7 U_N
Article number: 0054746

- Detection of undervoltage at < 0.7 U_N
- Fixed response value
- Without time delay
- Output: 1 changeover contact
- Nominal voltage U_N: AC 230 V
- Width: 17.5 mm

Variants

IK 9173.11/000

- 0 NC circuit operation

- 0 without time delay
- 3 settable time delay t_1
- 4 settable time delay t_2

- 0 settable response value
- 2 fixed response value

Odering example for variants

IK 9173 .11 /_ _ _ AC 230 V 50/60 Hz 0.55 ... 1.05 U_N 0.5 ... 20 s

- Time delay t_2
- Response value
- Nominal frequency
- Nominal voltage
- Variant, if required
- Contacts
- Type

VARIMETER
Undervoltage Relay
IL 9071, SL 9071

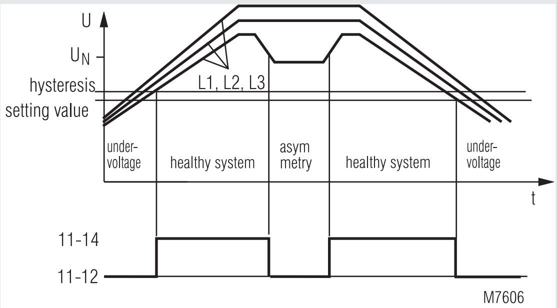
DOLD

0222092

IL 9071 SL 9071

- According to IEC/EN 60 255-1
- Identification of
  - undervoltage
  - phase failure
  - asymmetry also with reverse voltage
  - missing neutral in the system
  - broken neutral on IL/SL 9071
  - neutral exchanged against phase
- Single phase connection possible
- According to DIN VDE 0100-710
  (for rooms used for medical purposes) as an option
- Fixed setting value (variable as an option)
- De-energized on trip
- LED indicator
- With safe disconnection according to IEC/EN 61 140,
  IEC/EN 60 947-1 between the Measuring Circuit and the contacts
- Independant of phase sequence
- 2 changeover contacts
- Devices available in 2 enclosure version:
  IL 9071: depth 61 mm with terminals at the bottom for installations systems and industrial distribution systems according to DIN 43 880
  SL 9071: depth 98 mm with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

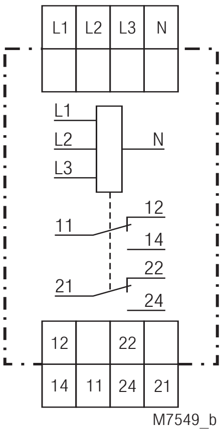
Function Diagram



Additional Information about this topic

- Datasheet undervoltage relay IK/IL 9171
- Relay workshop No. 15 and No. 16:
  The meaning of asymmetry in 3 phase systems (only in German)

Circuit Diagram



IL 9071.12, SL 9071.12

Approvals and Markings

A025518

*) only IL 9071

Applications

Monitoring of three-phase voltage systems to identify undervoltage, asymmetry or phase failure and switching-on of safety lighting in accordance with DIN VDE 0108.

Neutral monitoring in 3-phase systems. In 3-phase systems with neutral often also single phase load are connected between phase and neutral. If the neutral is missing in a system like this unsymmetric voltages occur that could damage single phase consumers if the voltage rises too high. Also consumers can stop to work if the phase-neutral voltage gets too low. The IL 9071 detects this problem and can switch of the system immediately.

Indicators

green LED:	on, when the mains system is working properly (contact 11-14 and 21-24 closed)

Notes

For single phase operation the terminals L1, L2 and L3 have to be bridged

Technical Data

Input

Nominal voltage U_N:		
single-phase connection:	AC 100 V, 115 V, 220 V, 230 V, AC 400 V, 415 V, 440 V, 500V	
3-phase without neutral connection:	3AC 100 V, 115 V, 220 V, 230 V, 3AC 400 V, 415 V, 440 V, 500 V	
3-phasig with neutral connection:	3/N AC 100 V / 58 V; 3/N AC 110 V / 64 V; 3/N AC 200 V / 115 V; 3/N AC 220 V / 127 V; 3/N AC 230 V / 133 V; 3/N AC 400 V / 230 V; 3/N AC 415 V / 240 V; 3/N AC 440V / 254 V; 3/N AC 500 V / 290 V	
Overload:	AC 440 V on all measuring inputs, for at least 1 h	
Voltage range:	0.7 ... 1.1 U_N	
Nominal consumption	approx. 6 VA (L3-N)	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Input current at U_N:	L1-N, L2-N: approx. 1.5 mA L3-N: approx. 25 mA	

Setting Ranges

Setting value U_{off}	
IL 9071/010, SL 9071/010:	0.7 U_N or 0.85 U_N(hysteresis approx. 4 %)
IL 9071/117, SL 9071/117:	0.7 ... 0.95 U_N (hysteresis approx. 4 %)
Asymmetry identification	
IL 9071/117, IL 9071/010, SL 9071/117, SL 9071/010:	approx. 5 ... 10 % phase asymmetry

Output

Contacts		
IL 9071.12, SL 9071.12:	2 changeover contacts	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	4 A	
Switching capacity		IEC/EN 60 947-5-1
AC 15		
NO contact:	3 A / AC 230 V	
NC contact:	2 A / AC 230 V	
Electrical life		IEC/EN 60 947-5-1
AC 15 at 1 A, AC 230 V:	5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated rated impulse voltage voltage / pollution degree:	4 kV / 2	IEC 60 664-1
between Measuring Circuit and contacts	6 kV / 2	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	10 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9071/010:	122 g	
SL 9071/010:	168 g	

Dimensions

Width x height x depth	
IL 9071:	35 x 90 x 61 mm
SL 9071:	35 x 90 x 98 mm

Standard Types

IL 9071.12/010 3/N AC 400 / 230 V 0.85 U_N
Article number: 0047074
SL 9071.12/010 3/N AC 400 / 230 V 0.85 U_N
Article number: 0051006

- with asymmetry detection
- 2 changeover contacts
- Nominal voltage U_N: AC 230 / 3 AC 400 V
- Setting value: 0.85 U_N
- Width: 35 mm

Variants

IL 9071/117, SL 9071/117: according to DIN VDE 0100-710, rooms used for medical purposes, variable setting value

Ordering example for variants

IL 9071 .12 /_ _ _ 3/N AC 400 / 230 V 50/60 Hz 0.7 U_N

Setting value
Nominal frequency
Nominal voltage
Variant, if required
Contacts
Type

VARIMETER
Undervoltage Relay
RK 9871

DOLD

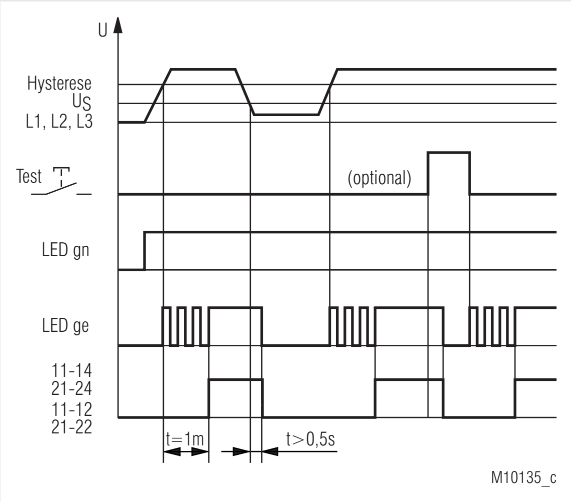
0261531

Your Advantages
- Higher safety in buildings

Features
- According to IEC/EN 60255-1
- For installations according to DIN VDE 0100-718 and DIN VDE 0108-100 (replacement of DIN VDE 0108)
- Detection of undervoltage in 3-phase systems
- Without separately auxiliary voltage (internal supply from all 3 phases)
- LED indication for für operation voltage and contact position
- De-energised on trip
- RK 9871.71: 1 changeover contact
  RK 9871.72: 2 changeover contacts
- Withfixed time delay of 0.5s for fault indication
- Withfixed time delay of 1min for reset
- Withfixed response value at AC 195.5V
- As option with test-button for function control
- Width 17,5 mm

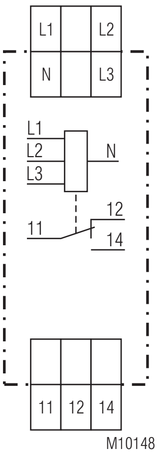
Approvals and Markings

Function Diagramm

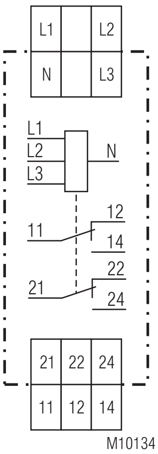


Application
Monitoring of undervoltage in 3 phase voltage systems and switch over to emergency supply
For installations according to
- DIN VDE 0108-100 (emergency lightings)
- VDE 0100-718 (locations for a larger number of people)

Circuit Diagrams



RK 9871.71



RK 9871.72

Function
When connecting the measuring voltage to the measuring inputs L1-L2-L3 at healthy voltage the output relay switches on after the voltage is healthy for at least 1 min.
During this time delay of 1 min the yellow led flashes. After detection of an undervoltage on one or several phases for at least 0.5 sec the output relay de-energises.
The undervoltage relay measures the arithmetic mean value of each of the three phases against neutral.

To measure single-phase voltage terminals L1, L2, L3 have to be linked together.

If a feed back voltage is generated by the load, that is higher then the setting value U_S, the unit will not detect phase failure.

Indication

LED green:	on, when supply connected
LED yellow:	on, when the output relay is energized
LED yellow:	flashes during 1min reset delay time

Safety Notes
- Never clear a fault when the device is switched on.
- The user must ensure that the device and the necessary components are mounted and connected according to the locally applicable regulations and technical standards.
- Adjustments may only be carried out by instructed specialist staff, while the applicable safety rules must be observed.

Technical Data

Input

Measuring voltage = supply voltage

Nominal voltage U_N:	3/N AC 400/230V
Max. overload:	$1.15U_N$ continuous
Nominal consumption:	ca. 6 VA
Nominal frequency:	50 / 60Hz
Measuring frequency range:	45 ... 65 Hz
Response value:	195.5V fixed
Hysteresis:	approx. 5%
Overvoltage category:	III (according to IEC 60664-1)
Accuracy:	± 5%
Repeat accuracy:	< 2%
Temperature influence:	< 1%

Output

Contacts		
RK 9871.71:	1 changeover contact	
RK 9871.72:	2 changeover contacts	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	1 x 10^5 switching cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	1 x 20^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Temperature range:		
operation:	- 25 ... + 55°C	
storage:	- 25 ... + 70°C	
Clearance and creepage distance		
rated impulse voltage /		
pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage		
between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with V0 behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, Frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	25 / 060 /04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 4 mm² solid or 1 x 2,5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Plus-minus terminal screws M3,5 box terminals with wire protection	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx. 70 g	

Dimensions

Width x height x depth:	17.5 x 90 x 66 mm

Standard Type

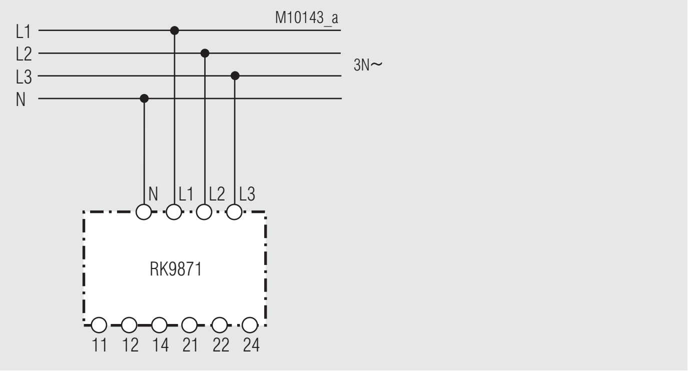
RK 9871.72 3/N AC 400/230V 50 / 60 Hz

Article number:	0062759
• Output:	2 changeover contact
• Nominal voltage U_N:	3/N AC 400/230V
• Width:	17.5 mm

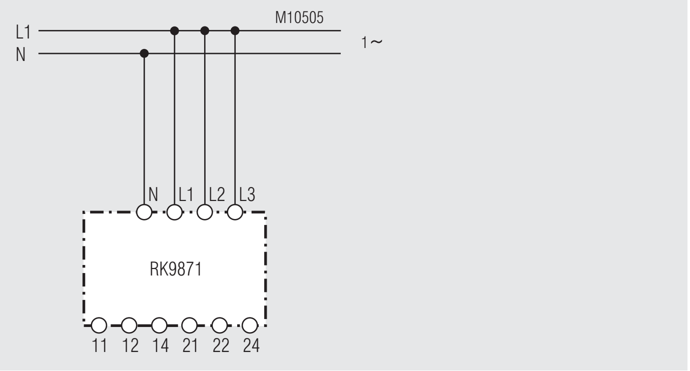
Variant

RK 9871.72/100:	with test-button for simulation of undervoltage

Connection Examples



3-phase



1-phase

VARIMETER
Battery Symmetry Monitor
BA 9054/331, BA 9054/332

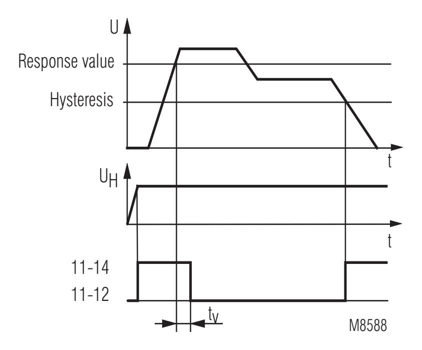
0243311

BA 9054

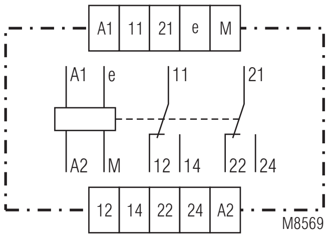
BA 9054/331
- According to IEC/EN 60 255
- To monitor for battery systems (emergency power supply)
- Measuring rang DC 0.12 ... 1.2 V or 0.2 ... 2 V
- Without separately auxiliary voltage
- High overload possible
- With time delay 10 s
- LED indicators for operation and contact position
- Width: 45 mm

BA 9054/332
as BA 9054/331 but with
- battery voltages up to 500 V
- separately auxiliary voltage

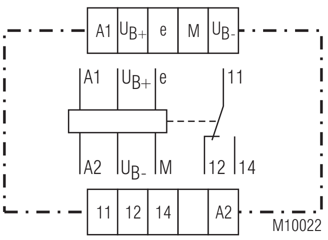
Function Diagram



Circuit Diagram



BA 9054/331



BA 9054/332

Approvals and Markings

CE

Applications

Monitoring of battery systems to find voltage inversions of single cells, internal short circuits and sulphating

Function

The middle connection of a Battery system is connected to terminal "M" of the BA 9054/331. If the two parts of the voltage differ more then the adjusted value for 10 s, the output relay trips. It trips also on broken wire on terminal "M".
The test button allows a test of the unit. It has to be pressed for at least 10 sec.

Indicators

green upper LED:	on, when auxiliary supply connected
yellow lower LED:	on, when output relay acitvated

Remark

Attention: New batteries are not symmetric in the beginning. The battery monitor has to be readjusted after some time of operation. (see setting). The adjustment has to be verifi

Technical Data

Input

Sensitivity of tripping:		
(Measuring range):	DC 0.12 ... 1.2 V absolute scale or DC 0.2 ... 2 V absolute scale	
Resetting value:	98% of operate value, fixed	
Repeat accuracy:	≤ ± 0.5 %	
Time delay t_v:	10 s	
Current middle connection (terminal M):	max 12 µA (bei 60 V bzw. 220 V)	
Principe de mesure:	arithmetic mean value	
Temperature influence:	< 0.05 % / K	

Auxiliary Circuit

BA 9054/331:		
Battery voltage = auxiliary voltage:	DC 24 ... 60 V / DC 110 ... 220 V	
Voltage range:	DC 19 ...80 V / DC 60 ... 300 V	
BA 9054/332:		
Battery voltage (U_B):	DC 200 ... 500 V	
Auxiliary voltage (A1/A2):	AC 230 V	
Voltage range:	0.8 ... 1.1 U_H	
Nominal consumption:	approx. 2.5 VA	
Nominal frequency:	50 / 60 Hz	
Frequency range:	± 5 %	

Output

Contacts:	2 changeover contacts with 5µm gold contacts max. DC 60 V / 300 mA	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC:	8 A / DC 24 V or 0.3 A / DC 220 V	
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	6 AgL	IEC/EN 60 947-5-1
Mechanical life:	50 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 40 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage/ pollution degree		
In-/output:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	200 g	

Dimensions

Width x height x depth:	45 x 75 x 120 mm

Standard Types

BA 9054/331 DC 0.12 ... 1.2 V DC 24 ... 60 V 10 s

Article number:	0056172
• Measuring range:	DC 0.12 ... 1.2 V
• Auxiliary voltage:	DC 24 ... 60 V
• Time delay:	10 s
• Width:	45 mm

BA 9054/331 DC 0.12 ... 1.2 V DC 110 ... 220 V 10 s

Article number:	0056204
• Measuring range:	DC 0.12 ... 1.2 V
• Auxiliary voltage:	DC 110 ... 220 V
• Time delay:	10 s
• Width:	45 mm

BA 9054/332 DC 0.12 ... 1.2 V DC 200 ... 500 V 10 s

Article number:	0062251
• Measuring range:	DC 0.12 ... 1.2 V
• Auxiliary voltage:	AC 230 V
• Battery voltage	DC 200 ... 500 V
• Time delay:	10 s
• Width:	45 mm

Ordering example

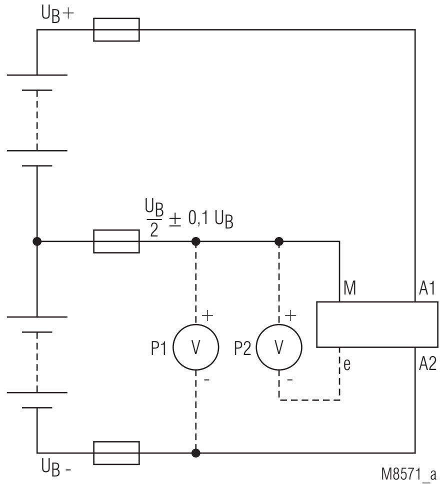
BA 9054 /33_ DC 0.12...1.2 V DC 24 ... 60 V AC 230 V 10 s

Time delay t_v
Auxiliary voltage (only for /332) Battery-voltage
Auxiliary voltage (/331)
Measuring range
Variant
Type

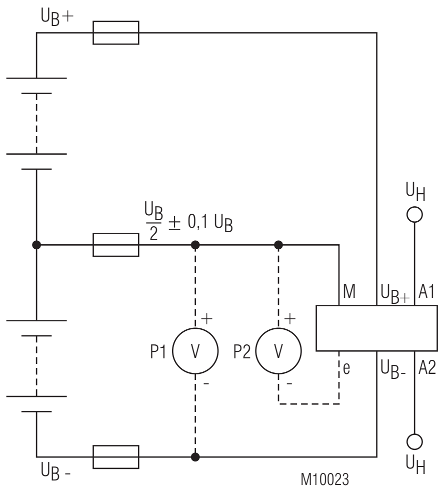
Setting

- Connect the device as shown in application example
- Connect nominal voltage (battery voltage) to A1/A2 (/331 e.g.U_B /332).
- Set potentiometer for response value to min setting (0.12 V)
- Connect auxiliary U_H (/332) to A1, A2
- Find the middle of the battery voltage with the potentiometers for symmetry “grob” and “fein” (tuning and fine tuning). Differences of block batteries can be adjusted up to 12 V. The correct setting is indicated by a green LED.
- Adjust potentiometer for response value to the required value. The device is now ready to use.

Application Example



BA 9054/331



BA 9054/332

Set-up Procedure

Example 1
Symmetric battery

P1= ½ battery voltage
Adjust P2 with tuning and fine tuning potentiometer to 0V

Example 2
60 V battery set, combination of 12 V Block batteries

P1 = 36 V
Adjust P2 with tuning and fine tuning potentiometer to 0V

Example 3
Non symmetric battery (compensation of battery tolerances)

P1 = ½ battery voltage + 200 mV
Adjust P2 with tuning and fine tuning potentiometer to 200 mV

VARIMETER
Undervoltage Relay To Detect Auto-Reclosing
IL 9079, SL 9079

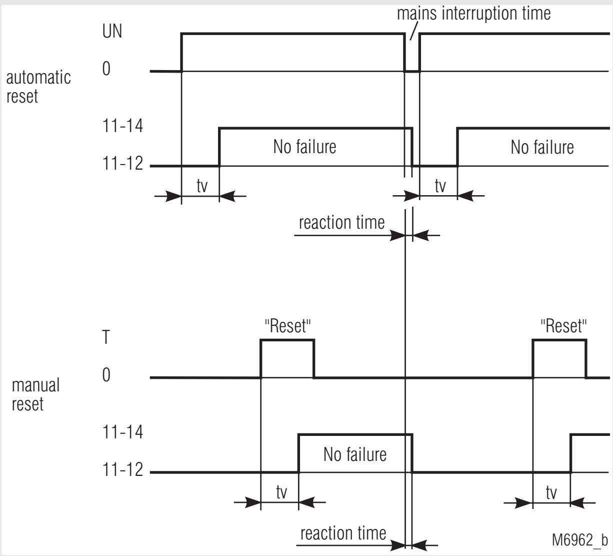
DOLD

0225283

IL 9079 SL 9079

- According to IEC/EN 60 255-1
- Fast detection of undervoltage or phase failure in three-phase voltage systems
- Detects auto reclosing of 20 ms
- Adjustable response value 0.55 ... 1.05 U_N
- Operate delay to generate a defined reset signal
- Manual reset possible with external circuit
- Single-phase connection possible
- Optionallyfixed response value 0.8 U_N
- De-energized on trip
- Green LED indicate for closed contact
- Independant of phase sequence
- 3p4w connection
- Optionally for 3p3w systems
- 2 changeover contacts
- Devices available in 2 enclosure versions:
  IL 9079: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9079: depth 98 mm, with terminals at the top for cabinets for mounting plate and cable duct
- Width 35 mm

Function Diagram



Approvals and Markings

A025518

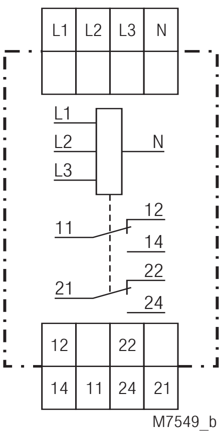
*) nur IL 9079

Applications

Monitoring of voltage systems to detect auto reclosing as e.g. generated by the energy supplier in the case of flash-overs or switching procedures. It is possible that in control circuits some of the devices are resetted during auto reclosing and some not. Because of this uncontrollable situations may occur.

By detecting these fast auto reclosings and addition of a certain time delay at reclosing the OFF-time is lengthened and every device has the time to reset. The circuit goes into a defined OFF state and is automatically resetted after the adjusted time delay or by manual reset if the automatic reset is disabled by an external circuit (see connection examples).

Circuit Diagram



IL 9079.12, SL 9079.12

Function

The voltage of each phase is measured against N (with devices without N L1 and L2 are measured against L3). If at least 1 phase voltage goes under the response value (e.g. 0.8 U_N) the green LED goes off and the output relay deenergizes (fault condition). Only when all 3 phases go over the reset value (e.g. 0.85 U_N) again the output relay energizes after the adjustable operate delay t_v and the green LED comes on.

Indicators

green LED: on, when the mains system is working properly (contact 11-14 and 21-24 closed)

Notes

For single phase operation the terminals L1, L2 and L3 have to be bridged.

Technical Data

Input

Nominal voltage U_N:

IL/SL 9079.12 and 002:	3/N AC 400 / 230 V	
IL/SL 9079.12/001 and /003:	3 AC 400 V, 3 AC 500 V	
SL 9079/103:	3 AC 400 V, 3 AC 500 V	
Maximum overload:	1.1 U_N, permanent	
Nominal consumption:	approx. 8 VA	
Nominal frequency:	50 / 60 Hz	
Input resistance:	approx. 150 kΩ	

Setting Ranges

Response / Reset value		
IL/SL 9079.12 and /001:	0.8 U_N / 0.85 U_N	
IL/SL 9079/002 und /003:	adjustable 0.55 ... 1.05 U_N	
SL 9079/103 3 AC 400 V:	adjustable 0.8 ... 1.05 U_N	
SL 9079/103 3 AC 500 V:	adjustable 0.7 ... 1.05 U_N	
	hysteresis 4 %	
Detection of auto-reclosing:	≥ 20 ms at response value 0.8 U_N	
	≥ 35 ms at response value 0.6 U_N	
Reaction time on phase failure:	approx. 40 ms at response value 0.8 U_N	
	approx. 55 ms at response value 0.6 U_N	
Reclosing delay:	adjustable, 0.2 ... 2 s	

Output

Contacts:		
IL 9079.12, SL 9079.12:	2 changeover contacts	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated rated impulse voltage voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EEMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	10 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9079:	110 g	
SL 9079:	137 g	

Dimensions

Width x height x depth	
IL 9079:	35 x 90 x 59 mm
SL 9079:	35 x 90 x 98 mm

Standard Types

IL 9079.12/002 3/N AC 400 / 230 V 0.55 ... 1.05 U_N 0.2 ... 2 s
Article number: 0047842
SL 9079.12/002 3/N AC 400 / 230 V 0.55 ... 1.05 U_N 0.2 ... 2 s
Article number: 0054759

- 3p4w connection
- Output: 2 changeover contacts
- Nominal voltage U_N: 3/N AC 400 / 230 V
- Adjustable response value: 0.55 ... 1.05 U_N
- Adjustable reclosing delay: 0.2 ... 2 s
- Width: 35 mm

Variants

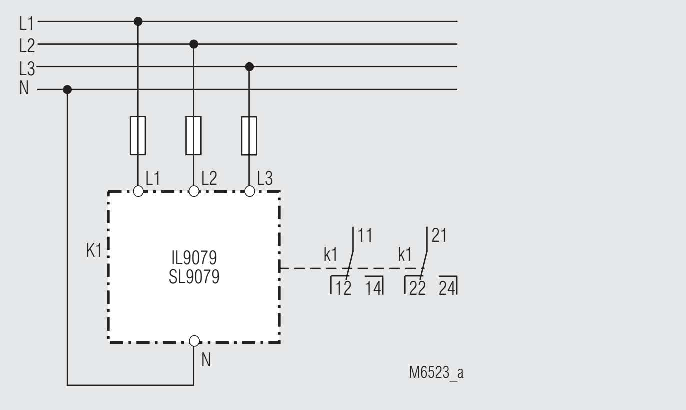
IL 9079:	for 3p4w systems, fixed response value 0.8 U_N
IL 9079/001:	for 3p3w systems, fixed response value 0.8 U_N
IL 9079/002:	for 3p4w systems, adjustable response value 0.55 ... 1.05 U_N
IL 9079/003:	for 3p3w systems, adjustable response value 0.55 ... 1.05 U_N
IL 9079/103:	for 3p3w systems,
3 AC 400 V:	adjustable response value 0.8 ... 1.05 U_N
3 AC 500 V:	adjustable response value 0.7 ... 1.05 U_N with transformator for mains with harmonic content

Ordering example for variants

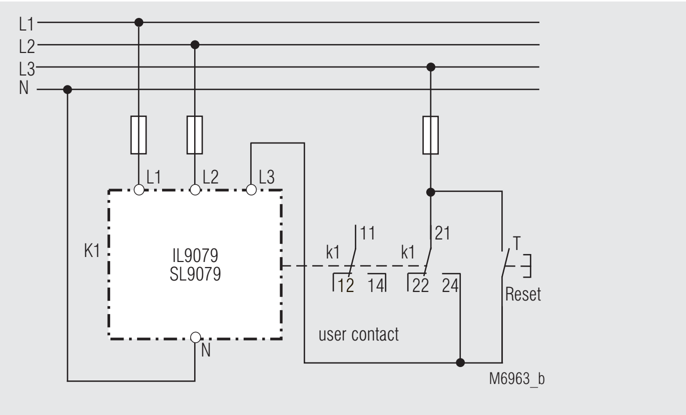
IL 9079 .12/_ _ _ 3/N AC400/230V 50/60Hz 0.55 ... 1.05 U_N 0.2...2 s

Time delay tv
Response value
Nominal frequency
Nominal voltage
Variant, if required
Contacts
Type

Connection Examples

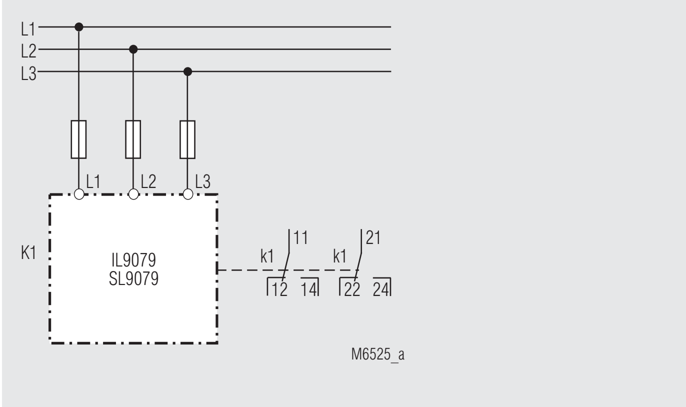


IL/SL 9079 and IL/SL 9079/002

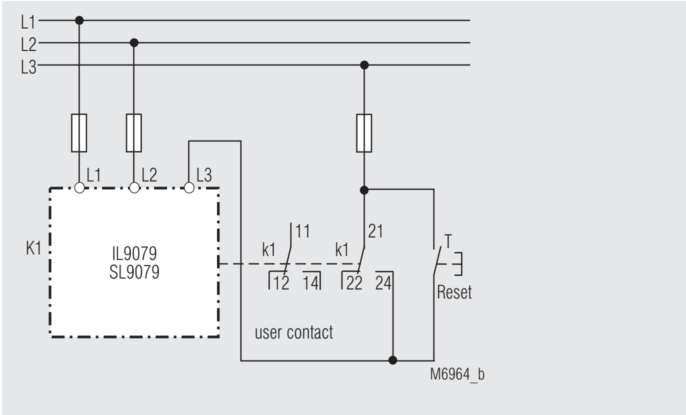


IL/SL 9079 and IL/SL 9079/002

Connection Examples



IL/SL 9079/001 and /003; SL 9079/103



IL/SL 9079/001 and /003; SL 9079/103

VARIMETER
Current Relay
RL 9853

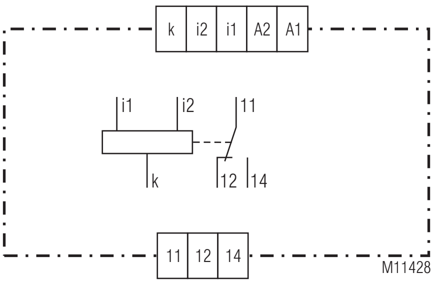
DOLD

0273494

Product Description

The measuring relay RL 9853 of the VARIMETER series monitors over-current and undercurrent in AC or DC current systems. The monitoring functions are easily selectable using a single turn switch without complex menu structure. The early detection of up-coming break downs and pre-ventive maintenance avoid expensive damages. As user you profit from the reliability and availability of your plant.

Circuit Diagram



Terminals i1/k: 2 mA … 11 mA; 0,1 A … 1,1 A
Terminals i2/k: 10 mA … 110 mA; 1 A … 10 A

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
i1, i2, k	Current measuting input
11, 12, 14	Changeover contact (outputrelays)

Your Advantages
- Preventive maintenance
- For better productivity
- High repeat accuracy
- Wide measuring voltage range
- Easy setting

Features
- According to IEC/EN 60 255-1
- For monitoring of current in DC and AC systems
- Detection of over- or undercurrent in AC- or DC mains
- Wide auxiliary range
- Output: 1 changeover contact
- De-Energized on trip
- Adjustable switching current
- Adjustable hysteresis for reset
- Adjustable switching delay
- Fast fault detection
- Width: 35 mm

Approvals and Markings

CE | c UL us LISTED
Canada / USA

Application

- Monitoring of current in DC and AC systems to identify overcurrent and undercurrent
- Switch over to emergency supply after fault detection

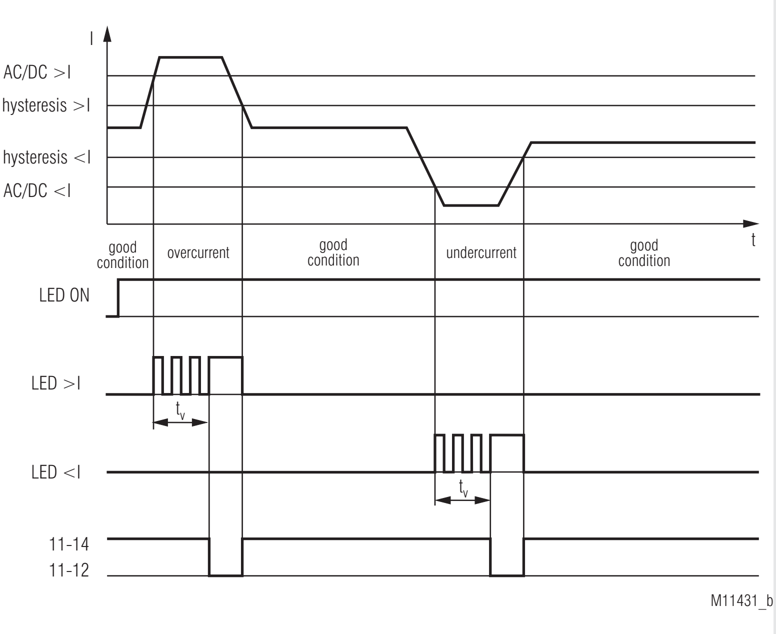
Indicator

green LED „ON“:	on, when supply connected
red LED „>I_N“:	on, when overcurrent
red LED „<I_N“:	on, when undercurrent

Function

When monitoring overcurrent or undercurrent the exceeding of the setting values above or below the thresholds is indicated by flashing of the current indicating LED. After the time delay the current indicating is continuously on and the relay de-energises. If the current returns to normal value, the LED goes immediately off and the output relay energises.

Function Diagram



Notes

The current to be measured can also be sourced from the auxiliary supply. In this case the galvanic separation between auxiliary supply and measuring circuit is without effect. Depending on the required net form the following monitoring functions can be set using the function switch:

Function select	Type of current	Monitoring function
AC $> I_N$	AC	Overcurrent
AC $< I_N$	AC	Undercurrent
DC $> I_N$	DC	Overcurrent
DC $< I_N$	DC	Undercurrent

AC/DC measuring ranges (variant 100 mA)				
Terminals	Measuring range		Internal resistance	Max. therm.contin. current
i1/k	DC	2 mA … 11 mA	10 Ω	50 mA
	AC	2 mA … 11 mA		
i2/k	DC	10 mA … 110 mA	1,0 Ω	200 mA
	AC	10 mA … 110 mA		

AC/DC measuring ranges (variant 10 A)				
Terminals	Measuring range		Internal resistance	Max. therm.contin. current
i1/k	DC	0.1 A … 1.1 A	40 mΩ	2 A
	AC	0.1 A … 1.1 A		
i2/k	DC	1 A … 10 A	4 mΩ	12 A
	AC	1 A … 10 A		

Technical Data

Auxiliary circuit

Auxiliary voltage U_H:	DC 24 AC 110 … 230 V 1-phase with neutral	
Voltage range:	0.8 … 1.1 U_H	
Nominal frequency:	50 / 60 Hz	
Nominal consumption:	approx. 5 VA	

Input

Operating current I_B:	AC/DC 2 mA … 100 mA, 100 mA … 10 A	

Output

Contact:	1 changeover contact	
Contact material:	AgNi	
Switching voltage:	AC 250 V	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	typ. 3 x 10^5 switching cyles	
Short circuit strength		IEC/EN 60 947-5-1
max. fuse rating:	5 A gL	
Mechanical life:	> 30 x 10^6 switching cyles	

Measuring circuit

Measuring current:	infinite adjustable 10 % … 110 % I_B	
Hysteresis:	infinite adjustable 4 ... 20 %	
Switching delay t_v:	infinite adjustable instantaneuos, 2 … 30 s	
Repeat accuracy:	± 2 %	
Temperature influence:	± 1 %	

Attention:
The combination of adjusted switching current I and hysteresis △I must be within the measuring range.

General Data

Operating mode:	continuous operation	
Temperature range		
Operation:	- 20 ... + 55 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	93 % at 40 °C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
Rated impuls voltage/		
Pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	12 V / m	IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge		
between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Enclosure:	Thermoplastic with V0 behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Class I	IEC/EN 60 255-21
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection:		DIN 46 228-1/-2/-3/-4
Fixed screw terminals		
Cross section:	0.2 ... 4 mm² (AWG 24 - 12) solid or 0.2 ... 2.5 mm² (AWG 24 - 12) stranded wire with and without ferrules	
Stripping length:	7 mm	
Fixing torque:	0.6 Nm	EN 60 999-1
Wire fixing:	Captive slotted screw / M2.5	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 105 g	

Dimensions

Width x height x depth:	35 x 90 x 71 mm

UL-Data

ANSI/UL 60947-1, 5th Edition
ANSI/UL 60947-5-1, 3rd Edition

CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition
CAN/CSA-C22.2 No. 60947-5-1-14, 1st Edition

Switching capacity:	Pilot duty B300 5A 240Vac Resistive, G.P. 5A 30Vdc Resistive or G.P. 5A 250Vac G.P.
Wire connection:	60°C / 75°C copper conductors only AWG 24 - 12 Sol/Str Torque 0.6 Nm

Technical data that is not stated in the UL-Data, can be found in the technical data section

Standard Type

RL 9853.11 AC/DC 0,1 … 10 A AC 110 … 230 V 4 ... 20 % 0 ... 30 s

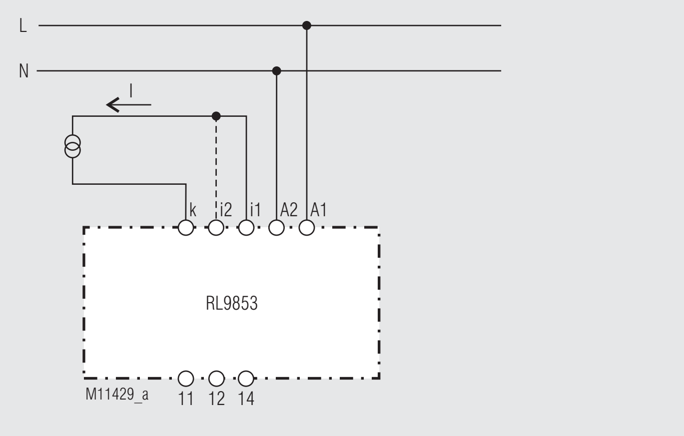
Article number:	0066431
• Output:	1 Wechsler
• Operating current:	AC/DC 0,1 … 10 A
• Auxiliary voltage U_H:	AC 110 … 230 V
• Hysteresis:	4 ... 20 %
• Switching delay:	0 ... 30 s
• Width:	35 mm

Ordering Example

RL 9853 .11 /00_ AC/DC 0,1 … 10 A AC 110 … 230 V 4 ... 20 % 0 ... 30 s

- Switching delay
- Hysteresis
- Auxiliary voltage
- Operating current
  AC/DC 2 … 100 mA
  AC/DC 0.1 … 10 A
- Operation mode/Outputs
  0: De-Energized on trip
  1: Energized on trip
- Contacts
- Type

Connection Example



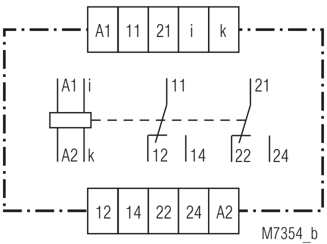
VARIMETER
Current Relay
BA 9053, MK 9053N

DOLD

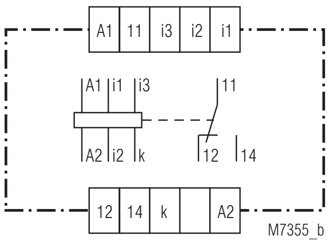
0221540

BA 9053 MK 9053N

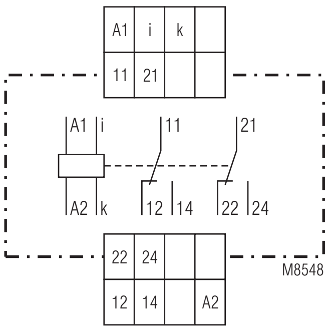
Circuit Diagrams



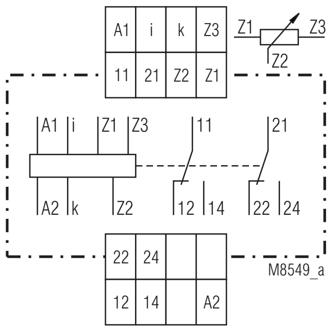
BA 9053



BA 9053/4_ _ z. B.:
Terminals i1/k: 0.1 ... 1 A
Terminals i2/k: 0.5 ... 5 A
Terminals i3/k: 1 ... 10 A



MK 9053N



MK 9053N/1_ _

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
i, k	Current measuring input
11, 12, 14	1st changeover contact
21, 22, 24	2nd changeover contact
at MK 9053/1_ _: Z1, Z2, Z3	Remote potentiometer for response value

Safety Notes

Please observe when connecting a remote potentiometer to MK 9053N/1_ _:

WARNING

Measuring circuit and remote potentiometer not galvanically separated. The voltage on on measuring circuit i, k / PE has connection to the remote potentiometer. The remote potentiometer has to be connected volt- and ground-free.

Your Advantages

- Preventive maintenance
- For better productivity
- Quicker fault locating
- Precise and reliable

Features

- According to IEC/EN 60 255-1, IEC/EN 60 947-1
- to: monitor DC and AC
- BA 9053 with measuring ranges from 2 mA to 25 A
- BA 9053 optionally with 3 measuring ranges 0.1 up to 25 A
- MK 9053N with measuring ranges from 2 mA up to 10 A
- High overload possible
- Input frequency up to 5 kHz
- Galvanic separation between auxiliary circuit - measuring ciruit
- Auxiliary supply AC/DC; BA 9053 with AC
- BA 9053 optionally with start-up delay (MK = standard)
- with time delay, up to max. 100 sec
- BA 9053 optionally with safe separation to IEC/EN 61140
- MK 9053N optionally with remote potentiometer
- As option with manual reset
- Option withfixed settings possible
- LED indicators for operation and contact position
- MK 9053N as option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width BA 9053: 45 mm
  Width MK 9053N: 22.5 mm

Approvals and Markings

CE c UL us * Canada / USA CCC A025518

* see variants

Applications

- Monitoring current in AC or DC systems
- For industrial and railway applications

Function

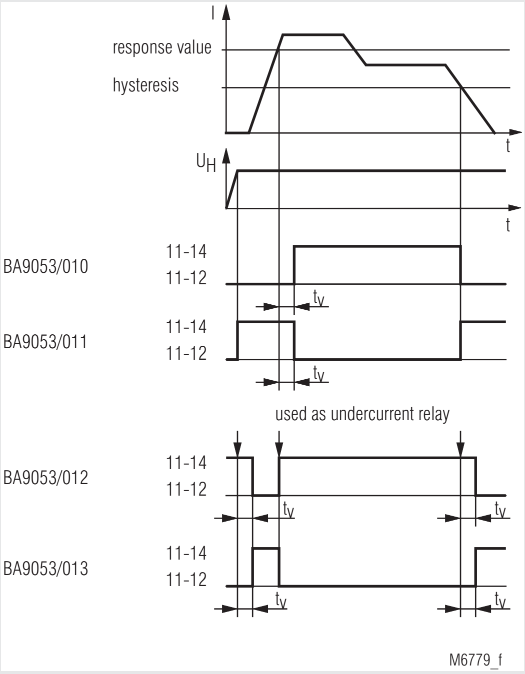
The relays measure the arithmetic mean value of the rectified measuring current. The AC units are adjusted to the r.m.s value. They have settings for response value and hysteresis. The units work as overcurrent relays but can also be used for undercurrent detection. The hysteresis is dependent on the response value.

2 time delays are possible in different variants:
The start up delay t_a operates only when connecting the auxiliary supply. It disables tripping e.g. caused by an increased starting current of a motor. The response delay t_v is active after exceeding a response value. On overcurrent relays the delay is active when the current goes over the tripping value, on undercurrent relays when the current drops below the hysteresis value.

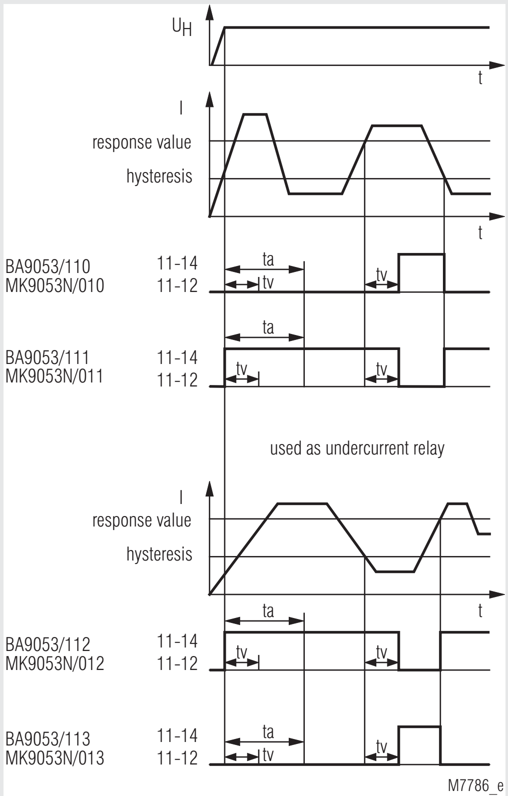
Indicators

green LED: on, when auxiliary supply connected
yellow LED: on, when output relay acitvated

Function Diagram without Start-up Delay



Function Diagram with Start-up Delay



On model BA 9053/6_ _ with manual reset the contacts remain in the fault state after detecting a fault or after to has elapsed. The contacts are reset by disconnecting the supply voltage.

Input (i, k)

BA 9053 for AC **a n d** DC				
Measuring range*)		internal resis-tance	max. perm. cont. current	max. permiss. current 3 s On, 100 s Off
AC	DC		Device mounted without distance	
2 - 20 mA	1.8 - 18 mA	1.5 Ω	0.7 A	1 A
20 - 200 mA	18 - 180 mA	0.15 Ω	2 A	4 A
30 - 300 mA	27 - 270 mA	0.1 Ω	2.5 A	8 A
50 - 500 mA	45 - 450 mA	0.1 Ω	2.5 A	8 A
80 - 800 mA	72 - 720 mA	40 mΩ	4 A	12 A
0.1 - 1 A	0.09 - 0.9 A	30 mΩ	4 A	12 A
0.5 - 5 A	0.45 - 4.5 A	6 mΩ	10 A	30 A
1 - 10 A	0.9 - 9 A	3 mΩ	20 A	40 A
1.5 - 15 A	1.35 - 13.5 A	3 mΩ	25 A	40 A
2 - 20 A	1.8 - 18 A	3 mΩ	25 A	40 A
2.5 - 25 A	2.25 - 22.5 A	3 mΩ	25 A	40 A

* DC or AC current 50 ... 5000 Hz
(other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

BA 9053/4_ _ with 3 measuring ranges:			
Range:	**Terminals i1/k**	**Terminals i2/k**	**Terminals i3/k**
AC 20 mA / 200 mA / 1A:	AC 2.0 ... 20 mA	AC 20 ... 200 mA	AC 0.1 ... 1 A
	DC 1.8 ... 18 mA	DC 18 ... 180 mA	DC 0.09 ... 0.9 A
AC 1 / 5 / 10A:	AC 0.1 ... 1 A	AC 0.5 … 5 A	AC 1.0 ... 10 A
	DC 0.09 ... 0.9 A	DC 0.45 ... 4.5 A	DC 0.9 ... 9 A
AC 5 / 10 / 25A:	AC 0.5 ... 5 A	AC 1.0 ... 10 A	AC 2.5 ... 25 A
	DC 0.45 ... 4.5 A	DC 0.9 ... 9 A	DC 2.25 ... 22.5 A

MK 9053N with 1 Measuring range for AC **a n d** DC					
Measuring rang*)		internal resis-tance	max. perm. cont. current		max. permiss. current 3 s On, 100 s Off
AC	DC		Device mount. without distance	with 5 mm dis-tance	
2 - 20 mA	1.8 - 18 mA	1.5 Ω	0.5 A	0.7 A	1 A
20 - 200 mA	18 - 180 mA	0.15 Ω	1.5 A	2 A	4 A
30 - 300 mA	27 - 270 mA	0.1 Ω	2 A	2.5 A	8 A
50 - 500 mA	45 - 450 mA	0.1 Ω	2 A	2.5 A	8 A
0.1 - 1 A	0.09 - 0.9 A	30 mΩ	3 A	4 A	8 A
0.5 - 5 A	0.45 - 4.5 A	6 mΩ	8 A	11 A	20 A
1 - 10 A	0.9 - 9 A	3 mΩ	12 A	15 A	20 A

* DC or AC current 50 ... 5000 Hz
(Other frequency ranges of 10 ... 5000 Hz, e.g. 16 $^2/_3$ Hz on request)

Extending of measuring range: For DC-current higher then the highest measuring range the voltage relay BA 9054 or MK 9054N measuring range 15 ... 150 mV or 6 ... 60 mV can be used with external Shunt.
For AC current higher then the highest measuring range can be used a current transformer e. g. with secondary winding of 1 A or 5 A togehter with BA 9053 or MK 9053N. The nominal load of the CT should be ≥ 0.5 VA.

Measuring principle: arithmetic mean value

Adjustment: The AC - devices can also monitor DC current. The scale offset in this case is: (I = 0.90 I_{eff})

Temperature influence:: < 0.05 % / K

Setting Ranges

Setting

Response value: infinite variable 0.1 I_N ... 1 I_N relative scale

Hysteresis
at AC: infinite variable 0.5 ... 0.98 of setting value
at DC: infinite variable 0.5 ... 0.96 of setting value

Accuracy:
Response value at
Potentiometer right stop (max): 0 .... + 8 %
Potentiometer left stop (min): - 10 .... + 8%

Repeat accuracy: ≤ ± 0.5 %

Recovery time
at devices with manual reset (Reset by braking of the auxiliary voltage)
BA 9053/6_ _; MK 9053N/6_ _: ≤ 1 s (dependent to function and auxiliary voltage)

Time delay t_v: infinite variable at logarithmic scale from 0 ... 20 s, 0 ... 30 s, 0 ... 60 s, 0 ... 100 s setting 0 s = without time delay

Start-up delay t_a:
BA 9053/1 _ _: 1 ... 20 s; 1 ... 60 s; 1 ... 100 s, adjustable on logarithmic scale. t_a is started when the supply voltage is connected. During elapse of time the output contact is in good state
MK 9053N: 0.1 ... 20 s; 0.1 ... 60 s; 0.1 ... 100 s

Auxiliary Circuit BA 9053 and MK 9053N

Auxiliary voltage U_H (A1, A2)
BA 9053, Nominal voltages: AC 24, 42, 110, 127, 230, 400 V
Voltage range: 0.8 ... 1.1 U_H
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 %
Nominal consumption: 2.5 VA

BA 9053:		
Nominal voltage	**Voltage range**	**Frequency range**
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 40 ... 265 V	45 … 400 Hz; DC 48 % W
	DC 40 ... 300 V	W ≤ 5 %
DC 12 V	DC 10 ... 18 V	battery voltage

MK 9053N:		
Nominal voltage	**Voltage range**	**Frequency range**
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 60 ... 265 V	45 … 400 Hz; DC 48 % W
	DC 60 ... 300 V	W ≤ 5 %

Nominal consumption: 4 VA; 1.5 W at AC 230 V Rel. energized
1 W at DC 80 V Rel. energized

Technical Data

Output

Contacts

BA 9053:	2 changeover contacts	
MK 9053N:	2 changeover contacts	
Thermal current I_{th}:		
BA 9053:	2 x 5 A	
MK 9053N:	2 x 4 A	
Switching capacity		
BA 9053		
to AC 15:		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
MK 9053N		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60 947-5-1
BA 9053, MK 9053N		
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
BA 9053		
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
MK 9053N		
to AC 15 at 3 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Short-circuit strength		
max. fuse rating:	6 A gG (gL)	IEC/EN 60 947-5-1
Mechanical life		
BA 9053:	50 x 10^6 switching cycles	
MK 9053N:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
BA 9053 (operation):		
≤ 10 A:	- 40 ... + 60°C	
≥ 15 A:	- 40 ... + 50°C (higher temperature with limitations on request)	
MK 9053N (operation):	- 20 ... + 50°C (higher temperature with limitations on request)	
BA 9053, MK 9053N (storage):	- 40 ... + 70°C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
BA 9053 meas. range ≤ 10 A:	6 kV / 2	IEC 60 664-1
BA 9053 meas. range ≥ 15 A:	4 kV / 2	IEC 60 664-1
MK 9053N:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages		
between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance		
BA 9053		
≤ 10 A:	40 / 060 / 04	IEC/EN 60 068-1
≥ 15 A:	40 / 050 / 04	IEC/EN 60 068-1
MK 9053N:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection		
BA 9053:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve	
MK 9053N:		
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	$12^{\pm 0.5}$ mm	
Wire fixing:		
BA 9053:	Plus-minus terminal screws M3.5 with self-lifting clamping piece	IEC/EN 60 999-1
MK 9053N:	Plus-minus terminal screws M3.5 box terminals with wire protection or cage clamp terminals	
Stripping length:	10 mm	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail	IEC/EN 60 715
Weight		
BA 9053:	AC-device: 280 g AC/DC-device: 200 g	
MK 9053N:	150 g	

Dimensions

Width x height x depth	
BA 9053:	45 x 75 x 120 mm
MK 9053N:	22.5 x 90 x 97 mm

Classification to DIN EN 50155 for BA 9053

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations	
Protective coating of the PCB:	No	

UL-Data

Auxiliary voltage U_H(A1, A2)		
BA 9053:	AC 24, 42, 48, 110, 115, 120 V	
Thermal current I_{th}:		
BA 9053:	2 x 5 A	
MK 9053N:	2 x 4 A	
Clearance and creepage distances		
BA 9053, MK 9053N:	4 kV / 2	IEC 60 664-1
HF irradiation		
BA 9053 (80 MHz ... 2.7 GHz)	10 V/m	IEC/EN 61 000-4-3
Switching capacity:	Pilot duty B150	
Ambient temperature:	- 40 ... + 60°C	

Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Switching capacity		
to AC 15:	1.5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

BA 9053/010 AC 0.5 ... 5 A AC 230 V
Article number: 0053128
- for Overcurrent monitoring
- Measuring range: AC 0.5 ... 5 A
- Auxiliary voltage U_H: AC 230 V
- Time delay by I_{an}: 0 ... 20 s
- Width: 45 mm

BA 9053/012 AC 0.5 ... 5 A AC 230 V
Article number: 0053192
- for Undercurrent monitoring
- Measuring range: AC 0.5 ... 5 A
- Auxiliary voltage U_H: AC 230 V
- Time delay by I_{ab}: 0 ... 20 s
- Width: 45 mm

MK 9053N.12/010 AC 0.5 ... 5 A AC/DC 80 ... 230 V t_v 0 ... 20 s t_a 0.1 ... 20 s
Article number: 0063176
- for Overcurrent monitoring
- Measuring range:: AC 0.5 ... 5 A
- Auxiliary voltage U_H: AC/DC 80 ... 230 V
- Time delay by t_v: 0 ... 20 s
- Start up delay t_a: 0.1 ... 20 s
- Width: 22.5 mm

Ordering Example for Variants

BA 9053 /_ _ _ /61 AC 1 ... 10 A AC 24 V 0 ... 20 s 1 ... 100 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- /61: With UL-approval
- Variants (second and third digits):
  - 10 Overcurrent relay energized on trip time delay at setting value
  - 11 Overcurrent relay de-energized on trip time delay at setting value
  - 12 Undercurrent relay de-energized on trip time delay at hysteresis value
  - 13 Undercurrent relay energized on trip time delay at hysteresis value
- Variant (first digit):
  - 0 Standard version
  - 1 With start up delay t_a
  - 2 With safe electrical separation of input- and output circuit accroding to DIN 61140
    Meas. range up to ≤ 10 A: DIN EN 60947-1; 4 kV/2 in relation of over-voltage category III with basic insulation to DIN EN 60664-1 of 4 kV;
    Meas. range up to ≥ 15 A: overvoltage category II with basic insulation of 2.5 kV
  - 3 With 5 µm gold plated contacts
  - 4 With 3 current ranges 1 C/O contact
  - 431 With 3 current ranges 1 C/O contact, with safe separation up to 10 A
  - 5 With forcibly guided contacts
  - 6 With manual reset, resetting by disconnecting the power supply
- Type

MK 9053N _ _ /_ _ _ AC 0,1 ... 1 A AC 230 V 0 ... 20 s 0,1 ... 20 s

- Start up delay t_a
- Time delay t_v
- Auxiliary voltage
- Measuring range
- Variants:
  - 10 Overcurrent relay energized on trip
  - 11 Overcurrent relay de-energized on trip
  - 12 Undercurrent relay de-energized on trip
  - 13 Undercurrent relay energized on trip
- Variant:
  - 0 Standard version without remote potentiometer
  - 1 Standard version with remote poten-tiometer (response-value) Z1, Z2, Z3 for 470 kΩ **at this version there is no potentiometer for the response value**
  - 6 With manual reset, resetting by disconnecting the power supply
- Type of terminals
  Without indication: terminal blocks fixed, with screw terminals
  PC (plug in cage clamp): pluggable terminal blocks with cage clamp terminals
  PS (plug in screw): pluggable terminal blocks with screw terminals
- Type

Options with Pluggable Terminal Blocks

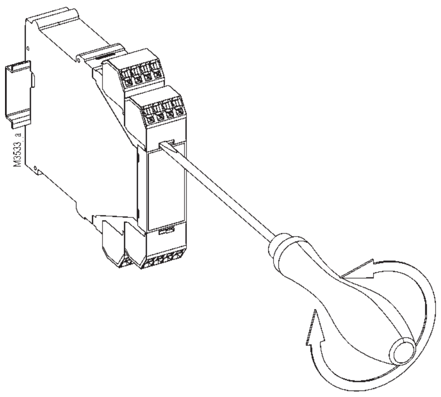
Screw terminal
(PS/plugin screw)

Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Accessories

AD 3:	Remote potentiometer 470 KΩ Article number: 0050174

Setting

Example:
Current relay BA 9053 / MK 9053N AC 0.5 ... 5 A

AC according to type plate:
i.e. the unit is calibrated for AC
0.5 ... 5 A = measuring range

Response value AC 3 A
Hysteresis AC 1.5 A

Settings:

upper potentiometer:	0.6	(0.6 x 5 A = 3 A)
lower potentiometer:	0.5	(0.5 x 3 A = 1.5 A)

The AC - devices can also monitor DC current. The scale offset in this case is: $\overline{I} = 0.90 \times I_{eff}$

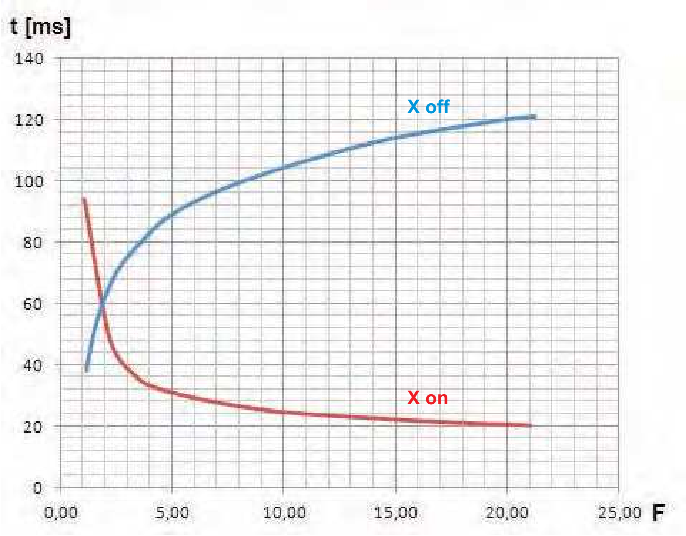
AC 0.5 ... 5 A is equivalent to DC 0.45 ... 4.5 A

Response value DC 3 A
Hysteresis DC 1.5 A

Settings:

upper potentiometer:	0.66	(0.66 x 4.5 A = 3 A)
lower potentiometer:	0.5	(0.5 x 3 A = 1.5 A)

Characteristic



M11504_a

Time delay of measuring circuit

X on: Measured value rise $F = \dfrac{\text{Measured value (after rise of measured value)}}{\text{Setting value}}$

X off: Measured value drops $F = \dfrac{\text{Mesaured value (befor measured value drops)}}{\text{Setting value (hysteresis)}}$

The diagram shows the typical delay of a standard devices depending on the measured values "X on and X off" at sudden rise or drop of the signal. At slow change of the measured value the delay is shorter.
The total reaction time of the device results from the adjustable delay t_v and the delay created by the measuring circuit.

The diagram shows an average delay. The delay times could differ on the different variants.

Example for "X on" (overcurrent detection with BA9053/010):
Adjusted setting value X on = 2 A.
Due to a stalled motor the current rises suddenly to 10 A.

$$F = \frac{\text{Measured value (after rise of measured value)}}{\text{Setting value}} = \frac{10\text{ A}}{2\text{ A}} = 5$$

Reading from the diagram:
The output relay switches on after 31 ms at a setting t_v=0.

Example for "X off" (undercurrent detection with BA9053/012):
Adjusted hysteresis setting value is 10 A.
The current drops suddenly from 23 A to 0 A.

$$F = \frac{\text{Mesaured value (befor measured value drops)}}{\text{Setting value (hysteresis)}} = \frac{23\text{ A}}{10\text{ A}} = 2.3$$

Reading from the diagram:
The output relay switches off after 70 ms at a setting t_v=0.

VARIMETER
Overcurrent Relay
IK 9270, IL 9270, IP 9270, SK 9270, SL 9270, SP 9270

0224259


IK 9270


IL 9270


IL 9270/5_ _


SL 9270/5_ _


SK 9270


IP 9270


SL 9270CT


SP 9270CT

- According to IEC/EN 60 255-1
- IP 9270, SP 9270CT: 3-phase
  IK 9270, SK 9270, IL 9270, SL 9270CT: single phase
- Measuring ranges from 0.1 ... 100 A
- Settable response value
- Fixed hysteresis
- Settable time delay
- De-energized on trip
- As option energized on trip
- LED indicators
- With auxiliary voltage
- Auxiliary supply and measuring input galvanic separated
- Devices available in 2 enclosure versions:
  - I-model, e.g. IK _ _ _ _, depth 61 mm
    with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  - S-model, e.g. SK _ _ _ _, depth 100 mm
    with terminals at the top for cabinets with mounting plate and cable duct
- Width IK 9270, SK 9270: 17.5 mm
  IL 9270, SL 9270CT: 35 mm
  IP 9270, SP 9270CT: 70 mm

Approvals and Markings

A025518

*) only IL-devices

Applications

Overcurrent detection in single phase or 3-phase voltage systems

Indicators

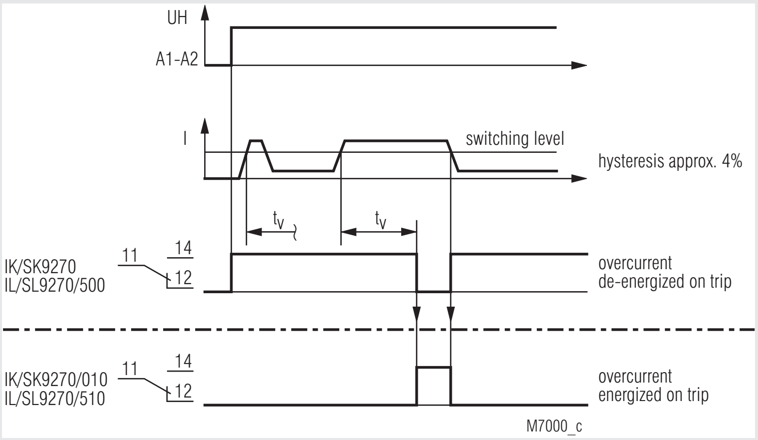
IK 9270.11, SK 9270.11
IL 9270.11/5_ _,
SL 9270.11/5_ _:

LED green:	aux. supply connected
LED yellow:	output contacts switched

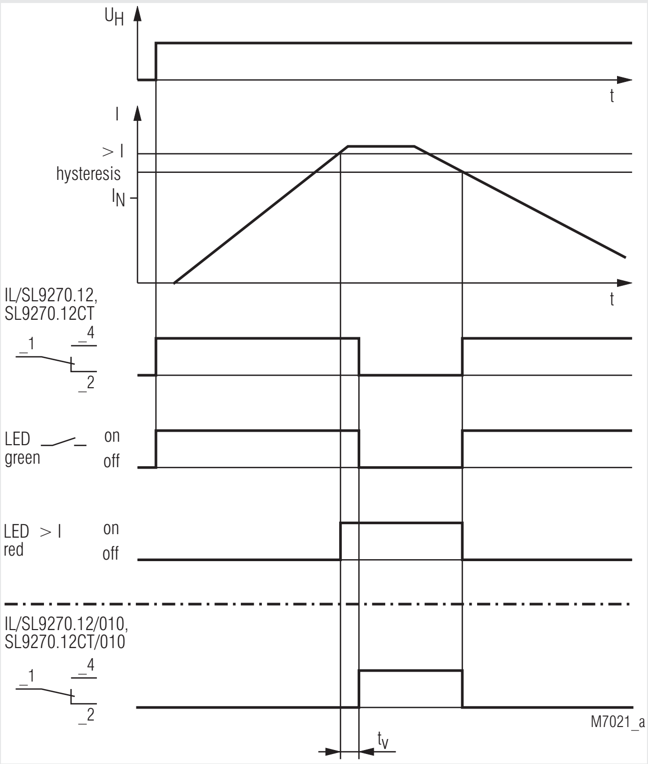
IL 9270, SL 9270,
IP 9270, SP 9270:

LED green:	current within limits
LED red I_{max}:	overcurrent

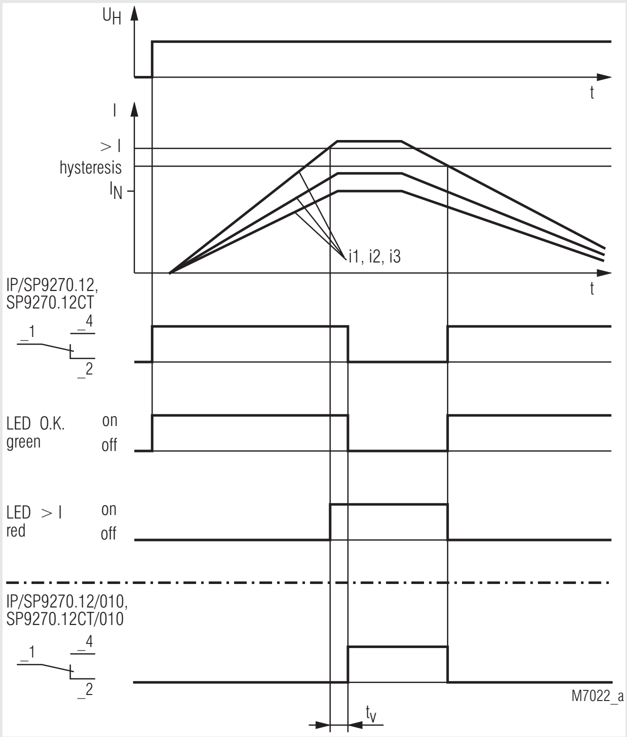
Function Diagram IK/SK 9270, IL/SL 9270.11/500



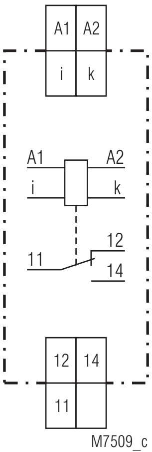
Function Diagram IL 9270.12, SL 9270.12



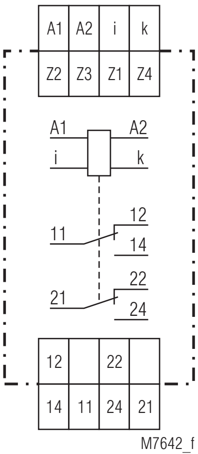
Function Diagram IP 9270, SP 9270



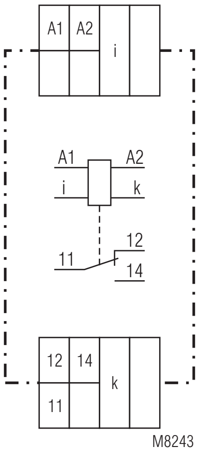
Circuit Diagrams



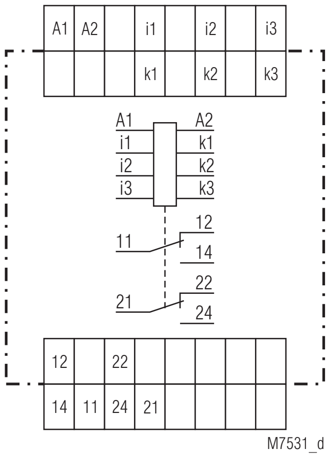
IK 9270.11, SK 9270.11



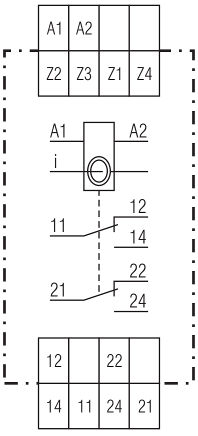
IL 9270.12, SL 9270.12



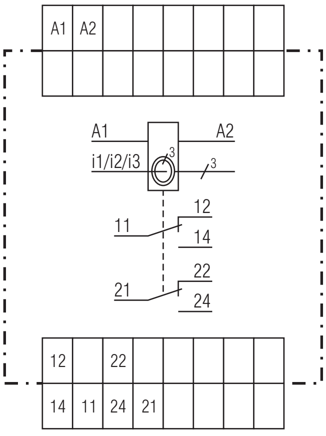
IL 9270.11/5_ _



IP 9270.12, SP 9270.12



SL 9270.12CT



SP 9270.12CT

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage AC or DC
i, k	Current measuring circuit AC or DC
i1, k1; i2, k2; i3, k3	Current measuring circuit phase 1; 2; 3
Z1 / Z2, Z3, Z4	Measuring ranges with bridges via terminals
11, 12, 14	Contacts Rel. 1
21, 22, 24	Contacts Rel. 2

Technical Data

Type						
	IK 9270	**SL 9270/5_ _**	**IL 9270**	**SL 9270CT**	**IP 9270**	**SP 9270CT**
Depth 61 mm	IK 9270.11	IL 9270.11/5_ _	IL 9270.12	-	IP 9270.12	-
Depth 100 mm	SK 9270.11	SL 9270.11/5_ _	SL 9270.12	SL 9270.12CT	SP 9270.12	SP 9270.12CT
Width	17.5 mm	35 mm	35 mm	35 mm	70 mm	70 mm
Measuring input	single-phase	single-phase	single-phase	single-phase	3-phase	3-phase
Measuring range (Nominal frequency 50 ... 400 Hz)	**0.1 ... 15 A** 4 part ranges settable with switch: 0.1 ... 1 A 0.5 ... 5 A 1 ... 10 A 1.5 ... 15 A Max. thermal continuous current: 20 A at 50 °C 15 A at 60 °C	**0.1 ... 50 A** 5 part ranges settable with switch: 0.1 ... 1 A 0.5 ... 5 A 2.5 ... 25 A 3 ... 30 A 5 ... 50 A Max. thermal continuous current: 50 A at 50 °C 60 A at 40 °C	**0.1 ... 15 A** 4 part ranges programmable with bridges: 0.1 ... 1 A (Z1-Z2) 0.5 ... 5 A (Z1-Z3) 1 ... 10 A (Z1-Z4) 1.5 ... 15 A (Z3-Z1-Z4) Max. thermal continuous current: 20 A t 50 °C 15 A at 60 °C	**0.5 ... 100 A** 4 part ranges programmable with bridges: 0.5 ... 5 A (Z1-Z2) 2.5 ... 25 A (Z1-Z3) 7.5 ... 75 A (Z1-Z4) 10 ... 100 A (Z3-Z1-Z4) Max. thermal continuous current: limited only by diameter of cable 25 mm^2	**0.1 ... 15 A** 1 fixed measuring range per unit 0.1 ... 1 A 0.5 ... 5 A 1 ... 10 A 1.5 ... 15 A Max. thermal continuous current: 3 x 15 A t 50 °C 3 x 20 A at 45 °C	**0.5 ... 100 A** 1 fixed measuring range per unit 0.5 ... 5 A 2.5 ... 25 A 5 ... 50 A 7.5 ... 75 A 10 ... 100 A Max. thermal continuous current: limited only by diameter of cable 25 mm^2
	5 ... 750 mA*) 4 part ranges settable with switch: 5 ... 50 mA 25 ... 250 mA 50 ... 500 mA 75 ... 750 mA Max. thermal continuous current: 5 A at 50 °C		**0.01 ... 1.5 A** 4 part ranges programmable with bridges: 0.01 ... 0.1 A (Z1-Z3) 0.5 ... 0.5 A (Z1-Z2) 0.1 ... 1 A (Z1-Z4) 0.15 ... 1.5 A (Z2-Z1-Z4) Max. thermal continuous current: 20 A at 50 °C 15 A at 60 °C			
Max. current at 50 °C		all ranges 80 A / 3 s				
Wire current path Solid Stranded ferruled	 2 x 2.5 mm^2 2 x 1.5 mm^2	 1 x 10 mm^2 1 x 6 mm^2	 2 x 2.5 mm^2 2 x 1.5 mm^2	CT-diameter = 10 mm 25 mm^2	 2 x 2.5 mm^2 2 x 1.5 mm^2	CT-diameter = 10 mm 25 mm^2
Contacts	1 changeover	1 changeover	2 changeover	2 changeover	2 changeover	2 changeover
Weight:	IK 9270: 70 g SK 9270: 90 g	IL 9270/5_ _: 125 g SL 9270/5_ _: 150 g	IL 9270: 125 g SL 9270: 150 g	approx. 230 g	IP 9270: 200 g SP 9270: 250 g	approx. 470 g

*) Rated impulse voltage / pollution degree (auxiliary voltage - measuring circuit): 4 kV/2

Technical Data

Max. overload: see table
Temperature influence: ≤ 0.05 % / K
Reaction time: see characteristic switching delay
Internal resistor: < 5 mΩ

Setting Ranges

Response value: infinite variable within measuring range
Hysteresis: approx. 4 % of setting value, fixed
Repeat accuracy: ≤ ± 1 %
Switching delay: 0.1 ... 20 sec settable

Auxiliary Circuit

Auxiliary voltage U_H: AC/DC 24 V, AC 220 ... 240 V
other voltages on request
Voltage range
at AC: 0.8 ... 1.1 U_H
at DC: 0.8 ... 1.25 U_H
Nominal consumption
at AC 230 V:
IL/SL 9270, IP/SP 9270: 3.2 VA
IK/SK 9270, IL/SL 9270/500: 2.3 VA
at DC 24 V:
IL/SL 9270, IP/SP 9270: 0.8 W
IK/SK 9270, IL/SL 9270/500: 0.4 W
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 %

Output

Contacts
IK 9270.11, SK 9270.11
IL/SL 9270.11/5_ _: 1 changeover contact
IL 9270.12, SL 9270.12
SL 9270.12CT: 2 changeover contacts
IP 9270.12, SP 9270.12
SP 9270.12CT: 2 changeover contacts
Thermal current I_{th}: 5 A
Switching capacity
to AC 15
NO contact:
IK 9270, IL 9270/5_ _: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
IL/SL 9270, IP/SP 9270,
SL 9270CT, SP 9270CT: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
Electrical life IEC/EN 60 947-5-1
to AC 15 bei 1 A, AC 230 V
NO contact
IK/SK 9270, IL/SL 9270/5_ _: 3×10^5 switching cycles IEC/EN 60 947-5-1
to AC 15 at 2 A, AC 230 V
IL/SL 9270, IP/SP 9270,
SL 9270CT, SP 9270CT: 2×10^5 switching cycles IEC/EN 60 947-5-1
Short-circuit strength
max. fuse rating:
IK/SK 9270, IL/SL 9270/5_ _: 4 A gL IEC/EN 60 947-5-1
IL/SL 9270, IP/SP 9270
SL 9270CT, SP 9270CT: 6 A gL IEC/EN 60 947-5-1
Mechanical life: > 50×10^6 switching cycles

Technical Data

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 20 ... + 60°C
Storage: - 25 ... + 70°C
Altitude: < 2.000 m
Clearance and creepage distances
rated impulse voltage/
pollution degree: IEC 60 664-1

	IP/SP	IK/SK IL/SL-devices/5_ _	IL/SL
Auxiliary voltage - Contacts	4 kV/2	4 kV/2	4 kV/2
Auxiliary voltage - Measuring circuit	6 kV/2	6 kV/2*)	4 kV/2
Measuring circuit - Contacts	6 kV/2	6 kV/2	4 kV/2
Measuring circuit-Measuring circuit	6 kV/2	-	-
Contacts-Contacts	4 kV/2	-	4 kV/2
The contacts are not designed for voltage systems with 400 / 690 V.			

*) 4 kV/2 at IK/SK 9270 with measuring range 5 ... 750 mA

EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF irradiation:
IK/SK9270, IP/SP 9270,
SL/SP 9270:
80 MHz ... 1 GHz: 20 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz: 10 V / m IEC/EN 61 000-4-3
SL/SP 9270CT, SL9270/5:
80 MHz ... 2.7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge voltages between
wires for power supply
IK/SK 9270, IL/SL 9270/5_ _: 2 kV IEC/EN 61 000-4-5
IL/SL 9270, IP/SP 9270,
SL/SP 9270CT: 1 kV IEC/EN 61 000-4-5
between wire and ground:
IK/SK 9270, IL/SL 9270/5_ _: 4 kV IEC/EN 61 000-4-5
IL/SL 9270, IP/SP 9270,
SL/SP 9270CT: 2 kV IEC/EN 61 000-4-5
HF wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm
frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 2 x 2.5 mm² solid or
2 x 1.5 mm² stranded ferruled
DIN 46 228-1/-2/-3/-4
Min. cross section: 0,6 mm²
Insulation of wires
or sleeve length: 10 mm
Wire fixing: Flat terminals with self-lifting
clamping piece IEC/EN 60 999-1
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715

Dimensions

Width x height x depth
IK 9270: 17.5 x 90 x 61 mm
SK 9270: 17.5 x 90 x 100 mm
IL 9270: 35 x 90 x 61 mm
SL 9270, SL 9270CT: 35 x 90 x 100 mm
IP 9270: 70 x 90 x 61 mm
SP 9270, SP 9270CT: 70 x 90 x 100 mm

CCC-Data

Switching capacity

to AC 15:	5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

IK 9270.11/010 AC 220 ... 240 V 50/60 Hz 0.1 ... 15 A
Article number: 0050330
SK 9270.11/010 AC 220 ... 240V 50/60Hz 0.1 ... 15 A
Article number: 0050736

- Single phase
- 4 programmable ranges up to 15 A
- Energized on trip
- Auxiliary voltage U_H: AC 220 ... 240 V
- 1 changeover contact
- Width: 17.5 mm

IP 9270.12/010 AC 220 ... 240 V 50/60 Hz 0.5 ... 5 A
Article number: 0049438
SP 9270.12/010 AC 220 ... 240 V 50/60 Hz 0.5 ... 5 A
Article number: 0050736

- 3-phase
- Range: 0.5 ... 5 A
- Energized on trip
- Auxiliary voltage U_H: AC 220 ... 240 V
- 2 changeover contacts
- Width: 70 mm

Variants

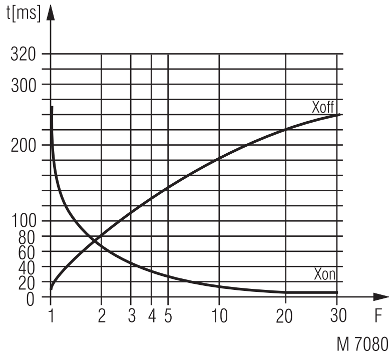
IK 9270.11, SK 9270.11:	Single phase current relay, de-energized on trip, 1 changeover contact
IL 9270.12, SL 9270.12:	Single phase current relay, de-energized on trip, 2 changeover contacts
IL 9270.12/010, SL 9270.12/010:	Single phase current relay, energized on trip, 2 changeover contacts
IL 9270.11/500, SL 9270.11/500:	Same as IK/SK 9270.11, except with 5 measuring ranges from 0.1 ... 50 A
IL 9270.11/510, SL 9270.11/510:	Same as IK/SK 9270.11/010, except with 5 measuring ranges from 0.1 ... 50 A
IP 9270.12, SP 9270.12:	3-phase current relay, de-energized on trip, 2 changeover contacts
SL 9270.12CT:	Single phase current relay with built in CT, de-energized on trip, 2 changeover contacts
SP 9270.12CT:	3-phase current relay with built in CT, energized on trip, 2 changeover contacts

Ordering Example for variants

SP 9270 .12 CT / _ _ 0 AC 220 ... 240 V 50 / 60 Hz 5 ... 50 A

Measuring range
Nominal frequency
Auxiliary voltage
0: de-energized on trip
1: energized on trip
Variant, if required
Built in CT
Contacts
Type

Characteristics



Switching delay
The characteristic shows the switching delay depending on the values of X_{on} - X_{off} when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{I\ applied}{I\ setting}$$

VARIMETER
Over- and Undercurrent Relay
IL 9277, IP 9277, SL 9277, SP 9277

DOLD

0224264

IL 9277

SL 9277

IP 9277

SP 9277

SL 9277CT

SP 9277CT

- According to IEC/EN 60 25-1
- IP 9277, SP 9277, SP 9277CT: 3-phase
  IL 9277, SL 9277, SL 9277CT: singele phase
- Detects over- and undercurrent
- Measuring ranges from 0.1 ... 15 A
- With built in current transformer for 0.5 ... 100 A
- IL 9277, SL 9277 with 4 programmable ranges
- Settable 0.1 ... 1 I_N
- Separate setting for over- and undercurrent
- Fixed hysteresis approx. 4 %
- Settable time delay
- IP 9277, SP 9277 with separate settable time delay for over- and undercurrent
- De-energized on trip
- LED indicators for over-, under- and normal current
- Auxiliary supply and measuring input galvanic separated
- IL 9277, SL 9277 with one output relay for over- and undercurrent
- IP 9277, SP 9277 with separate output relays for over- and undercurrent
- Optionally energized on trip
- Devices available in 2 enclosure versions:
  - I-model, e.g. IL _ _ _ _, depth 61 mm
    with terminals at the bottom for installations systems
    and industrial distribution systems according to DIN 43 880
  - S-model, e.g. SL _ _ _ _, depth 100 mm
    with terminals at the top for cabinets with mounting plate
    and cable duct
- DIN rail or screw mounting
- Width IL 9277, SL 9277, SL 9277CT: 35 mm
  IP 9277, SP 9277, SP 9277CT: 70 mm

Approvals and Markings

CE | CCC *) A025518

*) only IL-devices

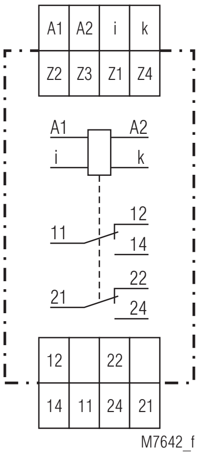
Applications

- Over- and undercurrent detection in single phase or 3-phase voltage systems
- For industrial and railway applications

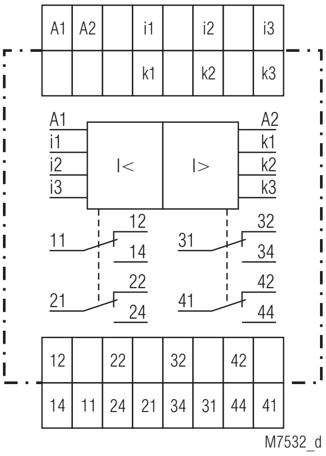
Indicators

LED green:	current within limits
LED red I_{max}:	overcurrent
LED red I_{min}:	undercurrent

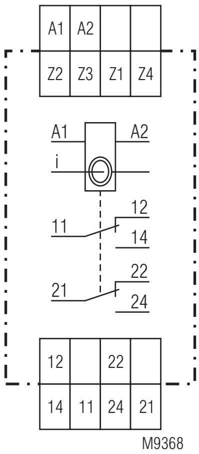
Circuit Diagram



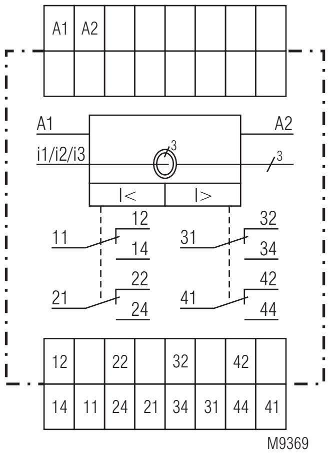
IL 9277.12, SL 9277.12



IP 9277.39, SP 9277.39



SL 9277.12CT

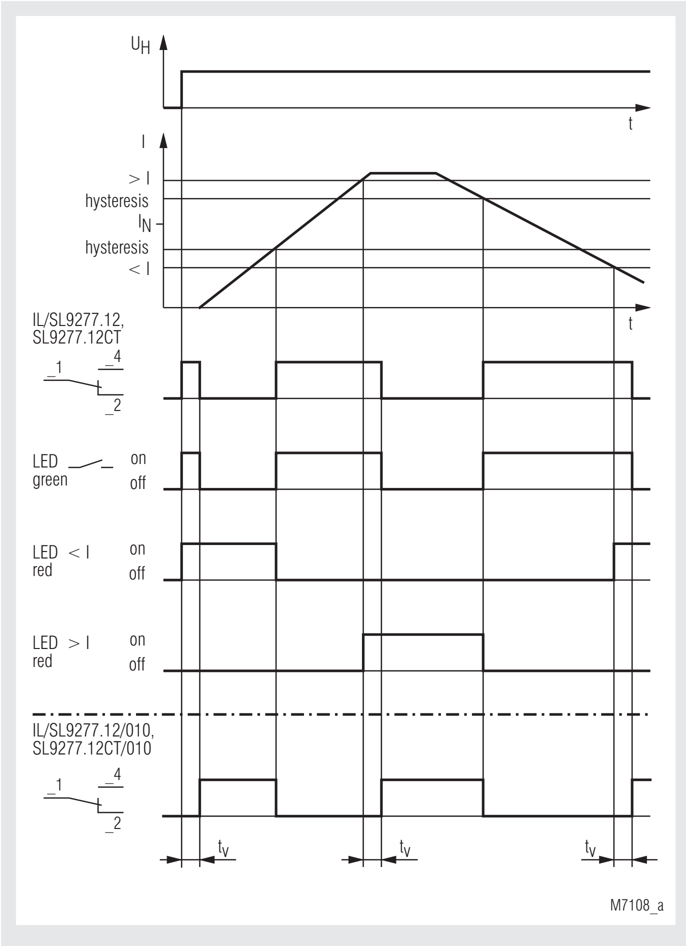


SP 9277.39CT

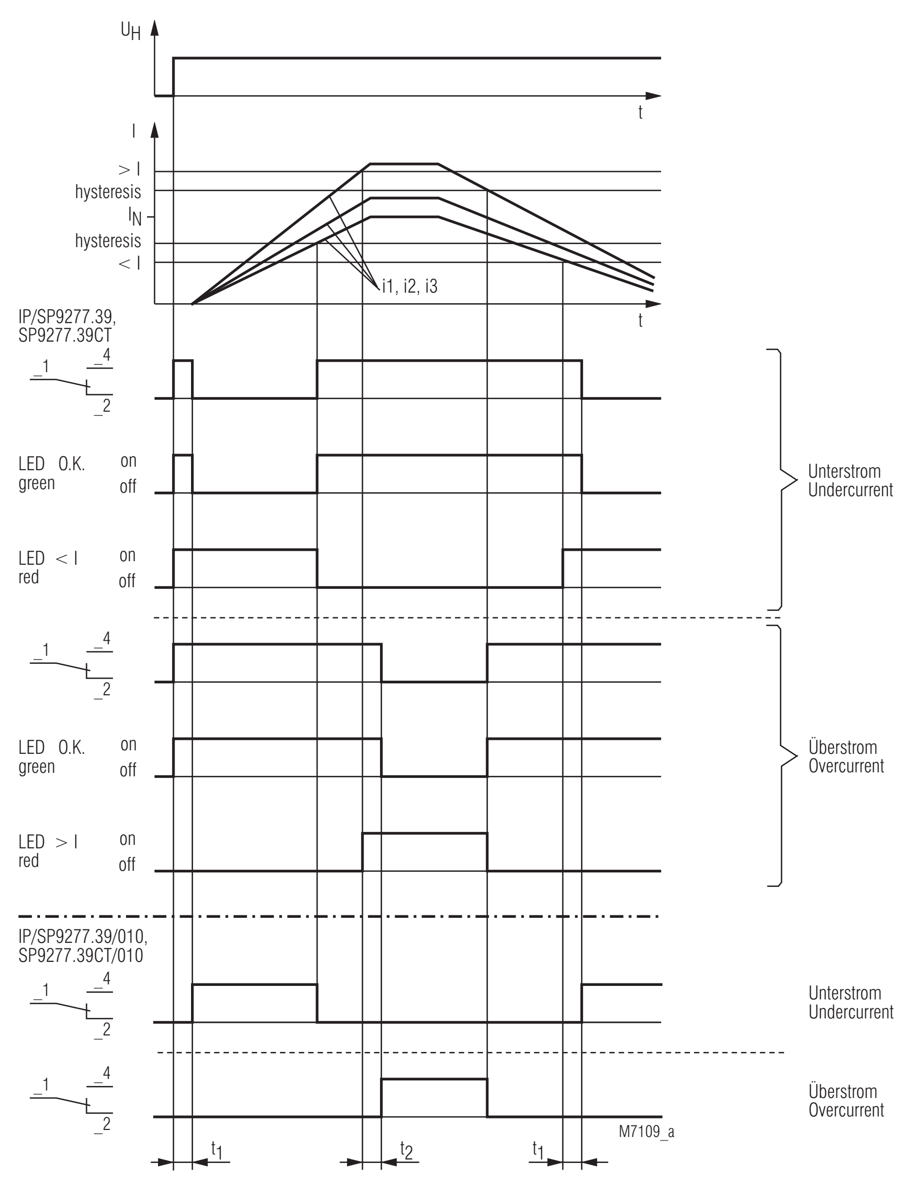
Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage AC or DC
i, k	Current measuring ciruit AC or DC
i1, k1; i2, k2; i3, k3	Current measuring ciruit phase 1; 2; 3
Z1 / Z2, Z3, Z4	Measuring ranges with bridges via terminals
IL-device: 11, 12, 14	Contacts Rel. 1 over- / undercurrent signal
IL-device: 21, 22, 24	Contacts Rel. 2 over- / undercurrent signal
IP-device: 11, 12, 14	Contacts Rel. 1 underrcurrent signal
IP-device: 21, 22, 24	Contacts Rel. 2 underrcurrent signal
IP-device: 31, 32, 34	Contacts Rel. 3 overcurrent signal
IP-device: 41, 42, 44	Contacts Rel. 4 overcurrent signal

Function Diagram IL 9277, SL 9277, SL 9277CT



Function Diagram IP 9277, SP 9277, SP 9277CT



Technical Data

Type				
	IL 9277	**SL 9277CT**	**IP 9277**	**SP 9277CT**
Depth 61 mm Depth 100 mm	IL 9277.12 SL 9277.12	SL 9277.12CT	IP 9277.39 SP 9277.39	SP 9277.39CT
Width	35 mm	35 mm	70 mm	70 mm
Measuring input	single-phase	single-phase	3-phase	3-phase
Measuring range Nominal frequency 50 ... 400 Hz	0.1 ... 15 A settable with switsch range / bridge 0.1 ... 1 A / Z1-Z2 0.5 ... 5 A / Z1-Z3 1 ... 10 A / Z1-Z4 1.5 ... 15 A / Z3-Z1-Z4 0.01 ... 1.5 A programmable with bridges: range / bridge 0.01 ... 0.1 A / Z1-Z3 0.05 ... 0.5 A / Z1-Z2 0.1 ... 1 A / Z1-Z4 0.15 ... 1.5 A / Z2-Z1-Z4	0.5 ... 100 A settable with bridges: range / bridge 0.5 ... 5 A / Z1-/Z2 2.5 ... 25 A / Z1-Z3 7.5 ... 75 A / Z1-Z4 10 ... 100 A / Z3-Z1-Z4	1 Meas. range per unit 0.1 ... 1 A 0.5 ... 5 A 1 ... 10 A 1.5 ... 15 A	1 Meas. range per unit 0.5 ... 5 A 2.5 ... 25 A 5 ... 50 A 7.5 ... 75 A 10 ... 100 A
Continouos current/ Max. ambient temperature	20 A / 50 °C 15 A / 60 °C	limited only by diameter of cable 25 mm^2	3 x 15 A / 50 °C 3 x 20 A / 45 °C	limited only by diameter of cable 25 mm^2
Wire current path Solid Stranded ferrule	2 x 2.5 mm^2 2 x 1.5 mm^2	CT-diameter = 10 mm 25 mm^2	2 x 2.5 mm^2 2 x 1.5 mm^2	CT-diameter = 10 mm 25 mm^2
Contacts	2 C/O contacts	2 C/O contacts	2 x 2 C/O contacts *)	2 x 2 C/O contacts *)
Weight:	IL 9277: 125 g SL 9277: 150 g	approx. 230 g	IP 9277: 200 g SP 9277: 250 g	a<pprox. 470 g

*) 2 changeover contacts for overcurrent, 2 changeover contacts for undercurrent

Technical Data

Max. overload: see table
Temperature influence: ≤ 0.05 % / K
Reaction time: see characteristic switching delay

Setting Ranges

Response value: infinite variable within measuring range
Hysteresis: approx. 4 % of setting value, fixed
Repeat accuracy: ≤ ± 1 %
Switching delay: 0.1 ... 20 sec settable

Auxiliary Circuit

Auxiliary voltage U_H
IL 9277, SL 9277, SL 9277CT: AC/DC 24 V
AC 115 ... 127 V, AC 220 ... 240 V,
AC 400 ... 440 V
IP 9277, SP 9277, SP 9277CT: AC/DC 24 V
AC 115, 127 V
AC 220 ... 240 V, AC 400 ... 440 V
Voltage range
at AC: 0.8 ... 1.1 U_H
at DC: 0.8 ... 1.25 U_H
Nominal consumption
IL 9277, SL 9277, SL 9277CT
at AC 230 V: 3.2 VA
at DC 24 V: 0.8 W
IP 9277, SP 9277, SP 9277CT
at AC 230 V: 7.2 VA
at DC 24 V: 1 W
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 %

Output

Contacts
IL 9277.12, SL 9277.12,
SL 9277.12CT: 2 changeover contact
IP 9277.39, SP 9277.39,
SP 9277.39CT: 2 x 2 changeover contact
Thermal current I_{th}: 5 A
Switching capacity
to AC 15
NO contact: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 2 A, AC 230 V
NO contact: 2 x 10^5 switch. cycles IEC/EN 60 947-5-1
Short-circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
Mechanical life: > 50 x 10^6 switching cycles

Technical Data

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 20 ... + 60°C
Storage: - 25 ... + 70°C
Altitude: < 2.000 m
Clearance and creepage distances
rated rated impulse voltage voltage/
pollution degree: IEC 60 664-1

	IP/SP-devices	IL/SL-devices
Supply - Contacts	4 kV/2	4 kV/2
Supply - Measuring Circuit	6 kV/2	4 kV/2
Measuring circuit-Measuring circuit	6 kV/2	-
Measuring Circuit - contacts	6 kV/2	4 kV/2
Contact-Contact	4 kV/2	4 kV/2
Measuring Circuit, max. voltage:	3 AC 400/690 V	AC 230 V/400
The contacts are not designed for voltage systems with 400 / 690 V		
contacts, max. voltage:	AC 230/400 V	AC 230/400 V

EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF irradiation
IL/SL 9277, IP/SP 9277
80 MHz ... 1 GHz: 20 V/m IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz: 10 V/m IEC/EN 61 000-4-3
SL/SP 9277CT
80 MHz ... 1 GHz: 10 V/m IEC/EN 61 000-4-3
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge voltages
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm
frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 2 x 2.5 mm² solid or
2 x 1.5 mm² stranded ferruled
DIN 46 228-1/-2/-3/-4
Min. cross section: 0,6 mm²
Insulation of wires
or sleeve length: 10 mm
Wire fixing: Flat terminals with self-lifting
clamping piece IEC/EN 60 999-1
Fixing torque: 0.8 Nm
Mounting: DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory

Dimensions

Width x height x depth
IL 9277: 35 x 90 x 61 mm
SL 9277, SL 9277CT: 35 x 90 x 100 mm
IP 9277: 70 x 90 x 61 mm
SP 9277, SP 9277CT: 70 x 90 x 100 mm

Classification to DIN EN 50155 for IL 9277

Vibration and
shock resistance: Category 1, Class B IEC/EN 61 373
Ambient temperature: T1 compilant
T2, T3 und TX with operational limitations
Protective coating of the PCB: No

CCC-Data

Switching capacity
to AC 15: 5 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: 2 A / DC 24 V IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

IL 9277.12   AC 220 ... 240 V
Article number: 0049306
SL 9277.12   AC 220 ... 240 V
Article number: 0054111
- Single phase
- 4 programmable ranges up to 15 A
- De-energized on trip
- Auxiliary voltage U_H: AC 220 ... 240 V
- 2 changeover contacts
- Width: 35 mm

IP 9277.39   0,5 ... 5 A   AC 220 ... 240 V
Article number: 0049308
SP 9277.39   0,5 ... 5 A   AC 220 ... 240 V
Article number: 0056075
- 3-phase
- Range 0.5 ... 5 A
- De-energized on trip
- Auxiliary voltage U_H: AC 220 ... 240 V
- 2 changeover contacts each for over- and undercurrent
- Width: 70 mm

Variants

IL 9277.12/010, SL 9277.12/010:	single phase current relay energized on trip
IP 9277.39/010, SP 9277.39/010:	3-phase current relay energized on trip
IP 9277.39/002, SP 9277.39/002:	3-phase current relay undercurrend de-energized on trip overcurrent energized on trip
SL 9277.12CT	single phase current relay with built in CT
SP 9277.39CT	3-phase current relay with built in CT

Ordering example for variants

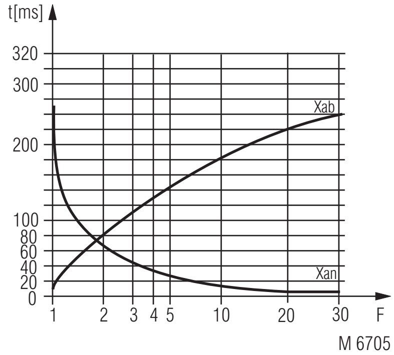
IP 9277 .39 CT / _ _ _   AC 220 ... 240 V   50 / 60 Hz   10 A

- 10 A: Measuring range
- 50 / 60 Hz: Nominal frequency
- AC 220 ... 240 V: Auxiliary voltage
- / _ _ _: Variant, if required
- CT: built in CT
- .39: Contacts
- IP 9277: Type

Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578

Characteristics



Switching delay
The characteristic shows the switching delay depending on the values of X_{an} - X_{ab} when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{\text{I applied}}{\text{I setting}}$$

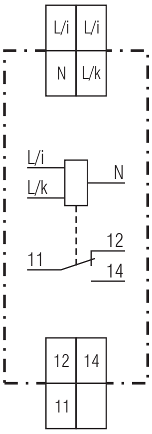
VARIMETER
Overcurrent Relay
IK 9272, SK 9272

0226828

IK 9272 SK 9272

- According to IEC/EN 60 255
- Single phase
- Measuring ranges from 0.05 ... 10 A
- Fixed hysteresis approx. 4 %
- Adjustable switching delay
- Closed circuit operation
- Optionally open circuit operation
- Automatic reset
- Optionally manual reset, reset button on the front
- LED indication for auxiliary voltage
- 1 changeover contact
- Devices available in 2 enclosure versions:
  IK 9272: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9272: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Circuit Diagram



Approvals and Markings

CE

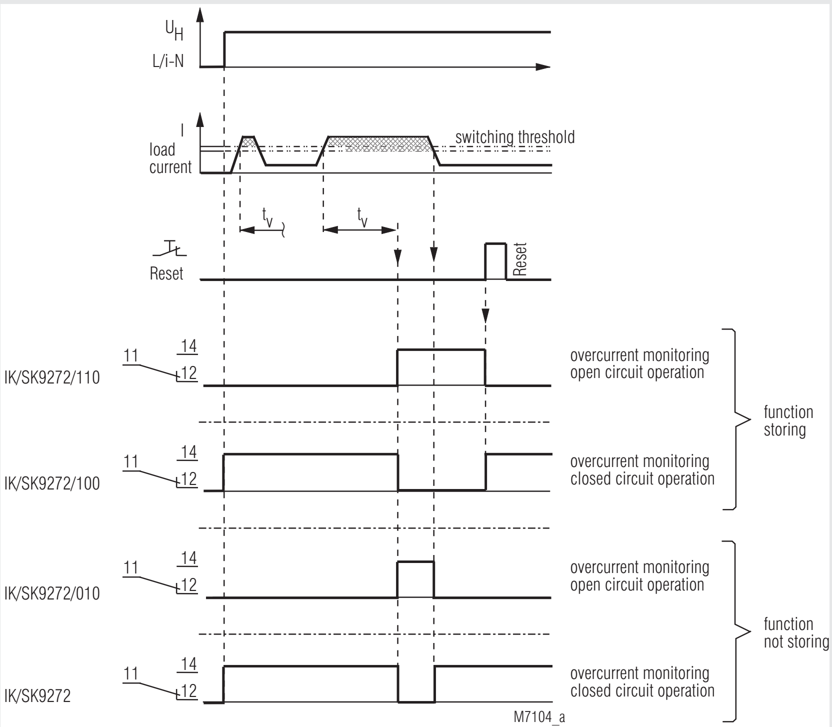
Application

Overcurrent detection in AC power supplies

Indication

green LED:	on when auxiliary supply connected
yellow LED:	on when output contacts switched

Function Diagram



Notes

Auxiliary voltage and measuring circuit are not galvanically seperated. Thus they need the same reference potential "N", if there is no external seperation, e.g. through a current transformer see Application Examples.

Technical Data

Input

Measuring range:	AC 50 ... 500 mA	
	AC 0.1 ... 1 A	
	AC 0.5 ... 5 A	
	AC 1 ... 10 A	
	higher currents via external current transformer (2.5 VA)	
Nominal frequency of measuring current:	50 / 60 Hz	
Maximum continuous measuring current:		
at AC 50 ... 500 mA:	2.5 A, at 50°C ambient temperature	
at AC 0.1 ... 1 A:	5 A, at 50°C ambient temperature	
at AC 0.5 ... 5 A:	11 A, at 50°C ambient temperature	
at AC 1 ... 10 A:	15 A, at 50°C ambient temperature	
Maximum overload:		
at AC 50 ... 500 mA:	8 A, max. 3 s	
at AC 0.1 ... 1 A:	10 A, max. 3 s	
at AC 0.5 ... 5 A:	20 A, max. 3 s	
at AC 1 ... 10 A:	20 A, max. 3 s	
Temperature influence:	≤ 0.2 % / K	
Reaction time:	see characteristic switching delay	

Setting Ranges

Response value:	infinite variable within measuring range
Hysteresis:	approx. 0.96 of setting value, fixed approx. 4 % hysteresis
Setting accuracy:	≤ ± 10 % of setting value
Repeat accuracy:	≤ ± 1 %
Time delay tv:	0.1 ... 20 s adjustable

Auxiliary Circuit

Auxiliary voltage U_H:	AC 115 ... 127 V, AC 220 ... 240 V
Voltage range:	0.8 ... 1.1 U_H
Nominal consumption	
at AC 230 V:	5.5 VA
Nominal frequency:	50 / 60 Hz
Frequency range:	± 5 %

Output

Contacts		
IK 9272.11, SK 9272.11:	1 changeover contact	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V		
NO contact:	3 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 10^8 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1

Technical Data

EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:	Housing: IP 40	IEC/EN 60 529
	Terminals:IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or	
	2 x 1.5 mm² stranded ferruled	
	DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
IK 9272:	65 g	
SK 9272:	80 g	

Dimensions

Width x height x depth:	
IK 9272:	17.5 x 90 x 59 mm
SK 9272:	17.5 x 90 x 98 mm

Classification to DIN EN 50155 for IK 9272

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Standard Types

IK 9272.11/010 AC 220 ... 240 V 50/60 Hz 10 A
Article number: 0050068

- Open circuit operation
- Output: 1 changeover contact
- Nominal voltage U_N: AC 220 ... 240 V
- Measuring range: 1 ... 10 A
- Width: 17.5 mm

SK 9272.11/010 AC 220 ... 240 V 50/60Hz 10 A
Article number: 0050613

- Open circuit operation
- Output: 1 changeover contact
- Nominal voltage U_N: AC 220 ... 240 V
- Measuring range: 1 ... 10 A
- Width: 17.5 mm

Variants

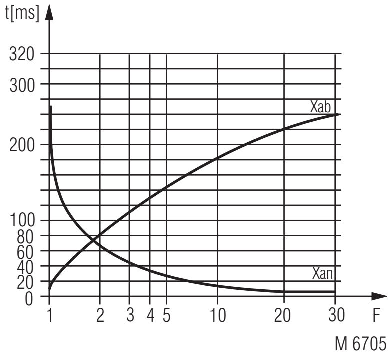
IK 9272:	Closed circuit operation
IK 9272.11/100:	Manual reset, closed circuit operation
IK 9272.11/110:	Manual reset, open circuit operation

Ordering example for variants

IK 9272 .11 /_ _ _ AC 220 ... 240 V 50 / 60 Hz 10 A

Measuring range
Nominal frequency
Auxiliary voltage
Variant, if required
Contacts
Type

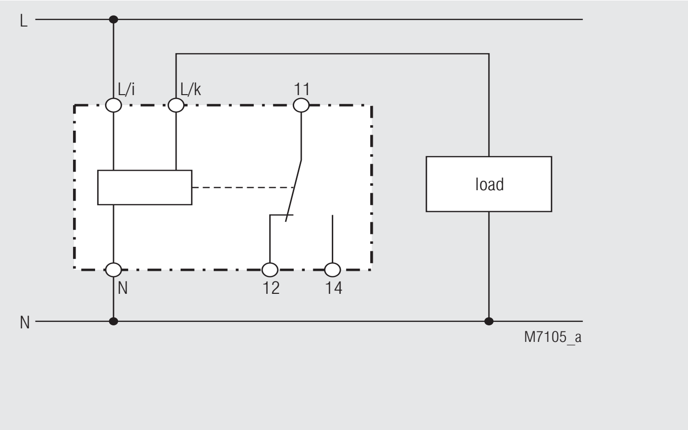
Characteristics



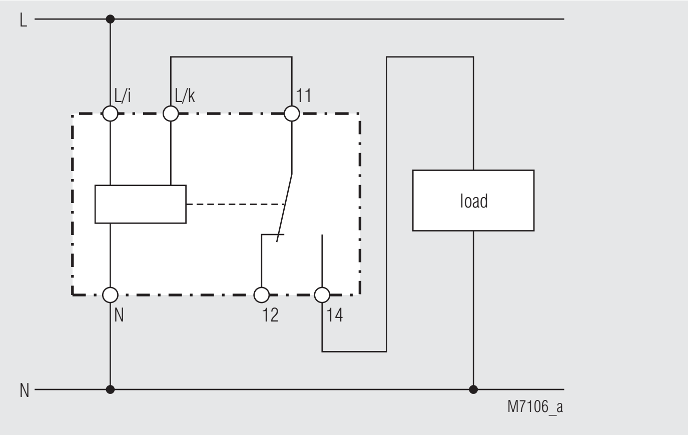
Switching delay
The characteristic shows the switching delay depending on the values of X_{an} - X_{ab} when switching the current on or off. A slow current change reduces the delay

$$F = \frac{I \text{ applied}}{I \text{ setting}}$$

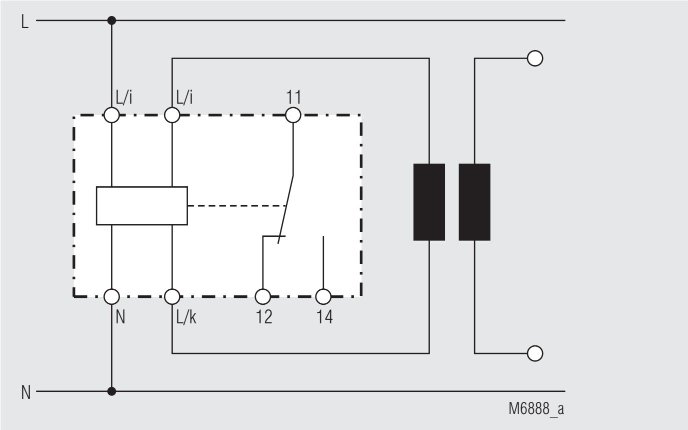
Connection Examples



L/i - N auxiliary voltage
L/i - L/k current input



Connection Example for IK 9272/100
Load in series to the contact. When overcurrent the load is turned off. The fault is stored. New start by pressing reset button or auxiliary voltage off, on.
Maximum continuous measuring current for this application is 5 A:



Connection Example with external galvanical seperation, e.g. via current transformer.
Attention: On the secondary side of the current transformer is the potential L.
L/i is allowed to be changed, so that the secondary side of the current ransformer has the potential N.

Monitoring Technique

VARIMETER
Overcurrent Relay
IL 5201/20007, SL 5201/20007CT

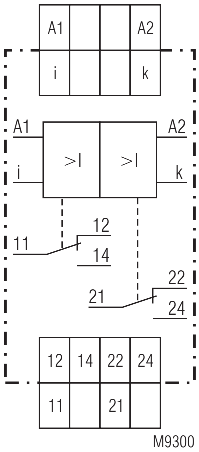
0266616

IL 5201/20007

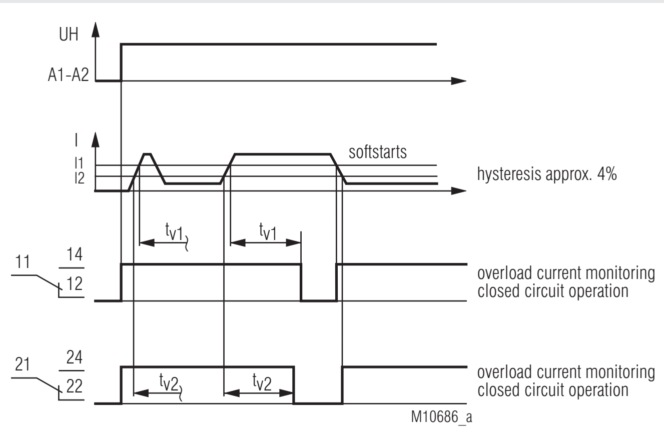
SL 5201/20007CT

- According to IEC/EN 60 255, DIN VDE 0435-303
- 2 independent relays in once enclosure
- 2 measuring ranges from 0.5 to 5 A
- Adjustable response values
- Fixed hysteresis
- Adjustable switching delay
- Closed circuit operation
- LED indicators
- with auyiliary voltage
- galvanic separation between Auxiliary Circuit and Measuring Circuit
- **2 models available:**
  IL 5201: 63 mm deep with terminals near to the bottom to be mounted in consumer units or industrial distribution systems according to DIN 43 880
  SL 5201: 100 mm deep with terminals near to the top to be mounted in cabinets with mounting plate and cable ducts
- Width: 35 mm

Circuit Diagram



Function Diagram



Approvals and Markings

CE

Application

Overcurrent detection in single phase or 3-phase voltage systems

Indicators

LEDs green:	on, when supply voltage connected
LEDs yellow:	on, when output relay active

Technical Data

Measuring Circuit

Measuring ranges	
IL 5201/20007:	2 separate Measuring Circuits 0.5 ... 5 A adjustable
SL 5201/20007CT:	2 separate Measuring Circuits 5 ... 50 A adjustable
Nominal frequency:	50 ... 400 Hz
Thermal continuous current ambient-temperature:	20 A / 50°C 15 A / 60°C
Temperature influence:	≤ 0.05 % / K
Reaction time:	see characteristic switching delay
Internal resistance:	< 5 mΩ

Setting Ranges

Setting of response value:	infinetely variable at measuring range
Hysteresis:	approx. 4 % of setting range, factory set fixed value
Repeat accuracy:	≤ ± 1 %
Time delay tv:	0.1 ... 20 s adjustable

Auxiliary Circuit

Auxiliary voltage U_H:	AC 220 ... 240 V
Voltage range:	0.8 ... 1.1 U_H
Nominal consumption:	2 x 2.3 VA
Nominal frequency:	50 / 60 Hz
Frequency range:	± 5 %

Technical Data

Output

Contacts:	2 x 1 changeover contacts	
thermal current I_{th}:	2 x 5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V		
NO contact:	3 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 50 x 10^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distance		
rated impulse voltage /		
pollution degree:		IEC 60 664-1
Auxiliary voltage-contacts:	4 kV/2	
Auxiliary voltage-measur. circuit:	6 kV/2	
Measuring circuit-contacts:	6 kV/2	

The contacts are not designed for voltage systems with 400 / 690 V

EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltage		
between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour accroding to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 5201/20007:	approx. 124 g	
SL 5201/20007CT:	approx. 245 g	

Dimensions

IL 5201/20007:	35 x 90 x 63 mm
SL 5201/20007CT:	35 x 90 x 100 mm

Standard Types

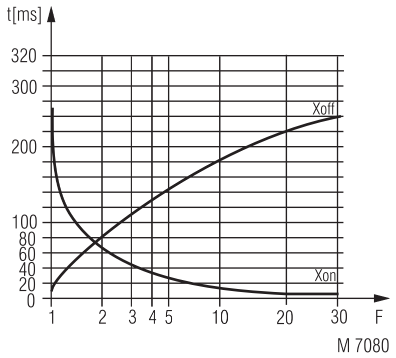
IL 5201/20007 AC 220 ... 240 V 50/60 Hz 0,5 ... 5 A
Article number: 0059589

- single phase
- 2 adjustable measuring ranges up to 5 A
- Closed circuit operation
- Auxiliary voltage U_H AC 220 ... 240 V
- 2 x 1 changeover contacts
- Width: 35 mm

SL 5201/20007CT AC 220 ... 240 V 50/60 Hz 5 ... 50 A
Article number: 0059807

- single phase
- 2 adjustable measuring ranges up to 50 A
- Closed circuit operation
- Auxiliary voltage U_H AC 220 ... 240 V
- 2 x 1 changeover contacts
- Width: 35 mm

Characteristic



Switching delay
The characteristic shows the switching delay depending on the values of X_{on} - X_{off} when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{I\ \text{applied}}{I\ \text{setting}}$$

VARIMETER
Undercurrent Relay
IK 9271, IL 9271, IP 9271, SK 9271, SL 9271, SP 9271

DOLD

0224263


IK 9271


IL 9271


IL 9271/5_ _


SL 9271/5_ _


SK 9271


IP 9271


SL 9271CT


SP 9271CT

- According to IEC/EN 60 255-1
- IP 9271, SP 9271, SP 9271CT: 3-phase
  IK 9271, IL 9271, SK 9271, SL 9271, SL 9271CT: single phase
- Measuring ranges from 0.1 ... 100 A
- IK 9271, SK 9271:
  with 4 ranges settable by rotational switch, 1 changeover contact
- IL 9271, SL 9271:
  with 5 ranges settable by rotational switch, 1 changeover contact
  with 4 ranges programmable by bridges, 2 changeover contacts
- IP 9271, SP 9271: with 1 range, 2 changeover contacts
- Settable response value
- Fixed hysteresis
- Settable time delay
- De-energized on trip
- Optionally energized on trip
- LED indicators
- With auxiliary voltage
- Auxiliary supply and measuring input galvanic separated
- Devices available in 2 enclosure versions:
  - I-model, e.g. IK _ _ _ _, depth 61 mm
    with terminals at the bottom for installations systems
    and industrial distribution systems according to DIN 43 880
  - S-model, e.g. SK _ _ _ _, depth 100 mm
    with terminals at the top for cabinets with mounting plate
    and cable duct
- Width

Width	IK 9271, SK 9271:	17.5 mm
	IL 9271, SL 9271, SL 9271CT:	35 mm
	IP 9271, SP 9271, SP 9271CT:	70 mm

Approvals and Markings

A025518

*) only IL-devices

Applications

Undercurrent detection in single phase or 3-phase voltage systems

Indicators

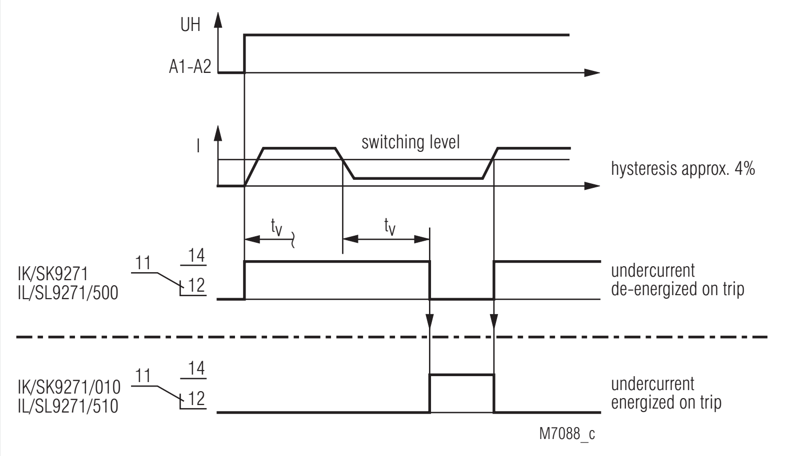
IK 9271.11, SK 9271.11
IL 9271.11/5_ _
SL 9271.11/5_ _:

green LED:	on when aux. supply connected
yellow LED:	on when output contacts switched

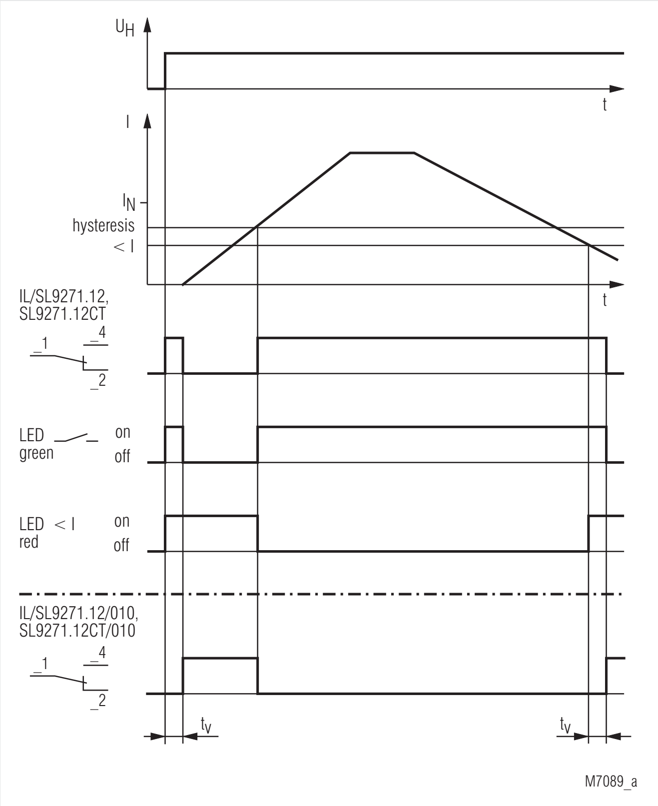
IL 9271, SL 9271,
IP 9271, SP 9271:

green LED:	on when current within limits
red LED I_{max}:	on when undercurrent

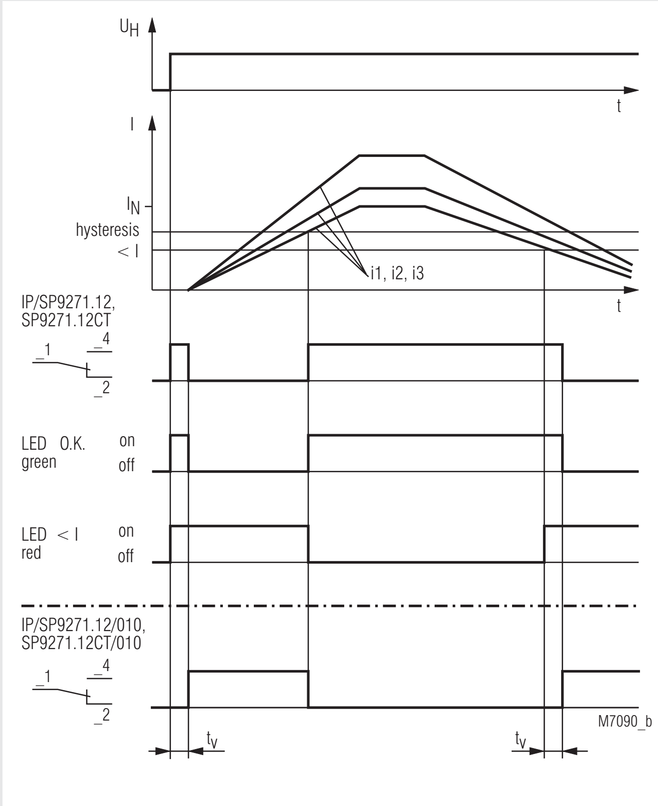
Function Diagram IK/SK 9271, IL/SL 9271.11/500

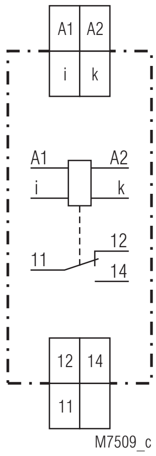


Function Diagram IL 9271.12, SL 9271.12

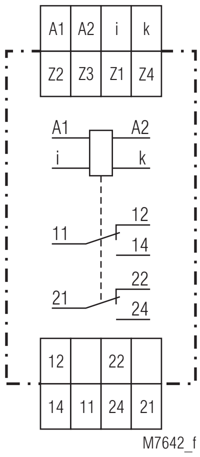


Function Diagram IP 9271, SP 9271

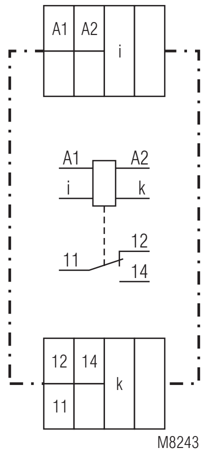




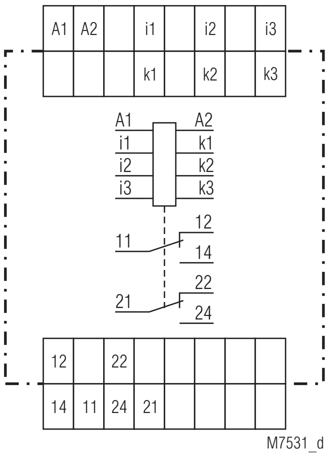
IK 9271.11, SK 9271.11



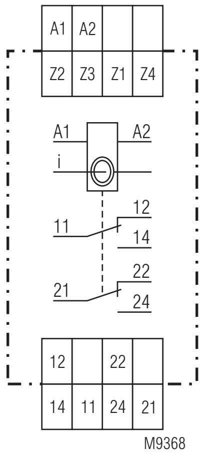
IL 9271.12, SL 9271.12



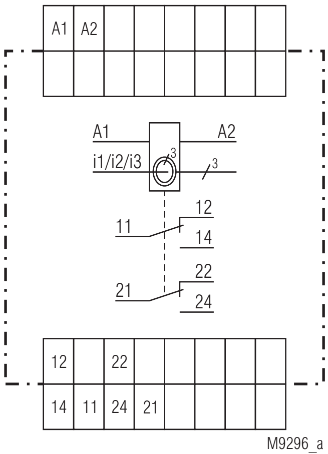
IL 9271.11/5_ _



IP 9271.12, SP 9271.12



SL 9271.12CT



SP 9271.12CT

Technical Data

Type						
	IK 9271	**SL 9271/5_ _**	**IL 9271**	**SL 9271CT**	**IP 9271**	**SP 9271CT**
Depth 61 mm Depth 100 mm	IK 9271.11 SK 9271.11	IL 9271.11/5_ _ SL 9271.11/5_ _	IL 9271.12 SL 9271.12	- SL 9271.12CT	IP 9271.12 SP 9271.12	- SP 9271.12CT
Width	17.5 mm	35 mm	35 mm	35 mm	70 mm	70 mm
Measuring input	single-phase	single-phase	single-phase	single-phase	3-phase	3-phase
Measuring range (Nominal frequency 50 ... 400 Hz)	**0.1 ... 15 A** 4 part ranges settable with switch: 0.1 ... 1 A 0.5 ... 5 A 1 ... 10 A 1.5 ... 15 A Max. thermal continuous current: 20 A at 50 °C 15 A at 60 °C	**0.1 ... 50 A** 5 part ranges settable with switch: 0.1 ... 1 A 0.5 ... 5 A 2.5 ... 25 A 3 ... 30 A 5 ... 50 A Max. thermal continuous current: 50 A at 50 °C 60 A at 40 °C	**0.1 ... 15 A** 4 part ranges programmable with bridges: 0.1 ... 1 A (Z1-Z2) 0.5 ... 5 A (Z1-Z3) 1 ... 10 A (Z1-Z4) 1.5 ... 15 A (Z3-Z1-Z4) Max. thermal continuous current: 20 A t 50 °C 15 A at 60 °C	**0.5 ... 100 A** 4 part ranges programmable with bridges: 0.5 ... 5 A (Z1-Z2) 2.5 ... 25 A (Z1-Z3) 7.5 ... 75 A (Z1-Z4) 10 ... 100 A (Z3-Z1-Z4) Max. thermal continuous current: limited only by diameter of cable 25 mm²	**0.1 ... 15 A** 1 fixed measuring range per unit 0.1 ... 1 A 0.5 ... 5 A 1 ... 10 A 1.5 ... 15 A Max. thermal continuous current: 3 x 15 A t 50 °C 3 x 20 A at 45 °C	**0.5 ... 100 A** 1 fixed measuring range per unit 0.5 ... 5 A 2.5 ... 25 A 5 ... 50 A 7.5 ... 75 A 10 ... 100 A Max. thermal continuous current: limited only by diameter of cable 25 mm²
	5 ... 750 mA*) 4 part ranges settable with switch: 5 ... 50 mA 25 ... 250 mA 50 ... 500 mA 75 ... 750 mA Max. thermal continuous current: 5 A at 50 °C		**0.01 ... 1.5 A** 4 part ranges programmable with bridges: 0.01 ... 0.1 A (Z1-Z3) 0.5 ... 0.5 A (Z1-Z2) 0.1 ... 1 A (Z1-Z4) 0.15 ... 1.5 A (Z2-Z1-Z4) Max. thermal continuous current: 20 A at 50 °C 15 A at 60 °C			
Max. current at 50 °C		all ranges 80 A / 3 s				
Wire current path Solid Stranded ferruled	 2 x 2.5 mm² 2 x 1.5 mm²	 1 x 10 mm² 1 x 6 mm²	 2 x 2.5 mm² 2 x 1.5 mm²	CT-diameter = 10 mm 25 mm²	 2 x 2.5 mm² 2 x 1.5 mm²	CT-diameter = 10 mm 25 mm²
Contacts	1 changeover	1 changeover	2 changeover	2 changeover	2 changeover	2 changeover
Weight:	IK 9271: 70 g SK 9271: 90 g	IL 9271/5_ _: 125 g SL 9271/5_ _: 150 g	IL 9271: 125 g SL 9271: 150 g	approx. 230 g	IP 9271: 200 g SP 9271: 250 g	approx. 470 g

*) Rated impulse voltage / pollution degree (auxiliary voltage - measuring circuit): 4 kV/2

Technical Data

Max. overload: see table
Temperature influence: ≤ 0.05 % / K
Reaction time: see characteristic switching delay

Setting Ranges

Response value: infinite variable within measuring range
Hysteresis: approx. 4 % of setting value, fixed
Repeat accuracy: ≤ ± 1 %
Switching delay: 0.1 ... 20 sec settable

Auxiliary Circuit

Auxiliary voltage U_H: AC/DC 24 V, AC 220 ... 240 V
other voltages on request
Voltage range
at AC: 0.8 ... 1.1 U_H
at DC: 0.8 ... 1.25 U_H
Nominal consumption
at AC 230 V:
IL/SL 9271, IP/SP 9271: 3.2 VA
IK/SK 9271, IL/SL 9271/500: 2.3 VA
at DC 24 V:
IL/SL 9271, IP/SP 9271: 0.8 W
IK/SK 9271, IL/SL 9271/500: 0.4 W
Nominal frequency: 50 / 60 Hz
Frequency range: ± 5 %

Output

Contacts
IK 9271.11, SK 9271.11
IL/SL 9271.11/5_ _: 1 changeover contact
IL 9271.12, SL 9271.12
SL 9271.12CT: 2 changeover contacts
IP 9271.12, SP 9271.12
SP 9271.12CT: 2 changeover contacts
Thermal current I_{th}: 5 A
Switching capacity
to AC 15
NO contact:
IK 9271, IL 9271/5_ _: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
IL/SL 9271, IP/SP 9271,
SL 9271CT, SP 9271CT: 5 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 2 A / AC 230 V IEC/EN 60 947-5-1
Electrical life IEC/EN 60 947-5-1
to AC 15 bei 1 A, AC 230 V
NO contact
IK/SK 9271, IL/SL 9271/5_ _: 3×10^5 switching cycles IEC/EN 60 947-5-1
to AC 15 at 2 A, AC 230 V
IL/SL 9271, IP/SP 9271,
SL 9271CT, SP 9271CT: 2×10^5 switching cycles IEC/EN 60 947-5-1
Short-circuit strength
max. fuse rating:
IK/SK 9271, IL/SL 9271/5_ _: 4 A gL IEC/EN 60 947-5-1
IL/SL 9271, IP/SP 9271
SL 9271CT, SP 9271CT: 10 A gL IEC/EN 60 947-5-1
Mechanical life: > 50×10^6 switching cycles

Technical Data

General Data

Operating mode: Continuous operation
Temperature range
Operation: - 20 ... + 60°C
Storage: - 25 ... + 70°C
Altitude: < 2.000 m
Clearance and creepage distances
rated impulse voltage/
pollution degree: IEC 60 664-1

	IP/SP	IK/SK IL/SL-devices/5_ _	IL/SL
Auxiliary voltage - Contacts	4 kV/2	4 kV/2	4 kV/2
Auxiliary voltage - Measuring circuit	6 kV/2	6 kV/2*)	4 kV/2
Measuring circuit - Contacts	6 kV/2	6 kV/2	4 kV/2
Measuring circuit-Measuring circuit	6 kV/2	-	-
Contacts-Contacts	4 kV/2	-	4 kV/2
The contacts are not designed for voltage systems with 400 / 690 V.			

*) 4 kV/2 at IK/SK 9271 with measuring range 5 ... 750 mA and IK 9271.11/800

EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF irradiation:
IK/SK9271, IP/SP 9271,
SL/SP 9271:
80 MHz ... 1 GHz: 20 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz: 10 V / m IEC/EN 61 000-4-3
SL/SP 9271CT, SL9271/5:
80 MHz ... 2.7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge voltages between
wires for power supply
IK/SK 9271, IL/SL 9271/5_ _: 2 kV IEC/EN 61 000-4-5
IL/SL 9271, IP/SP 9271,
SL/SP 9271CT: 1 kV IEC/EN 61 000-4-5
between wire and ground:
IK/SK 9271, IL/SL 9271/5_ _: 4 kV IEC/EN 61 000-4-5
IL/SL 9271, IP/SP 9271,
SL/SP 9271CT: 2 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Degree of protection:
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm
frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 2 x 2.5 mm² solid or
2 x 1.5 mm² stranded ferruled
DIN 46 228-1/-2/-3/-4
Min. cross section: 0,6 mm²
Insulation of wires
or sleeve length: 10 mm
Wire fixing: Flat terminals with self-lifting
clamping piece IEC/EN 60 999-1
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715

Dimensions

Width x height x depth
IK 9271: 17.5 x 90 x 61 mm
SK 9271: 17.5 x 90 x 100 mm
IL 9271: 35 x 90 x 61 mm
SL 9271, SL 9271CT: 35 x 90 x 100 mm
IP 9271: 70 x 90 x 61 mm
SP 9271, SP 9271CT: 70 x 90 x 100 mm

CCC-Data

Switching capacity

to AC 15:	5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

IK 9271.11 AC 220 ... 240 V 50/60 Hz 0.1 ... 15 A
Article number: 0050331
SK 9271.11 AC 220 ... 240 V 50/60 Hz 0.1 ... 15 A
Article number: 0050647

- Single phase
- 4 programmable ranges up to 15 A
- energized on trip
- Auxiliary voltage U_H: AC 220 ... 240 V
- 1 changeover contact
- Width: 17.5 mm

IP 9271.12 AC 220 ... 240 V 50/60 Hz 0.5 ... 5 A
Article number: 0049961
SP 9271.12 AC 220 ... 240 V 50/60 Hz 0.5 ... 5 A
Article number: 0050648

- 3-phase
- Range: 0.5 ... 5 A
- de-energized on trip
- Auxiliary voltage U_H: AC 220 ... 240 V
- 2 changeover contacts
- Width: 70 mm

Variants

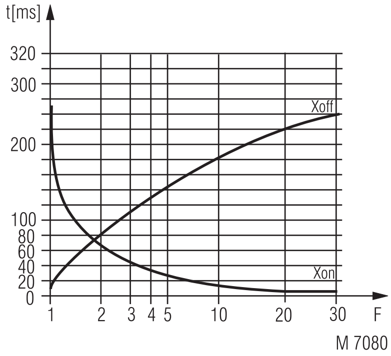
IK 9271.11/010, SK 9271.11/010:	single phase current relay energized on trip, 1 changeover contact
IK 9271.11/800:	single phase current relay energized on trip, exept with 1 measuring ranges from 10 ... 100 mA 1 changeover contact
IL 9271.12/010, SL 9271.12/010:	single phase current relay energized on trip, 2 changeover contacts
IL 9271.11/500, SL 9271.11/500:	same as IK/SK 9271.11, except with 5 measuring ranges from 0.1 ... 50 A
IL 9271.11/510, SL 9271.11/510:	same as IK/SK 9271.11/010, except with 5 measuring ranges from 0.1 ... 50 A
IP 9271.12/010, SP 9271.12/010:	3-phase current relay energized on trip 2 changeover contacts
SL 9271.12CT:	single phase current relay with built in CT, de-energized on trip, 2 changeover contacts
SP 9271.12CT:	3-phase current relay with built in CT, de-energized on trip, 2 changeover contacts

Ordering example for variants

SP 9271 .12 CT /_ _ 0 AC 220 ... 240 V 50 / 60 Hz 5 ... 50 A

Measuring range
Nominal frequency
Auxiliary voltage
0: de-energized on trip
1: energized on trip
Variant, if required
Built in CT
Contacts
Type

Characteristics



Switching delay

The characteristic shows the switching delay depending on the values of X_{on} - X_{off} when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{I\ applied}{I\ setting}$$

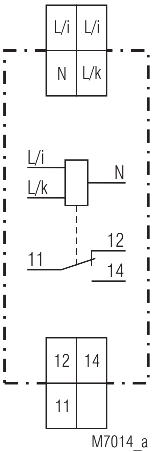
VARIMETER
Undercurrent Relay
IK 9273, SK 9273

0226829

IK 9273 SK 9273

- According to IEC/EN 60 255
- Single phase
- Measuring ranges from 0.05 ... 10 A
- Setting value adjustable from 0.1 ... 1 I_N
- Fixed hysteresis approx. 4 %
- Settable switching delay
- Closed circuit operation
- Optionally open circuit operation
- Automatic reset
- Optionally manual reset, reset button on the front
- LED indication for auxiliary voltage and contact position
- 1 changeover contact
- Devices available in 2 enclosure versions:
  IK 9273: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9273: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Circuit Diagram



IK 9273.11, SK 9273.11

Approvals and Markings

CE

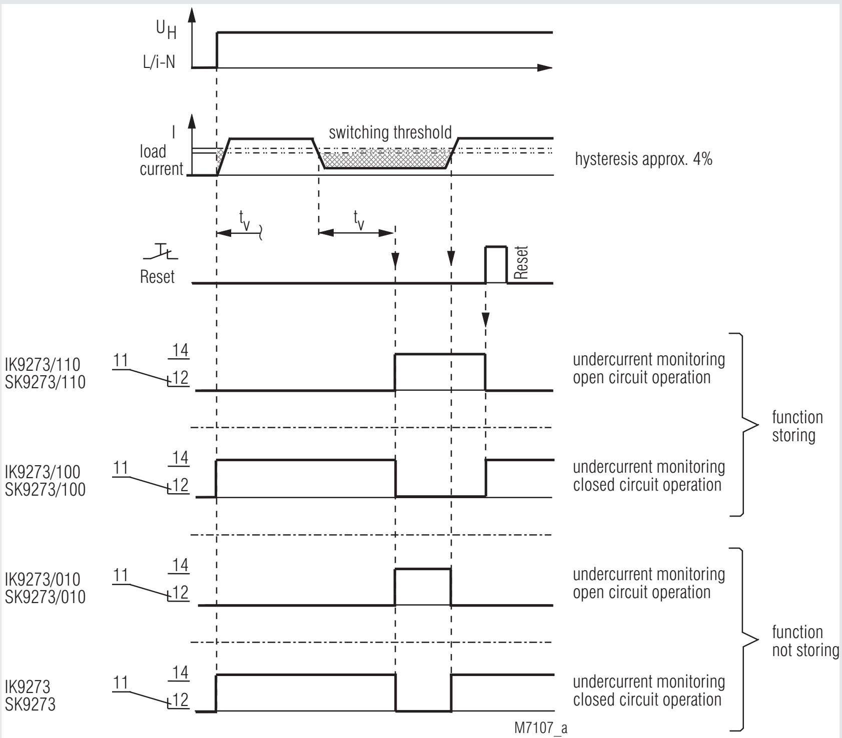
Application

Undercurrent monitoring in AC voltage power supplies

Indication

green LED:	on when auxiliary supply connected
yellow LED:	on when output contacts switched

Function Diagram



Notes

Auxiliary voltage and measuring circuit are not galvanically seperated. Thus they need, the same reference potential "N" if there is no external galvanic seperation, e.g. through a current transformer see Application Examples.

Technical Data

Input

Measuring ranges:	AC 50 ... 500 mA	
	AC 0.1 ... 1 A	
	AC 0.5 ... 5 A	
	AC 1 ... 10 A	
	higher currents via external current transformer (2.5 VA)	
Nominal frequency of measuring current:	50 / 60 Hz	
Maximum continuous measuring current:		
at AC 50 ... 500 mA:	2.5 A, at 50°C ambient temperature	
at AC 0.1 ... 1 A:	5 A, at 50°C mabient temperature	
at AC 0.5 ... 5 A:	11 A, at 50°C ambient temperature	
at AC 1 ... 10 A:	15 A, at 50°C ambient temperature	
Max. overload:		
at AC 50 ... 500 mA:	8 A, max. 3 s	
at AC 0.1 ... 1 A:	10 A, max. 3 s	
at AC 0.5 ... 5 A:	20 A, max. 3 s	
at AC 1 ... 10 A:	20 A, max. 3 s	
Temperature influence:	≤ 0.2 % / K	
Reaction time:	see characteristics, switching delay	

Setting Ranges

Response value:	infinite variable within measuring range
Hysteresis:	approx. 0.96 of setting value, fixed approx. 4 % hysteresis
Setting accuracy:	≤ ± 10 % of setting value
Repeat accuracy:	≤ ± 1 %
Switching delay tv:	0.1 ... 20 s adjustable

Auxiliary Circuit

Auxiliary voltage U_H:	AC 115 ... 127 V, AC 220 ... 240 V
Voltage range:	0.8 ... 1.1 U_H
Nominal consumption	
at AC 230 V:	5.5 VA
Nominal frequency:	50 / 60 Hz
Frequency range:	± 5 %

Output

Contacts		
IK 9273.11, SK 9273.11:	1 changeover contact	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V		
NO contact:	3 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 10^8 Schaltspiele	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1

Technical Data

EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:	Housing: IP 40	IEC/EN 60 529
	Terminals:IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9273:	65 g	
SK 9273:	84 g	

Dimensions

Width x heigth x depth	
IK 9273:	17.5 x 90 x 59 mm
SK 9273:	17.5 x 90 x 98 mm

Standard Types

IK 9273.11 AC 220 ... 240 V 50/60 Hz 10 A
Article number: 0050544

- Closed circuit operation
- Output: 1 changeover contact
- Nominal voltage U_N: AC 220 ... 240 V
- Measuring range: 1 ... 10 A
- Width: 17.5 mm

SK 9273.11 AC 220 ... 240V 50/60Hz 10 A
Article number: 0054747

- Closed circuit operation
- Output: 1 changeover contact
- Nominal voltage U_N: AC 220 ... 240 V
- Measuring range: 1 ... 10 A
- Width: 17.5 mm

Variants

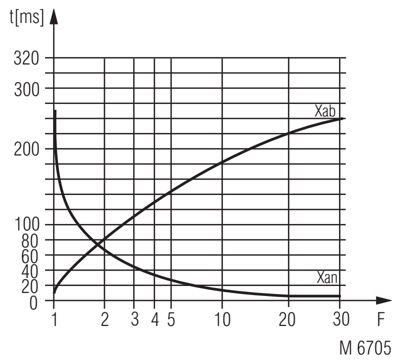
IK 9273.11/010:	Open circuit operation
IK 9273.11/100:	Manual reset, closed circuit operation
IK 9273.11/110:	Manual reset, open circuit operation

Ordering example for variants

IK 9273 .11 /_ _ _ AC 220 ... 240 V 50 / 60 Hz 10 A

Measuring range
Nominal frequency
Auxiliary voltage
Variant, if required
Contacts
Type

Characteristics

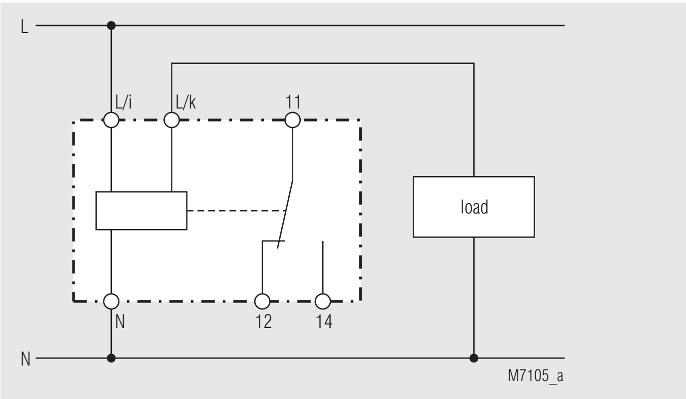


Switching delay

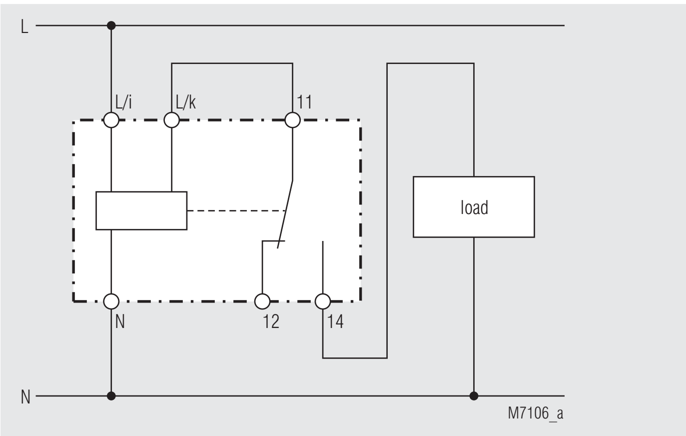
The characteristic shows the switching delay depending on the values of X_{an} - X_{ab} when switching the current on or off. A slow current change reduces the delay.

$$F = \frac{\text{I applied}}{\text{I setting}}$$

Application Examples

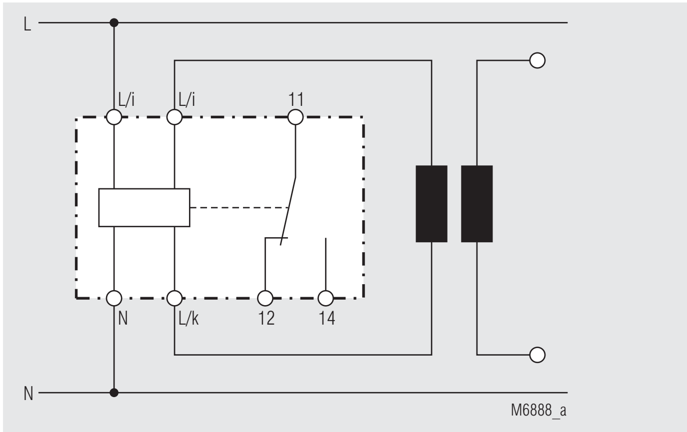


L/i - N auxiliary voltage
L/i - L/k current input



Connection Example for IK 9273/100 + IK 9273

Load in series to the contact. When undercurrent the load is turned on. The fault is stored. New start by pressing reset button or auxiliary voltage off, on.Maximum continuous measuring current for this application is 5 A.



Connection Example with external galvanic seperation, e.g. by current transformer

Attention: On the secondary side of the current transformer is the potential L.
L/i is allowed to be exchanged, so that the secondary side of the current transformer has the potential N.

VARIMETER
Current Monitor
IK 8839, IL 8839

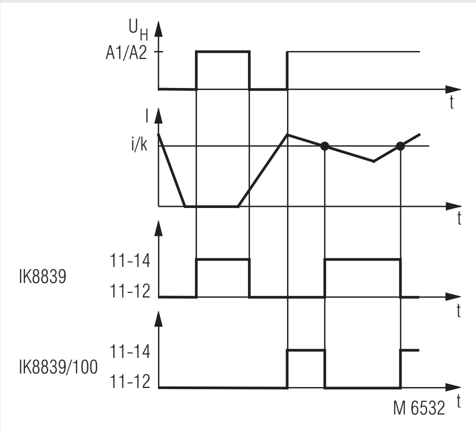
DOLD

0222089

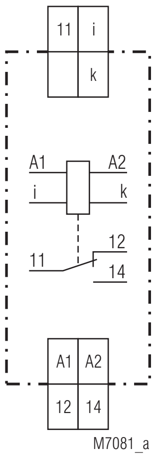
IK 8839 IL 8839

- According to IEC/EN 60 255, DIN VDE 0435-303
- Measuring range 0.175 ... 1 A
- Fixed switching point setting
- High maximum load
- As option with semiconductor output
- Width
  IK 8839: 17.5 mm
  IL 8839: 35 mm

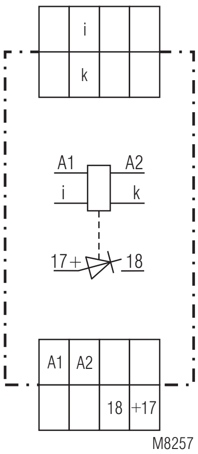
Function Diagram



Circuit Diagram



IK 8839.11



IL 8839.95

Approvals and Markings

CE

Application

For monitoring the operation of consumers that are primarily electrothermal in nature, e.g. heating spirals, supplementary tubular heaters. The current monitor checks whether the operating current is flowing when the consumer is switched on.

Technical Data

Input

Switching point, fixed:	Permanent maximum load	2 s
AC 0.175 A:	AC 5 A	AC 16 A
AC 0.75 A:	AC 20 A	AC 150 A
AC 1.0 A:	AC 20 A	AC 150 A
Switching tolerance:	± 15 %	
Frequency influence:	48 ... 52 Hz / – 8 % ... + 3 %	
Auxiliary voltage U_H:	AC/DC 24 V, AC/DC 48 V AC 110 ... 127 V, AC 220 ... 230 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption at AC 230 V:	50 / 60 Hz	
apparent power:	2.2 VA	
active power:	0.5 W	
Nominal frequency:	50 Hz	
Nominal consumption:	± 5 %	

Output

Contacts		
IK 8839.11:	1 changeover contact	
Operate time:	approx. 60 ms	
Thermal current I_{th}:	5 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 5 A, AC 230 V:	approx. 10^5 switching cycles	
to AC 15 at 8 A, AC 230 V:	approx. 5 x 10^4 switching cycles	
Permissible switching frequency:	3000 / h	
Short circuit strength max. fuse rating:	4 AgL	IEC/EN 60 947-5-1
Mechanical life:	20 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1

Semiconductor Output

Output		
IL 8839.95:	Transistor	
Output voltage:	DC 24 V (0 ... 30 V)	
Min. output voltage U_{ON}:	< 0.3 V	
Clearance and creepage distances	4 kV / 2	
$I_{max.}$	5 A	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	70 g	

Dimensions

Width x height x depth: 17.5 x 89 x 58 mm

Standard Type

IK 8839.11 AC 230 V 50 Hz 1 A

Article number:	0054134	stock item
• Output:	1 changeover contact	
• Auxiliary voltage U_H:	AC 230 V	
• Switching point:	1 A	
• Width:	17.5 mm	

Variants

IK 8839.11/100:	with an inverted output
IK 8839.11/001:	with a fixed operate delay 180 ... 300 ms
IK 8839.01/150, IK 8839.05/150	
IK 8839.01/250, IK 8839.05/250:	with High current terminals max. 16 mm² solid max. 6 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
IK 8839.01/150:	with a fixed switching point AC 1.0 A, permanent maximum load: 40 A, 1 NO contact
IK 8839.05/150:	same as IK 8839.01/150, but with 1 NC contact
IK 8839.01/250:	same as IK 8839.01/150, but with an inverted output
IK 8839.05/250:	same as IK 8839.05/150, but with an inverted output

Ordering example for variants

IK 8839 .11 /_ _ _ AC 230 V 50 Hz 1A

- 1A — Switching point
- 50 Hz — Nominal frequency
- AC 230 V — Auxiliary voltage
- /_ _ _ — Variant, if required
- .11 — Contacts
- IK 8839 — Type

Specification for Tender for IK 8839

Current monitor according to IEC/EN 60 255, DIN VDE 0435-303 to be built in consumer units. Switching point AC 0.175 A ... 5 A permanent, can be overloaded for a short time for 2 s ... 16 A. 1 changeover contact.
Width 17.5 mm
Type IK 8839
Manufactured by E. DOLD & SÖHNE KG

Current monitor according to IEC/EN 60 255, DIN VDE 0435-303 to be built in consumer units. Switching point AC 0.175 A ... 20 A permanent, can be overloaded for a short time for 2 s ... 150 A. 1 changeover contact.
Width 17.5 mm
Type IK 8839
Manufactured by E. DOLD & SÖHNE KG

Current monitor according to IEC/EN 60 255, DIN VDE 0435-303 to be built in consumer units. Switching point AC 1.0 A ... 20 A permanent, can be overloaded for a short time for 2 s ... 150 A. 1 changeover contact.
Width 17.5 mm
Type IK 8839
Manufactured by E. DOLD & SÖHNE KG

Monitoring Technique

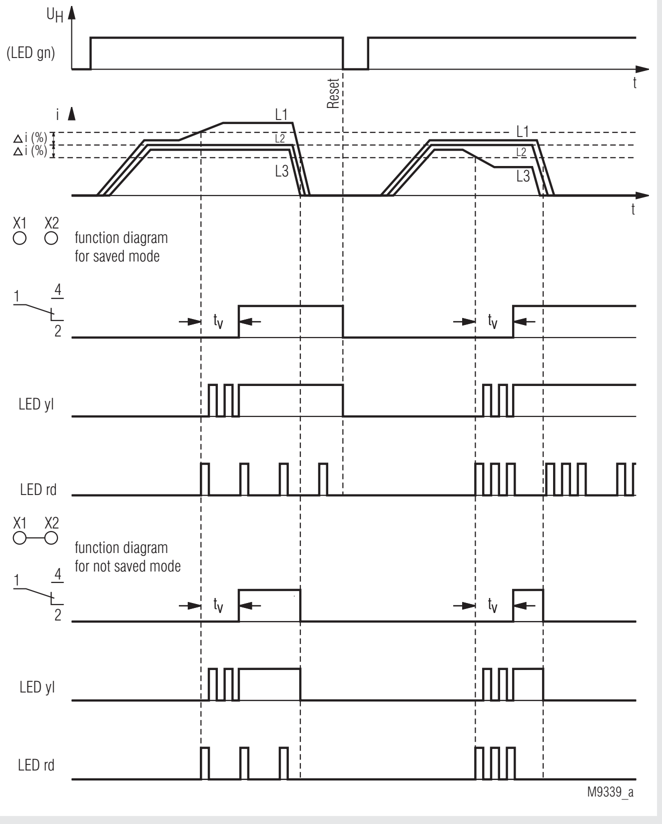
VARIMETER
Current Asymmetry Relay with integrated current transformer up to 100 A - IP 9278, SP 9278CT

0254039

IP 9278 SP 9278CT

- According to IEC/EN 60 255, DIN VDE 0435-303
- IP 9278, SP 9278: 3-phase
- Measuring range IP 9278, SP 9278: up to 15 A
  SP 9278CT: up to 100 A
- 2 changeover contacts
- Adjustable asymmetry
- Settable time delay
- Open circuit operation
- LED indicators
- With auxiliary voltage
- Auxiliary supply and measuring input galvanic separated
- As option with external remote reset
- Width 70 mm

Function Diagram



Approvals and Markings

CE

Applications

Monitoring of current asymmetry in 3-phase systems e.g. monitoring of heating elements, heating and load circuits

Indicators

LED green:	on when aux. supply connected
LED yellow:	on when output contacts switched, flashes during timing
LED red:	Failure code: 1 short pulse, followed by longer space = failure in current path i1/k1 2 short pulses, followed by longer space = failure in current path i2/k2 3 short pulses, followed by longer space = failure in current path i3/k3 4 short pulses, followed by longer space = current is out of operating range

Function

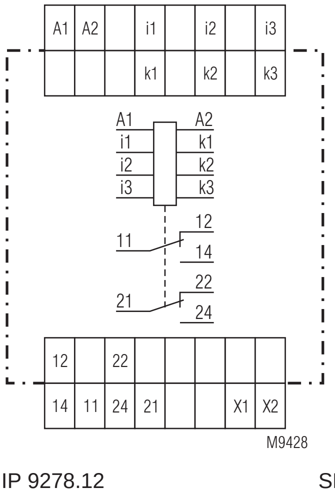
The IP 9278 monitors 3 currents (phases) on asymmetry.
Within the operating range the device searches continuously for the 2 currents with the smallest current difference in %.
The currents in these 2 paths are the reference for the asymmetry calculation of the third current path. The asymmetry is adjustable within 10 ... 40%.

If asymmetry is detected, the fault is indicated after an adjustable time delay t_v by 2 changeover contacts. Without bridge the fault is stored, with bridge it auto resets.
The flashing code on the red LED indicates in which current path the failure occurred.
The reset is made by disconnecting the auxiliary voltage.
On request the unit is also available with remote reset.

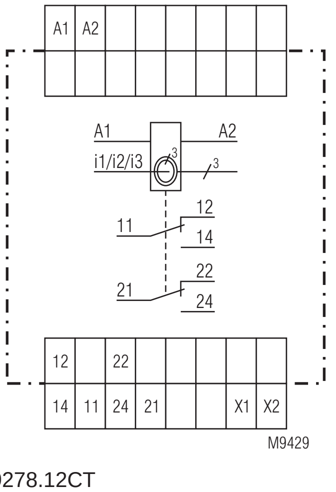
Notes

For small currents at the bottom end of the operating range it is recommended to adjust the asymmetry value slightly higher to reduce the response sensitivity.

Circuit Diagrams



IP 9278.12



SP 9278.12CT

Technical Data

Input

Measuring Ranges

	IP 9278 **SP 9278**		**SP 9278CT**
Measuring range:	1 ... 15 A	4 ... 50 A	8 ... 100 A
	other ranges on request		
Operating range (asymmetry ± 10 %):	0.9 ... 16.5 A	3.5 ... 55 A	9 ... 110 A
	at asymmetry setting > 10 % the operating range is reduced, e. g.		
Asymmetry ± 20 %:	1.2 ... 13.7 A	4.5 ... 45 A	9 ... 90 A
Asymmetry ± 40 %:	1.5 ... 11.5 A	6 ... 39 A	12 ... 78 A

When the current falls below or rises above the operating range a fault is indicated by the output relay and the red LED gives the flash code 4 (Out of range).

The current transformers are mounted in the base of the SP 9278, the wires are lead through the CTs (no terminals).

Measuring Circuit

Frequency range of measuring current:	50 ... 400 Hz
Max. permitted continuous current of the current paths	
IP 9278:	20 A at 45°C ambient temperature 15 A bei 50°C ambient temperature
SP 9278CT:	100 A
Temperature influence:	≤ 0.05 % / K
Reaction time:	approx. 500 ms

Setting Ranges

Response value of asymmetry:	adjustable within the operating range 10 ... 40 % compared to the mean value of the 2 current paths with the lowest difference.
Repeat accuracy:	≤ ± 1 %
Time delay t_v:	0.1 ... 20 s settable (logarithmic scale)

Auxiliary Circuit

Auxiliary voltage U_H:	AC/DC 24 V, AC 220 ... 240 V others on request
Voltage range	
at AC:	0.8 ... 1.1 U_H
at DC:	0.8 ... 1.25 U_H
Nominal consumption	
at AC 230 V:	3.2 VA
at DC 24 V:	1 W
Nominal frequency:	50 / 60 Hz
Frequency range:	± 5 %

Output

Contacts		
IP 9278.12, SP 9278.12CT:	2 changeover contacts	
Thermal current I_{th}:	5 A	
Switching capacity to AC 15		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A, AC 230 V		
NO contact:	2 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short-circuit strength max. fuse rating:	10 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 50 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated rated impulse voltage voltage/ pollution degree:		IEC 60 664-1
Supply - contacts:	4 kV/2	
Supply - Measuring circuit:	6 kV/2	
Measuring circuit - contacts:	6 kV/2	
Measuring circuit - Measuring circuit -	6 KV/2	

The contacts are not designed for voltage systems with 400 / 690 V

EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4	
Current path i/k on SP 9278CT:	3 x 25 mm^2 with insulation max. 10 mm ∅ DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IP 9278:	200 g	
SP 9278CT:	300 g	

Dimensions

Width x height x depth	
IP 9278:	70 x 90 x 61 mm
SP 9278CT:	70 x 90 x 100 mm

Standard Type

IP 9278.12 AC/DC 24 V 1 ... 15 A 0.1 ... 20 s

Article number:	0057915
• Measuring range:	1 ... 15 A
• 2 changsover contacts	
• Auxiliary voltage U_H:	AC/DC 24 V
• Time delay:	0.1 ... 20 s

Variants

IP 9278.12/100:	Variant with external remote reset control voltage on terminals X1-X2 AC/DC 10 ... 265 V for reset

Ordering example for variants

SP 9278 .12 CT /_ _ _ AC 220 ... 240 V 50 / 60 Hz 4 ... 50 A 0.1 ... 20 s

Switching delay
Measuring range
Nominal frequency
Auxiliary voltage
Variant, if required
Built in CT
Contacts
Type

VARIMETER
Motor Load Monitor
MK 9397N, MH 9397

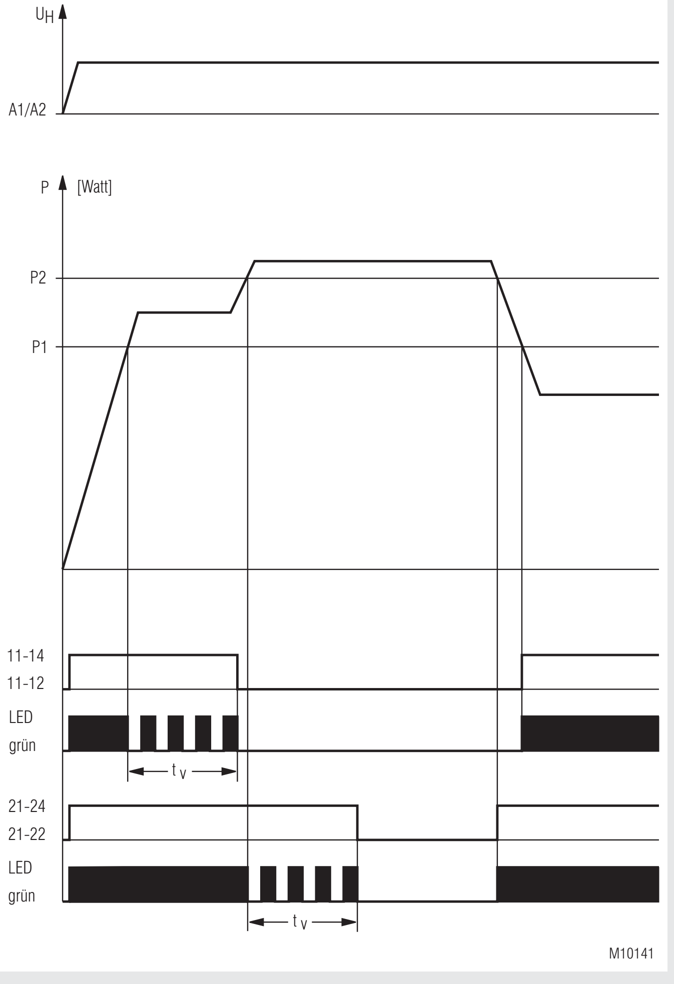
MK 9397N MH 9397

Product description

The Load monitor MK9397 and MH9397 of the varimeter family monitor reliably the load of motors as well as the function of 3 phase electrical users.

If the measured value falls under or goes over the adjusted settings the corresponding output relay is energised. To avoid unnecessary tripping a response delay t_v can be adjusted between 0 and 10 s. LEDs show the status of the output relays.

Function Diagram



Your Advantage
- Preventive maintenance
- For a evaluate time
- Quicker fault locating
- Precise and reliable
- Overload detection, as option also with prewarning
- Can also be used for underload monitoring
- Simple adjustment and fault diagnostics
- Space and cost saving

Features
- According to EN 60255-1
- Active power measuring
- Relay output
  MK 9397N: 1 changeover contact
  MH 9397: 1 changeover contact each for overload and prewarning
- On delay
- Closed circuit operation
- As option open circuit operation
- As option with plugable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- MK 9397N: Width 22,5 mm
  MH 9397: Width 45 mm

Approvals and Markings

CE

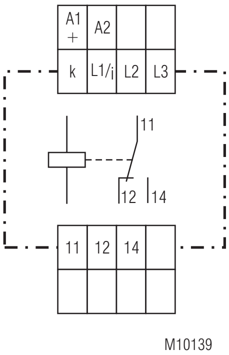
Application

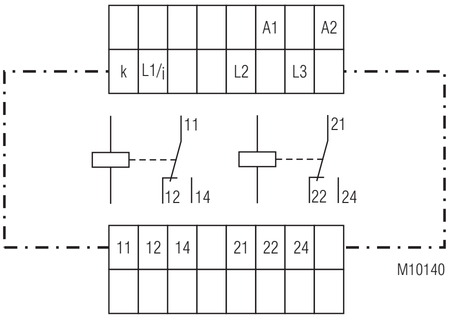
The load monitor is suitable to monitor industrial motors with variable load as well as to monitor the correct function of electrical users. The units can detect in time wearing or failures on machines and tools. So maintenance can be carried out before a plant stops.

Function

The load monitor monitors the effective power of electrical consumers. As the current is only measured in one phase a symmetric load in a 3 phases is assumed. as it is usual with motors. The setting value is adjusted with potentiometers, the range selection by rotational switches. The MH 9397 has 2 response values (e.g. for prewarning).

Circuit Diagrams





MK 9397N MH 9397

Connection Terminals

Terminal designation	Signal designation
A1 / A2	Auxiliary voltage
K / L1/i	Current path (current at phase L1)
L1 / L2 / L3	Supply
11 / 12 / 14	Contacts relay 1
21 / 22 / 24	Contacts relay 2 (only at MH 9397)

Connection notes

The unit can also be used on single phase loads. the terminals L2 and L3 have to be bridged in this case. The device also switches at the set points in the case of reverse power. Overload in the current path is indicated by fast flashing of the LEDs.

Geräteanschluss

The connection has to be done according to the connection diagrams. To connect the motor current of L1 the terminals i and k are used.. For current exceeding the limits of the device an additional current transformer has to be used.

Setting

2 rotational switches for P_1

rotary switch 1:	fine adjustment
rotary switch 2:	8 ranges adjustable: 0 ... 1 kW 1 ... 2 kW 2 ... 3 kW ⋮ 7 ... 8 kW

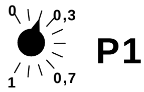
2 rotational switches for P_2

rotary switch 3:	fine adjustment
rotary switch 4:	8 ranges adjustable: 0 ... 1 kW 1 ... 2 kW 2 ... 3 kW ⋮ 7 ... 8 kW

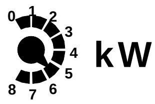
rotary switch t_v: 0 ... 10 s

Example **Response value: 5.2 kW**

fine adjustment
(upper rotary switch): 0,2 kW



Bereichswahl
(lower rotary switch): 5 ... 6 kW



Indication

The LED indicate the state.

green LED, UN: on, when auxiliary voltage present

green LED, P1: flashes: during time delay
permanently on: Relay 1 active

(only at MH 9397)
green LED, P2: flashes: during time delay
permanently on: Relais 2 active

Overload within the current range is indicated by fast flashing of the LED.

Technical Data

Auxiliary Voltage A1 / A2

Nominal auxiliary voltage U_H:	
MK 9397N:	DC 24 V (0.9 ... 1.1 x U_H)
MH 9397:	AC 230V (0.8 ... 1.1 x U_H)
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 400 Hz
Input current:	
at DC 24V:	50 mA
at AC 230V:	15 mA

Voltage Measuring Input L1 / L2 / L3

Nominal voltage U_N:	3 AC 400 V
Measuring range:	3 AC 12 ... 400 V

Variants without auxiliary supply get their power from the measuring input. The Voltage range of the Measuring voltage is then identical with the range of the auxiliary supply.

Current Measuring Input i / k

Nominal current I_N:	AC 12 A
Measuring range:	AC 100 mA ... 12 A
Max. overload	
continuously:	16 A
short time < 10 s:	max. 25 A

Overload within the current range is indicated by fast flashing of the LED.

Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 400 Hz

Setting range (at absolute scale)

Rel 1:	fine adjustment
Range:	8 ranges 0 ... 8 kW
Rel 2:	fine adjustment
Range:	8 ranges 0 ... 8 kW
Measuring accuracy at nominal frequency (in % of setting value):	± 4%
Hysteresis (in % of setting value):	< 5 %
Reaction time:	< 150 ms
Time delay t_v:	0 ... 10 s adjustable
Start up delay:	500 ms fixed

Output Circuit (Rel1: 11/12/14; Rel2: 21/22/24)

Contacts		
MK 9397N:	1 changeover contact for P1	
MH 9397:	1 changeover contact for P1 and 1 changeover contact for P2	
Thermal current I_{th}:	2 x 4 A	
Switching capacity to AC 15:		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life to AC 15 at 3 A, AC 230 V:	2 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Permissible switching frequency:	1800 switching cycles / h	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

Technical Data

General Data

Nominal operating mode:	continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distance rated impulse voltage / pollution degree:	4 kV / 2	
high voltage test:	IEC/EN 60 664-1	
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power sypply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour according to UL Subject 94	
Vibration resistance:	Amplitude 0,35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminal (fixed):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated) or 2 x 1.5 mm² stranded ferruled (isolated) or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Terminal block with screw terminals		
Max. cross section:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Insulation of wires or sleeve length:	8 mm	
Terminal block with cage clamp terminals		
Max. cross section:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled (isolated)	
Min. cross section:	0.5 mm²	
Insulation of wires or sleeve length:	12 $^{\pm 0.5}$ mm	
Wire fixing:	Plus-minus terminal screws M3,5 box terminals with wire protection or cage clamp terminals	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	360 g	

Dimensions

Width x height x depth:	
MK 9397N:	22.5 x 90 x 99 mm
MH 9397:	45 x 90 x 99 mm

Standard Types

MK 9397N.11/010   3 AC 24 ... 400 V   AC 12 A   DC 24 V   10 s
Article number: 0062043
- Measuring voltage: 3 AC 24 ... 400 V
- Measuring current: AC 12 A
- Auxiliary voltage U_H: DC 24 V
- On delay: up to 10 s
- Output: 1 changeover contact
- Width: 22,5 mm

MH 9397.12/010   3 AC 24 ... 400 V   AC 12 A   AC 230 V   10 s
Article number: 0062046
- Measuring voltage: 3 AC 24 ... 400 V
- Measuring current: AC 12 A
- Auxiliary voltage U_H: AC 230 V
- On delay: up to 10 s
- Output: 1 changeover contact (Rel1) and 1 changeover contact (Rel2)
- Width: 45 mm

Ordering Example

MK 9397N .11 _ _ /010 3 AC 24 ... 400 V AC 12 A DC 24 V 10 s

On delay
Auxiliary voltage U_H
Measuring current U_M
Measuring voltage
Type of terminals
without indication: terminal blocks fixed with screw terminals
PC (plug in cage clamp): pluggableterminalblocks withcageclampterminals
PS (plug in screw): pluggableterminalblocks with screw terminals
Contacts
Type

Options with Pluggable Terminal Blocks

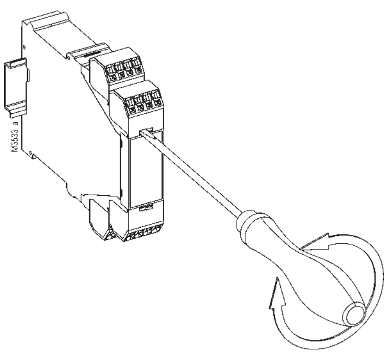
Screw terminal
(PS/plugin screw)

Cage clamp terminal
(PC/plugin cage clamp)

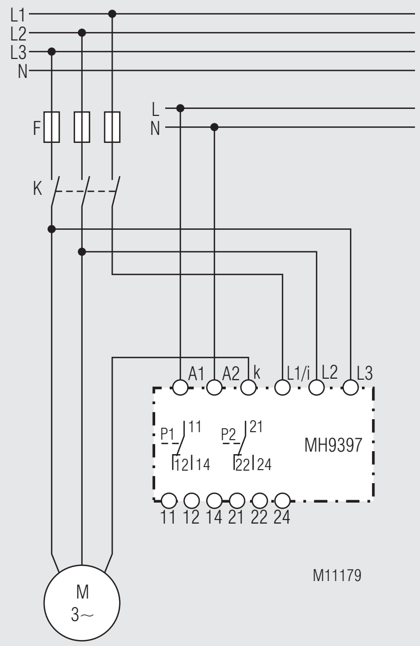
Notes

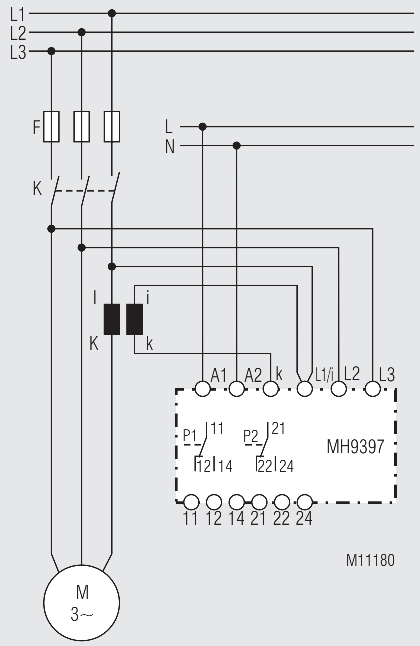
Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Connection Example





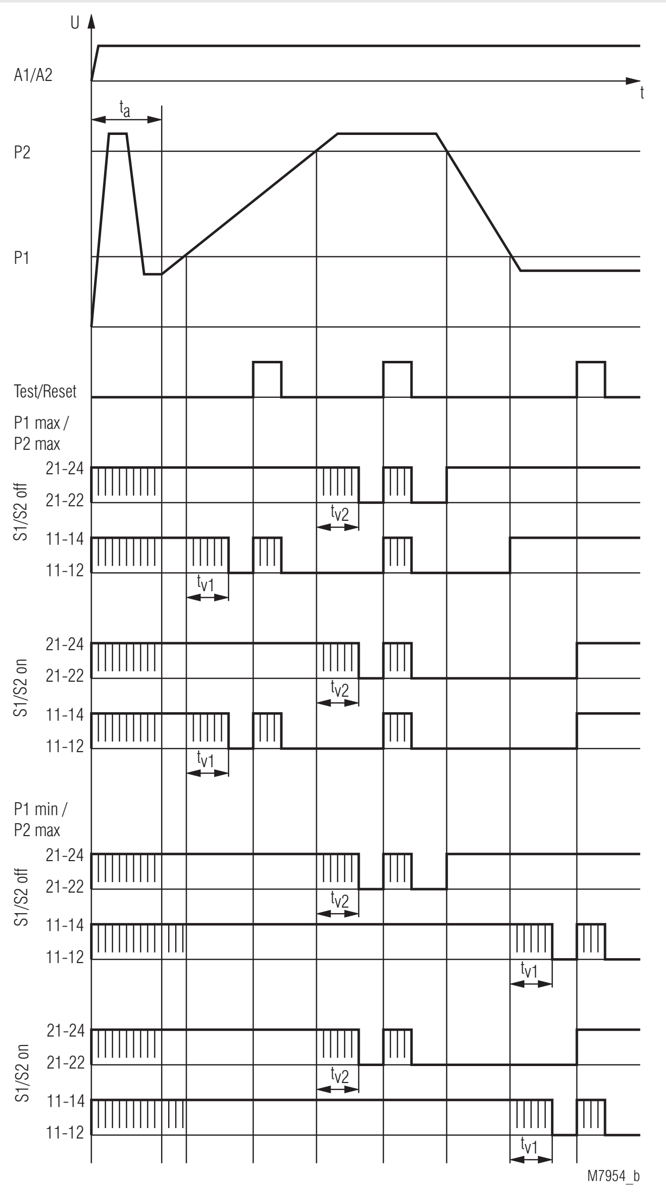
Remark:
When using external current transformers the setting values have to be multiplied with the transmission ratio ü of the current transformer.

Example: response value = setting value (P1/P2) x ü

VARIMETER
Motor Load Monitor
BH 9097

0239914


Function Diagram for Setting De-energized on Fault*)



P1max/P2max: Overload monitoring with prewarning
P1min/P2max: Under- and overload monitoring
S1/S2 ON: manual reset
S1/S2 OFF: automatic reset
IIIII: corresponding LED is flashing
*) when set to energized on fault the function of LEDs and output relays are inverted.

- According to IEC/EN 60255-1, IEC/EN 60255-26, DIN/VDE 0435-303
- Identification of
  - Underload P_1 and Overload P_2
  - Overload P_1 (prewarning) and Overload P_2 programmable
- Adjustment of P_1 and P_2 on absolute scale
- For motors up to 22 kW / 400 V; 37 kW / 600 V
- Measurement: effective power
- Large current range because of automatic range selection
- 1 changeover contact for P_1 and 1 changeover contact for P_2
- Adjustable start-up delay t_a
- Adjustable switching delay t_v
- With automatic or manual reset, programmable
- Test / Reset button for easy setup
- Up to 40 A without external current transformer
- De-energized or energized on fault, programmable
- Also for single-phase operation
- LED indicators
- Width 45 mm

Approvals and Markings

A025518 *

* see variants

Applications

The BH 9097 is used to monitor variable loads on industrial motors.

Function

The motor load monitor BH 9097 checks the active power consumption of electrical consumers. As the measuring principle is only single phase correct measurement of 3-phase load is only possible when all three phases have the same load which is normal with motors. Using DIP-switches the unit can be set up to act as under- and overload relay P_{1min} / $P_{2\,max.}$ or as overload relay with pre-warning $P_{1\,max.}$/$P_{2\,max.}$ The settings of P_1 and P_2 are absolute values and calibrated in Watts adjustable via rotational switches. 2 LEDs show the state of the corresponding output relays. The unit can be configured to energise or to de-energise on fault. Every output relay is fitted with it´s own time delay t_v. A start-up delay t_a acts on both outputs.

Indication

green LED, U_N:	flashing:	during Start-up delay t_a
	continuous:	supply connected
yellow LED, P_1:	flashing:	during time delay t_{v1} and for set up assistance
	continuous:	when relay P_1 active (contact 11-14)
yellow LED, P_2:	flashing:	during time delay t_{v2} and for set up assistance
	continuous:	when relay P_2 active (contact 21-24)

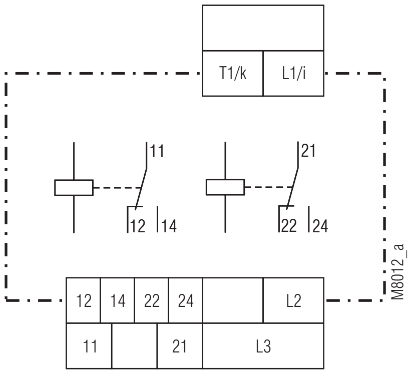
Fault indication

2 different faults are displayed with the LEDs.

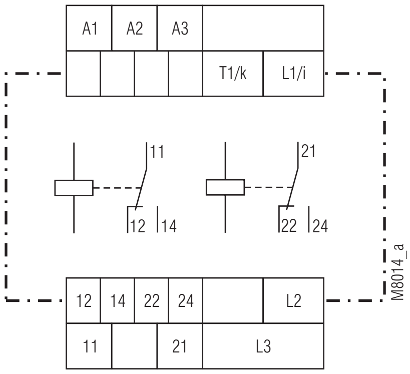
1.) No measurement:
Without measuring voltage measurement is not possible
- All 3 LEDs flash in sequence one after the other.
The output contacts are in failure state.

2.) The BH 9097 measures negative load:
Possible reason: The unit measures reverse power or the current connections are connected wrong.
- All 3 LEDs flash simultaneously.

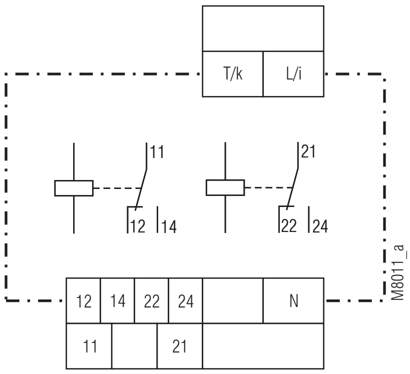
Connection Diagrams



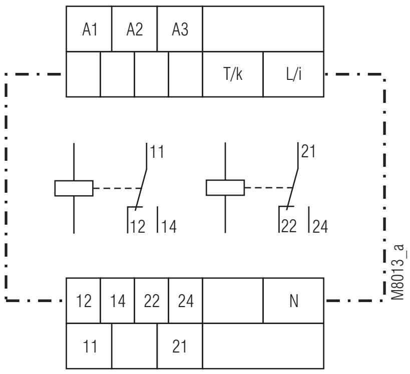
BH 9097.38/001



BH 9097.38/011



BH 9097.38



BH 9097.38/010

Technical Data

Input

Measuring voltage
Voltage range: without auxiliary voltage 0.8 ... 1.1 x U_N
with auxiliary voltage, see setting ranges
Input resistance: 300 kΩ ... 500 kΩ
Measuring current
Measuring range: see setting ranges

Nominal current [A]	40	24	8	2.4	0.8	0.24
Permissible current range (overload) [A]						
continuously:	0 ... 40	0 ... 40	0 ... 16	0 ... 8	0 ... 2,4	0 ... 1
1 min. (10 min. break):	150	150	20	16	3	1,5
20 s (10 min. break):	200	200	25	20	4	2
Input res. of current on i-k [mΩ]:	≤ 1	≤ 1	7	14	830	830

Frequency range: 10 ... 400 Hz
(please see characteristics M7953)

Setting Ranges

P_1 und P_2 on absolute scale
Switch
load range
for P1 and P2: lower range
upper range
Measuring accuracy
(in % of setting value): ± 4 % (2 % on request)
Hysteresis
(in % of setting value): < 5 %
Harmonic distortion < 40 %
Reaction time: < 50 ms
Switching delay t_{v1}/t_{v2}: 0 ... 10 s (infinite variable)
Start-up delay t_a: 0 ... 30 s (infinite variable)

Setting Ranges

Available variants	**Measuring voltage U_N**	**Measuring current I_N [A]**	**selection of load range**
1-phase			
without auxiliary voltage			
BH 9097.38/000	AC 230 V	0.0024 ... 0.24	0.1 ... 60 W
	AC 230 V	0.024 ... 2.4	1 ... 600 W
	AC 230 V	0.24 ... 24	10 ... 6000 W
with auxiliary voltage			
BH 9097.38/010	AC 35...250 V	0.0024 ... 0,24	0.1 ... 60 W
	AC 35...250 V	0.024 ... 2,4	1 ... 600 W
	AC 35...250 V	0.24 ... 24	10 ... 6000 W
3-phase			
without auxiliary voltage			
BH 9097.38/001	3 AC 400 V	0.008 ... 0,8	0.1 ... 60 W
	3 AC 400 V	0.08 ... 8	10 ... 6000 W
	3 AC 400 V	0.4 ... 40	0.1 ... 30 kW
with auxiliary voltage			
BH 9097.38/011	3 AC 60 ... 440 V	0.008 ... 0,8	1 ... 600 W
	3 AC 60 ... 440 V	0.08 ... 8	10 ... 6000 W
	3 AC 100 ... 760 V	0.4 ... 40	0.1 ... 52 kW

Auxiliary Circuit

Auxiliary voltage U_H
only for BH 9097.38/010,
BH 9097.38/011: AC 110 V (Klemmen A 1 - A 2),
AC 230 V (Klemmen A 1 - A 3),
DC 24 V
Voltage range: 0.8 ... 1.1 U_H
Frequency range of U_H: 45 ... 400 Hz
Input current
AC 110 V: approx. 30 mA
AC 230 V: approx. 15 mA
DC 24 V: approx.. 50 mA

Technical Data

Output

Contacts:	1 changeover contact for P1 1 changeover contact for P2	
Thermal current I_{th}:	2 x 5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 3 A, AC 230 V:	2×10^5 switching cycles	IEC/EN 60 947-5-1
Permissible switching frequency:	1800 switching cycles / h	
Short circuit strength max. fuse rating:	4 A gl	IEC/EN 60 947-5-1
Mechanical life:	30×10^6 switching cycles	

General Data

Operating mode:	continuous	
Temperature range:	- 20 ... + 55°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Load terminals:	1 x 10 mm² solid or 1 x 6 mm² stranded wire with sleeve	
Control terminals:	1 x 4 mm² solid or 2 x 1.5 mm² stranded wire with sleeve or 1 x 2,5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Box terminals with self-lifting wire protection and Plus-minus terminal screws M3.5	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	430 g	

Dimensions

Width x height x depth: 45 x 84 x 121 mm

CCC-Data

Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

BH 9097.38/001 3 AC 400 V 50 / 60 Hz t_a 30 s t_v 10 s
Article number: 0053944
- 3-phase, without auxiliary supply
- Output: 1 changeover contact for P1 and 1 changeover contact for P2
- Nominal voltage U_N: 3 AC 400 V
- Width: 45 mm

Variants

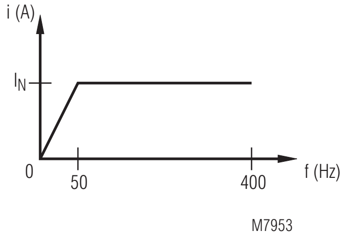
BH 9097:	with CCC-approval on request
BH 9097.38/001:	3-phase without auxiliary supply
BH 9097.38/011:	3-phase with auxiliary supply
BH 9097.38/000:	1-phase without auxiliary supply
BH 9097.38/010:	1-phase with auxiliary supply
BH 9097.38/1_ _:	With galvanically separated current path. For applications with current transformers grounded on the secondary side, current range limited to 25 A
BH 9097.38/801:	same as BH 9097.38/001, but with start up delay t_a = 0 ... 10 s

Ordering example for variants

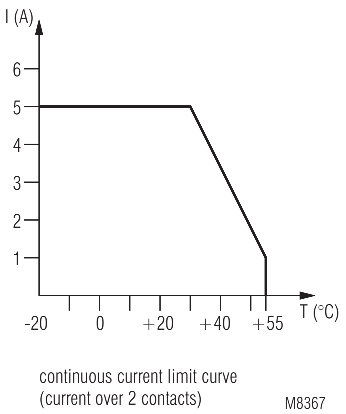
BH 9097 .38 /_ _ _ 3 AC 100...760 V AC 40 A AC 230/110 V

- Auxiliary voltage U_H
- Max. nom. current I_N of input circuit
- Nominal voltage U_N of input circuit
- Variant, if required
- Contacts
- Type

Characteristics



Max. input current curve in relation to input frequency



Settings

2 rotational switches for P_1:	Value P_1 (2 decades)
2 rotational switches for P_2:	Value P_2 (2 decades)
Potentiometer t_{v1}:	time delay for value P_1
Potentiometer t_{v2}:	time delay for value P_2
Potentiometer t_a:	start-up delay after connection voltage
Test/Reset-Taste:	Test function as setting assistance Reset function when manual reset is selected

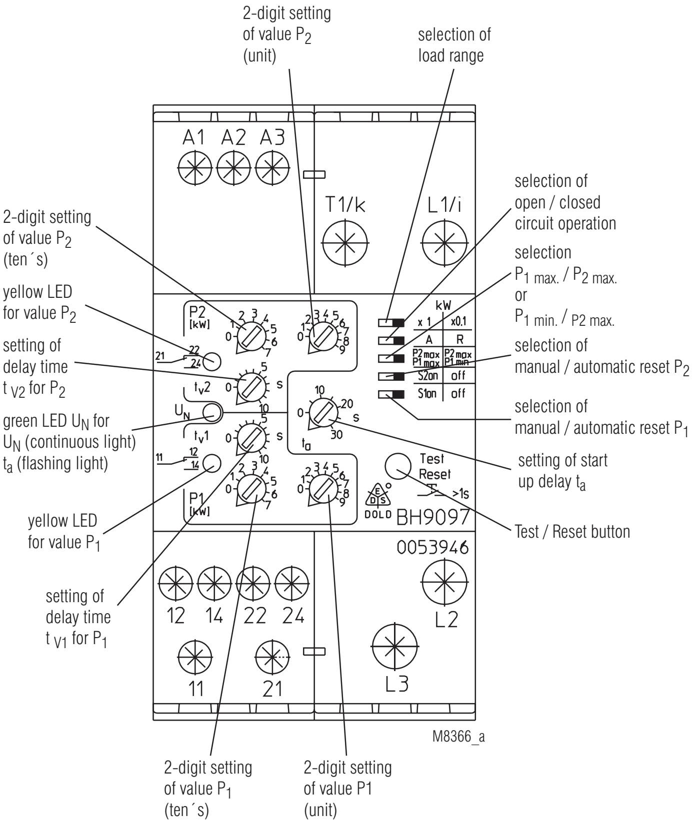
Dip-switches:

x10 | x1	selection of upper / lower load range
A | R	selection of closed or open circuit operation for output relays
$P_{2\,max.}$ | $P_{2\,max.}$ $P_{1\,max.}$ | $P_{1\,min.}$	2 MAX switching values (Overload with Pre-warning) or MAX and MIN switching value (Overload / Underload monitoring)
S1 ON | OFF:	manual / automatic reset for P_1
S2 ON | OFF:	manual / automatic reset for P_2

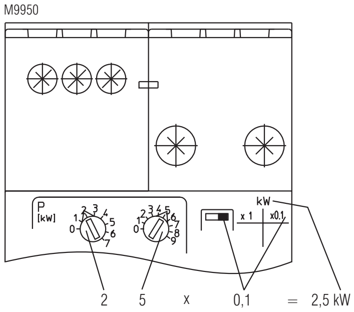
Connection

The device has to be connected according to the connection diagrams. The motor is connected to terminals L/i and T/k or L1/i and T1/k. The flow direction of the current has to be observed. On reverse power the unit gives a fault signal. The max continuous motor current is 40 A limited by the terminals. With higher currents a current transformer with 2,5 VA has to be used.

Set-up Procedure and Setting Instructions



Adjustemt example: response value: 2,5 kW



Response value = 25 x 0,1 = 2,5 kW

The adjustment of the unit can be made without additional measuring equipment and calculations. Please make sure that the load values are in the permitted operating range of the unit. Based on the max permitted values the BH 9097 can be used for 48 kW 3-phase motors at 3 AC 690 V and 5.8 kW single phase motors at AC 230 V.

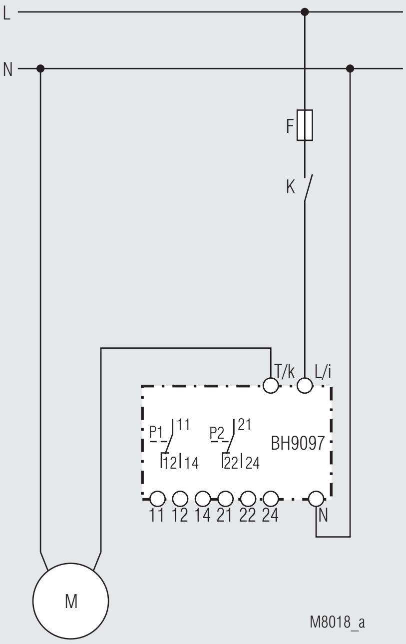
There are three methods to set up the unit:

Method 1:
If the absolute values of the actual required tripping points P_1 and P_2 are known, they can be set directly on the unit (2-digit setting of P_1 and P_2).

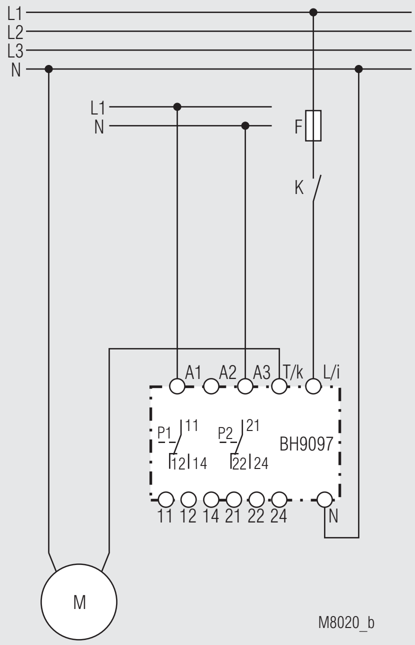
Method 2:
This method is recommended when it is possible to simulate the different load situations during set-up. In this case nothing has to be calculated. Turn the delay time for P_1 and P_2 to min. The motor runs in underload while the Pot 1 is turned until the output relay switches. The same has to be done for overload. Now the unit is set accurately. Now adjust the operate delay and the start-up delay to the required values.
Pressing the test / reset button during setup disables the switching of the output relays. The LEDs of P_1 and P_2 flash.

Method 3:
This method is the most simple one but not the most accurate. The operate delay is set to min. The motor is switched on and runs on nominal load. With both potentiometers the set points are searched by slowly turning the max. Pot from high to low value and the min. Pot from low to high value until the corresponding output relays switch. After that turn the Pot P_2 to the right (e.g. + 10 %) side and the Pot P_1 to the left (e.g. - 10 %) until the output relays reset. The unit is now set and responds if the load differs from the nominal value. Finally set the operate delay and start-up delay to the required values. The DIP switch should be set to $P_{1\,min}$ / $P_{2\,max}$.

single phase

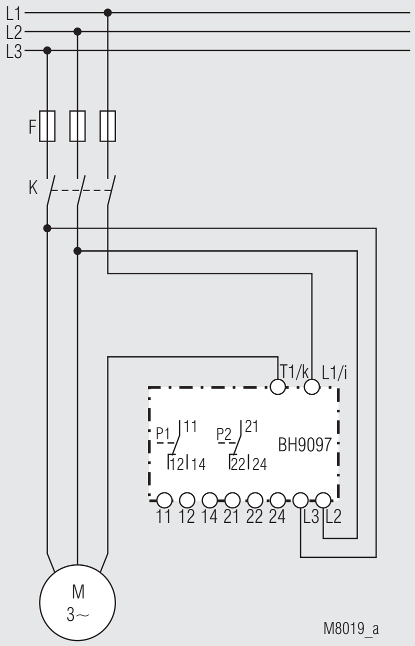


BH 9097.38

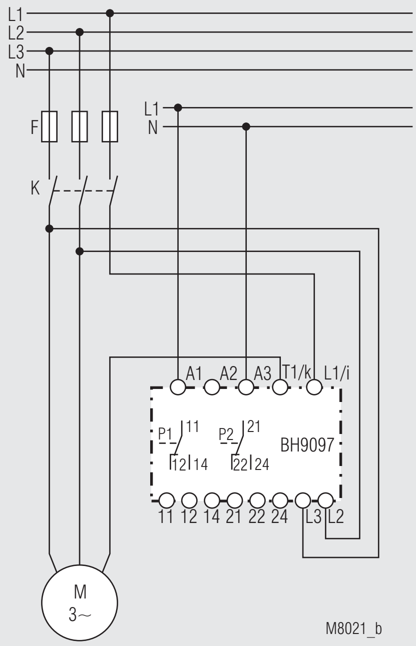


BH 9097.38/010

3-phase



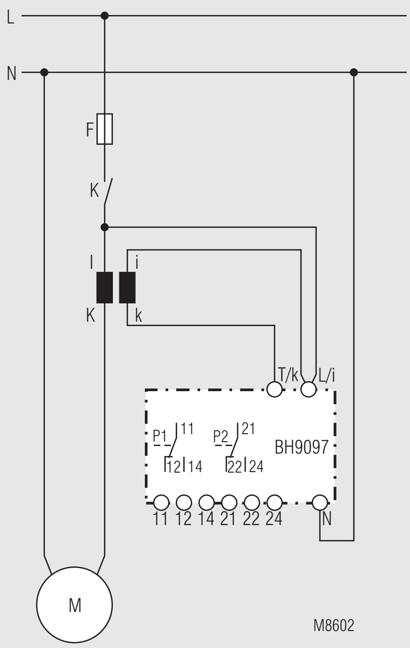
BH 9097.38/001



BH 9097.38/011

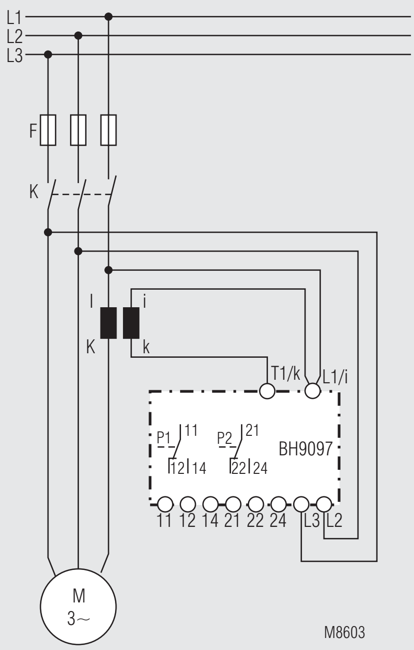
Connection Examples with External Current Transformer

single phase



BH 9097.38

3-phase



BH 9097.38/001

Note: When using external CTs the adjusted value has to be multiplied with the transmission ratio (ü) of the CT.

Example: Switching value = Setting value (P1/P2) x ü

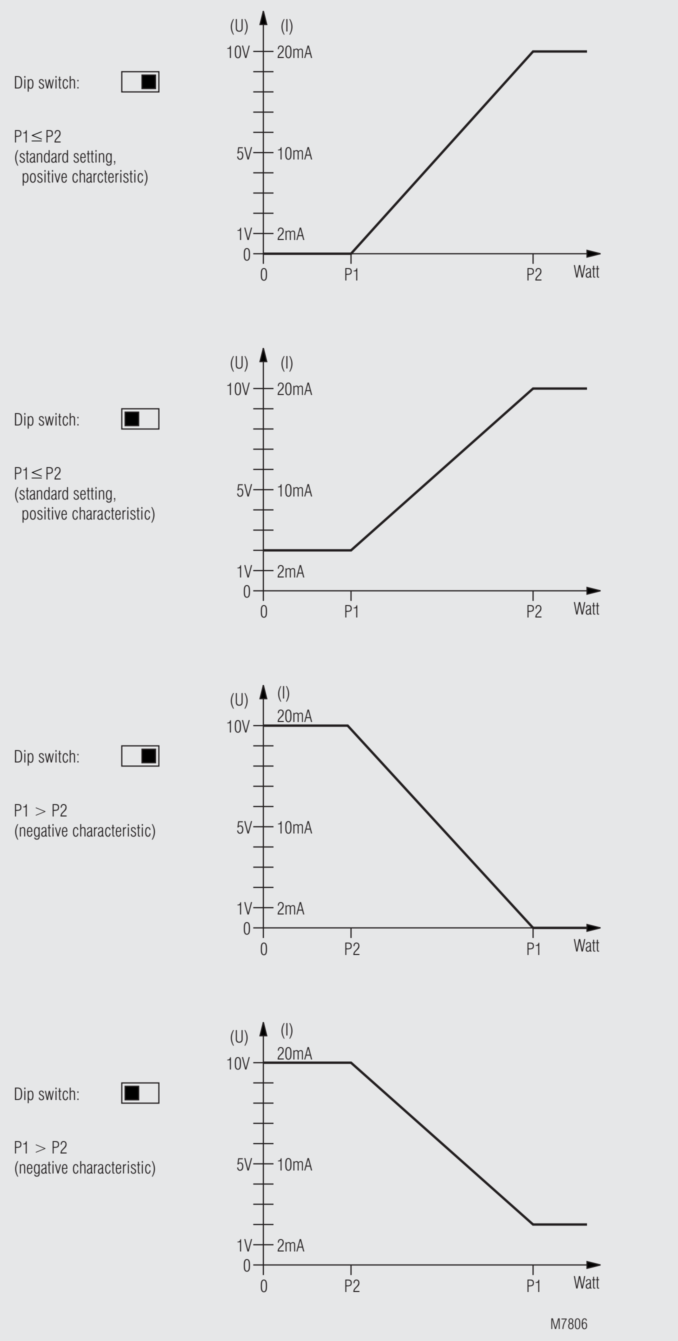
VARIMETER
Motor Load Transmitter
BH 9098

0240708

- According to IEC/EN 60 255, DIN VDE 0435-303
- As load depending output signals are available
  - 0 ... 20 mA and 0 ... 10 V or
  - 4 ... 20 mA and 2 ... 10 V
- Measures effective load
- Adjustment of P_1 and P_2 on absolute scale
- For motors up to 22 kW / 400 V bzw. 37 kW / 690 V
- Adjustable start up delay t_a
- Up to 40 A without external current transformer
- As option for single phase loads
- LED indicators
- Width 45 mm

Load Characteristics

4 different types of load characteristics can be selected via P_1, P_2 and a DIP switch.



Approvals and Markings

CE

Application

The motor load transmitter is suitable to monitor motors with variable load.

Function

The motor load transmitter BH9098 monitors the effective load of motors and balanced three phase and single phase systems. Due to the single phase current measuring system, the unit assumes the load is balanced on all phases, as is the norm for motors. The power consumption of the load is continuously monitored and converted into a standard dc current or voltage signal. Two pairs of rotary switches, P1 and P2 set the lower and upper end of the measured range in Watts. When the monitored load is between these set values a proportional output signal is produced. If the monitored load is out side the set range the output signal will remain at minimum or maximum.

Indicators

green LED, U_N:	flashing:	start up delay t_a
	Continuous light:	voltage connected

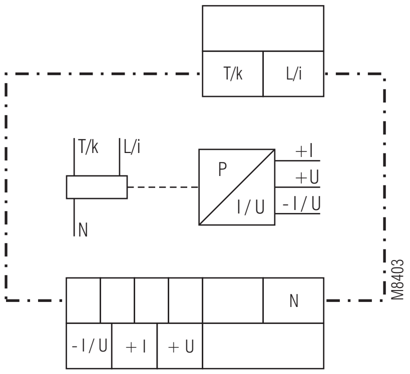
Failure Indication

Two different failure states are displayed by LEDs.

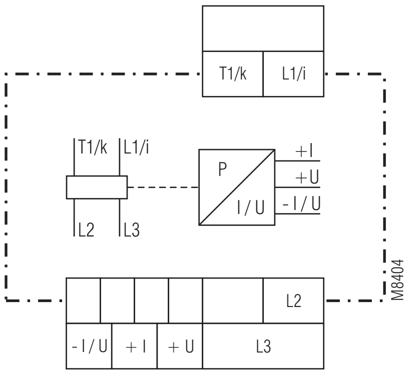
1.) No measuring voltage:
If the measuring voltage is missing, measurement is not possible.
- The LED flashes fast in intervals.
- The output signals are on min. value.

2.) Reverse power:
The calculated power value is negative.
- The LED flashes fast.
- The output signals are on min. value.
Possible reason:
The unit detects reverse power or the current connections are inverted.

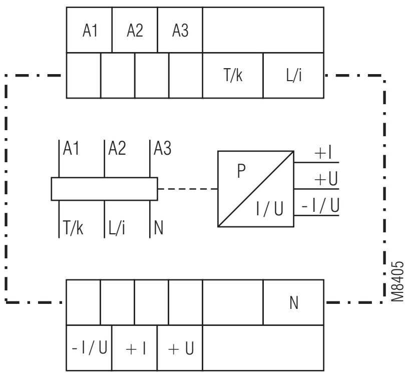
Circuit Diagrams



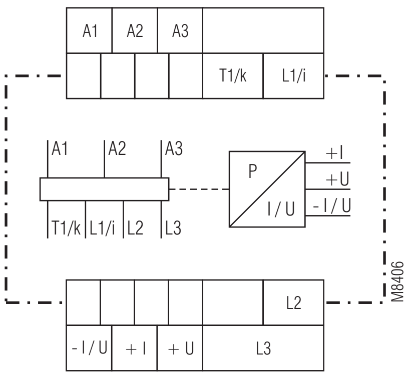
BH 9098.90



BH 9098.90/001

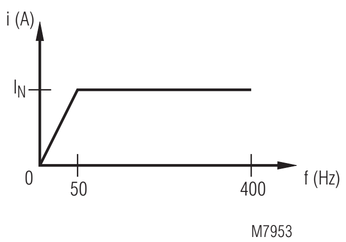


BH 9098.90/010



BH 9098.90/011

Characteristics



Max. input current curve in relation to input frequency

Technical Data

Input

Measuring voltage

Voltage range:	without auxiliary voltage 0.8 ... 1.1 x U_N with auxiliary voltage, see setting ranges
Input resistance:	300 kΩ ... 500 kΩ
Mesured current	
Measuring range:	see setting ranges

Rated current [A]	40	24	8	2.4	0.8	0.24
Permissible current range (overload) [A] continuously:	0 ... 40	0 ... 40	0 ... 16	0 ... 8	0 ... 4	0 ... 1
1 min. (10 min. break):	150	150	20	16	3	1,5
20 s (10 min. break):	200	200	25	20	4	2
Input resistance of current i-k [mΩ]:	≤ 1	≤ 1	7	14	150	500

Frequency range: 10 ... 400 Hz (see characteristics M7953)

Setting Ranges

P_1 und P_2 on absolute scale:

Upper Switch load range for P1 and P2: lower range  upper range 

Measuring accuracy (in % at nominal load):	± 5 %
Harmonic distortion:	< 40 %
Start-up delay t_a:	0 ... 30 s (infinetely variable)

Analogue Output for Current 0 / +I

Galvanically isolated to measuring input and auxiliary voltage:	4 kV eff.
Output current:	DC 0 ... 20 mA DC 4 ... 20 mA (selectable via DIP switch)
Output impendance (Load):	max. 500 Ω

Analogue Output for Voltage 0 / +U

Galvanically isolated to measuring input and auxiliary voltage:	4 kV eff.
Output voltage:	DC 0 ... 10 V DC 2 ... 10 V (selectable via DIP switch)
Output impendance (Load):	min. 5000 Ω

Setting Ranges

Available variants	Measuring voltage U_N	Measuring current I_N [A]	selection of load range resistive
1-phase			
without auxiliary voltage			
BH 9098.90/000	AC 230 V	0.0024 ... 0.24	0.1 ... 60 W
	AC 230 V	0.024 ... 2.4	1 ... 600 W
	AC 230 V	0.24 ... 24	10 ... 6000 W
with auxiliary voltage			
BH 9098.90/010	AC 35...250 V	0.0024 ... 0.24	0.1 ... 60 W
	AC 35...250 V	0.024 ... 2.4	1 ... 600 W
	AC 35...250 V	0.24 ... 24	10 ... 6000 W
3-phase			
without auxiliary voltage			
BH 9098.90/001	3 AC 400 V	0.008 ... 0,8	0.1 ... 60 W
	3 AC 400 V	0.08 ... 8	10 ... 6000 W
	3 AC 400 V	0.4 ... 40	0.1 ... 30 kW
with auxiliary voltage			
BH 9098.90/011	3 AC 60 ... 440 V	0.008 ... 0.8	1 ... 600 W
	3 AC 60 ... 440 V	0.08 ... 8	10 ... 6000 W
	3 AC 100 ... 760 V	0.4 ... 40	0.1 ... 52 kW

Technical Data

Auxiliary Circuit

Auxiliary voltage U_H only for BH 9098.90/010 and BH 9098.90/011:	AC 110 V (terminals A 1 - A 2), AC 230 V (terminals A 1 - A 3), DC 24 V	
Voltage range:	0.8 ... 1.1 U_H	
Frequency range of U_H:	45 ... 400 Hz	
Input current		
AC 110 V:	approx. 30 mA	
AC 230 V:	approx. 15 mA	
DC 24 V:	approx. 50 mA	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 55°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0-behaviour according to UL subject 94	
Vibration resistance:	amplitude 0.35 mm frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Load terminals:	1 x 10 mm² solid or 1 x 6 mm² stranded ferruled	
Control terminals:	1 x 4 mm² solid or 2 x 1.5 mm² stranded ferruled or 1 x 2.5 mm² stranded ferruled or DIN 46 228-1/-2/-3/-4	
Wire connection:	Box terminals with self-lifting wire protection and plus-minus terminal screws M3.5	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	430 g	

Dimensions

Width x height x depth: 45 x 84 x 121 mm

Standard Type

BH 9098.90/001 3 AC 400 V AC 40 A
Article number:

- 3-phase, without auxiliary voltage
- Output: analogue
- Nominal voltage U_N: 3 AC 400 V
- Width: 45 mm

Variants

BH 9098.90/1_ _:	3-phase without auxiliary voltage with galvanically separated current path. For applications with current transformers grounded on the secondary side, current range limited to 25 A
BH 9098.90/011:	3-phase with auxiliary voltage
BH 9098.90/000:	1-phase without auxiliary voltage
BH 9098.90/010:	1-phase with auxiliary voltage

Ordering example for variants

BH 9098 .90 /011 3 AC 100...760 V AC 40 A AC 230/110 V

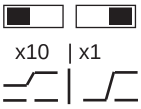
- AC 40 A: max. rated current I_N of input circuit
- AC 230/110 V: auxiliary voltage U_H
- 3 AC 100...760 V: Nominal voltage U_N of input circuit
- /011: Variant, if required
- .90: Contacts
- BH 9098: Type

Settings

Rotational switches P_1 and P_2 (2 digits) (calculation for resistive load) 48 kW
The switches are used to set the minimum and maximum load values P_1 and P_2 of the load characteristics. The scale shows the absolute value. On the 3-phase variant the max. possible power setting value is 52 kW (760 V x 40 A x 1.732). The setting resolution is 1 kW and the load range can be selected by DIP-switchs. If the load range is reduced by factor 10 the setting resolution is 100 W.

Potentiometer t_a
A start-up delay can be adjusted between 0 ... 30 s.
After mains voltage is connected the start-up delay begins. During this time the measurement is disabled and the LED flashes (see indicators).
Independent of the settings the analogue output is on min. value.

DIP-switches:



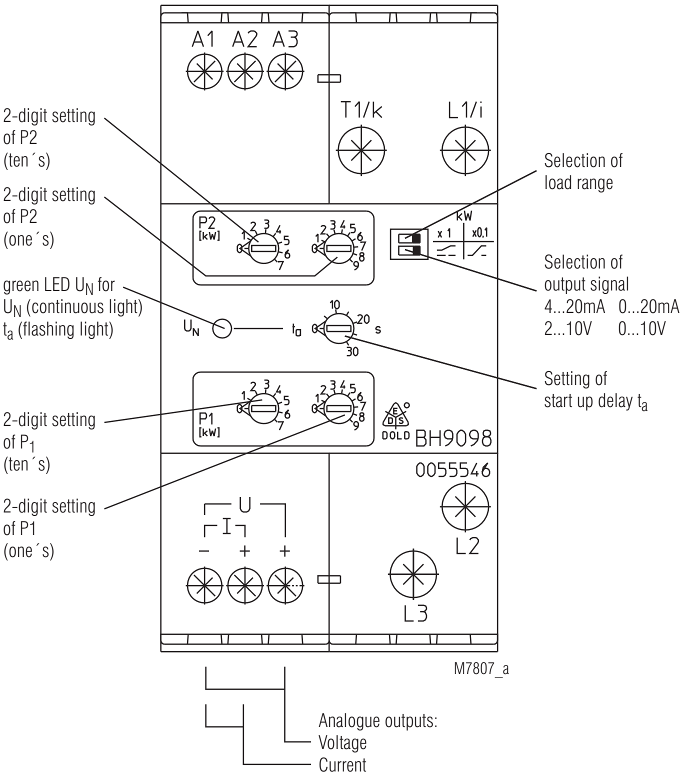
reduction of load range P_1 and P_2 by factor 10

Selection of output signal:

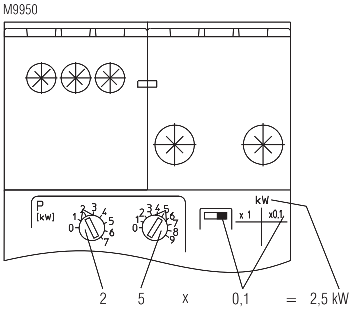
4 ... 20 mA	to	0 ... 20 mA
2 ... 10 V	to	0 ... 10 V

Connection

The connection has to be made according to the application drawings. The measuring current has to be connected to terminals L/i and T/k or L1/i and T1/k. The flow direction of the current must be correct. On reverse power the unit gives a failure indication. The maximum nominal motor current flowing directly through the load transmitter is 40 A. On higher current a current transformer with 2,5 VA burden capacity has to be used.

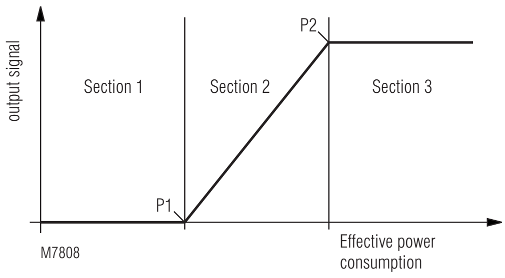


Adjustemt example: response value: 2,5 kW



Response value = 25 x 0,1 = 2,5 kW

The load charasteristic shows 3 sections:



Example 1

The smaller value is adjusted on P_1
The higher value is adjusted on P_2
Standard setting: positive characteristic

- If the effective power consumption of the load is in section 1 between 0 W and P_1 setting the analogue output signal is on minimum value.
- If the effective power consumption of the load is in section 2 between P_1 and P_2 setting the analogue output signal is proportional to the effective load following a **positive characteristic**.
- If the effective power consumption of the load is in section 3 between P_2 setting and Pmax the analogue output signal is on maximum value.

Example 2

P_1 = 0 and P_2 = Pmax

- Selection of the maximum possible load range span.
  The whole load range of the unit is converted into a proportional output signal. Section 1 and 3 are missing.

Example 3

$P_1 = P_2$

- If the **same** value is adjusted for P_1 and P_2 section 2 is missing, i.e. the output signal is either on minimum or maximum value. The unit works as limit switch.

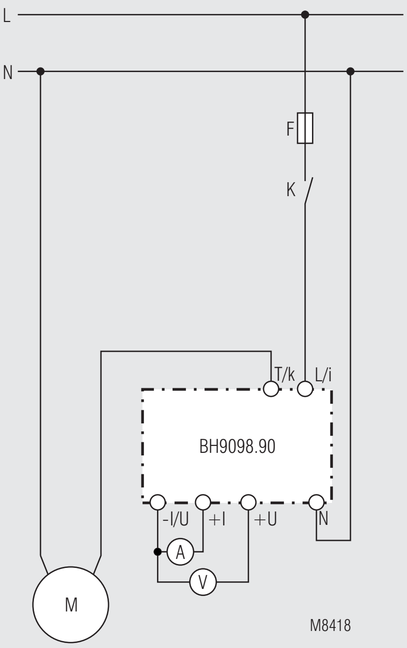
Example 4

On P_1 the higher value is adjusted.
On P_2 the lower value is adjusted.

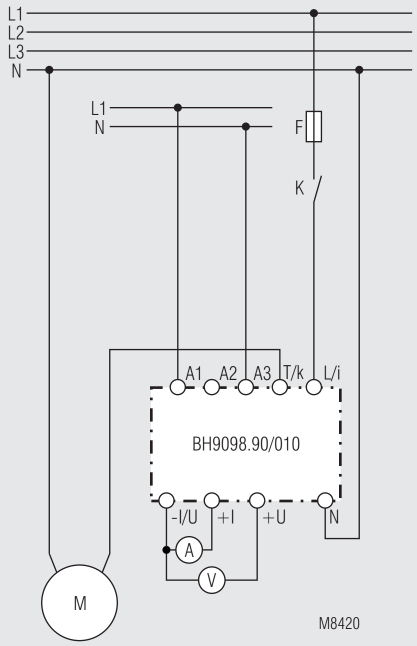
- Inverted output, negative characteristic

Connection Example

1-phase

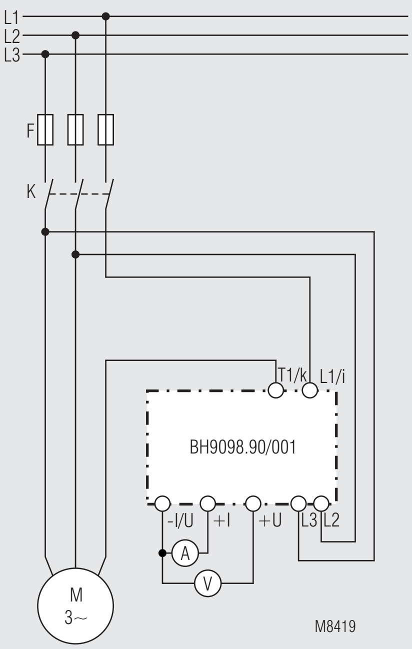


BH 9098.90

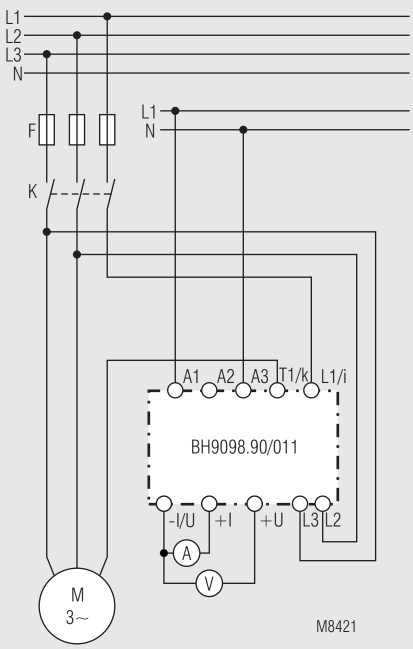


BH 9098.90/010

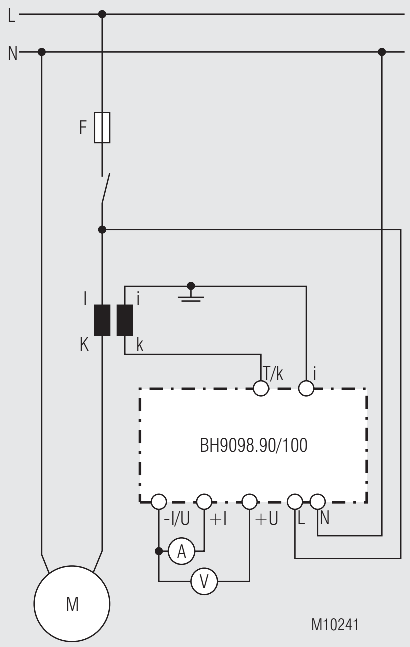
3-phase



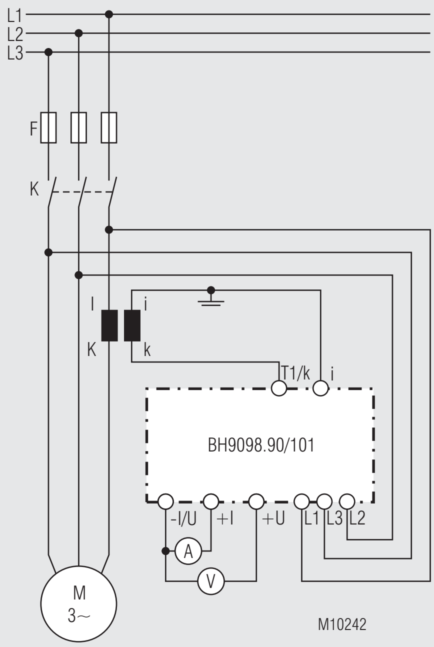
BH 9098.90/001



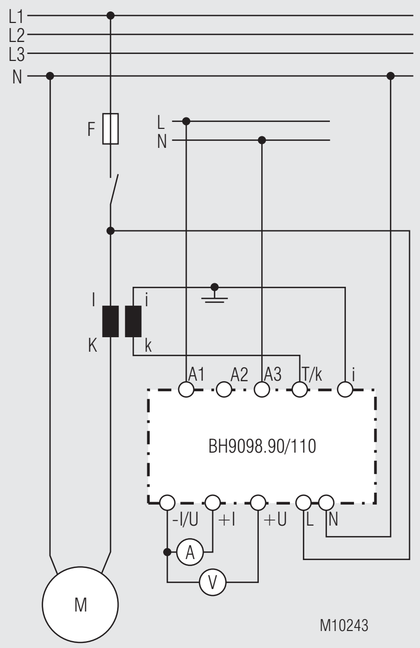
BH 9098.90/011



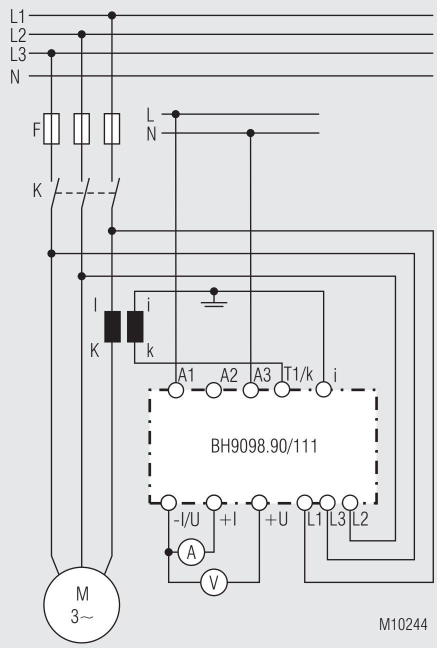
BH 9098.90/100



BH 9098.90/101



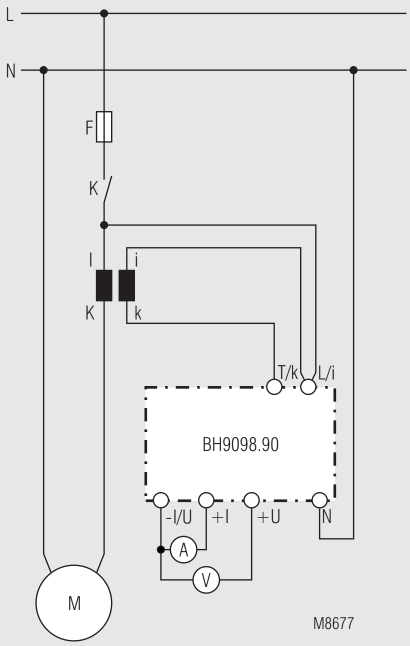
BH 9098.90/110



BH 9098.90/111

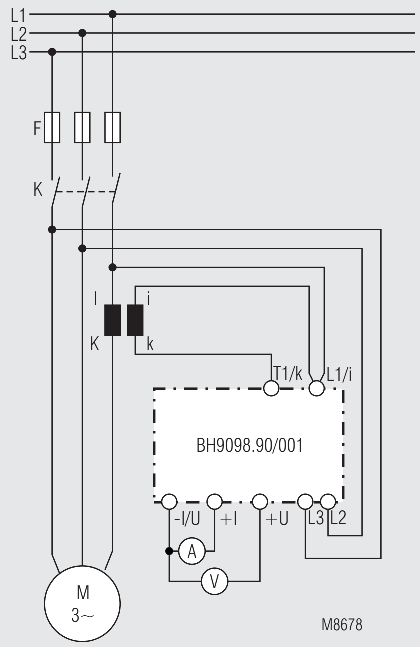
Connection Examples with external current transformer

1-phase



BH 9098.90

3-phase



BH 9098.90/001

Note: When using external CTs the adjusted value has to be multiplied with the transmission ratio (ü) of the CT.

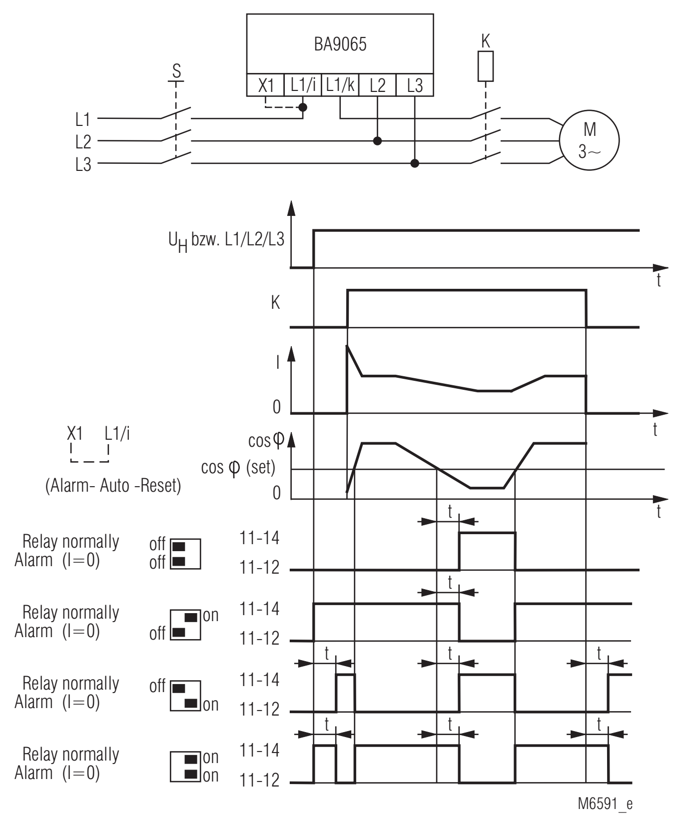
Example: Switching value = Setting value (P1/P2) x ü e.g. for 100/5A C/T u=20 (100 divided by 5)

VARIMETER
Underload Monitor (cos φ)
BA 9065

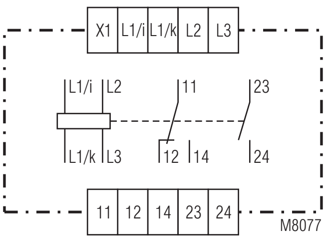

0225071

- According to IEC/EN 60 255, VDE 0435
- Detection of underload (cos φ)
- Current ranges up to 10 A, for higher values a CT must be used
- Adjustable response value
- Programmable functions:
  - alarm when I = 0
  - automatic or manual reset
  - closed or open circuit operation
- Manual remote reset
- Adjustable operate delay
- Independent of phase sequence
- Also for 400 Hz systems
- Optionally for motors with frequency converters (10 ... 100 Hz) (see notes)
- Width 45 mm

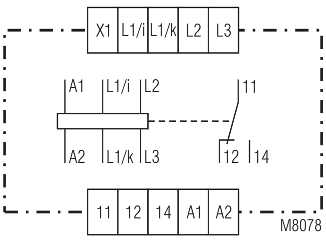
Function Diagram



Circuit Diagram



BA 9065.20



BA 9065.11/001

Approvals and Markings

CE

Applications

Monitors underload and no load on squirrel cage motors e.g.
- fan monitoring (broken belt)
- filter monitoring (blocked filter)
- pump monitoring (blocked valve, dry running)

Function

The underload monitor BA 9065 measures the phase shift between voltage and current. The phase angle changes with changing load. This measuring method is suitable to monitor asynchronous motors on underload and no load independent of motor size. The change of cos φ has to be bigger then the hysteresis of the monitor (see diagram). In some cases the cos φ does not change much with load change on the motor, e.g.:
- small load change on oversized motor
- single phase chaded-pole and collector motors

In these cases we recommend the use of our motor load monitors BA 9067 or BH 9067.
The BA 9065 can also be used on systems with variable frequency because of it's frequency independent measuring principle.
The BA 9065.20 does not need a separate auxiliary supply as it takes the required energy from the monitored mains.
A yellow LED indicates operation. If the cos φ goes under the setting value the device reacts after a settable time delay. A green LED shows the state of the output relay.

Functions programmable with DIP-switches:

- open circuit operation (relay normally off)
- alarm when no current is flowing (Alarm at I = 0 on)
- closed circuit operation (relay normally on)
- no alarm when no current is flowing (Alarm at I = 0 off)

Function programmable with bridge X1-L1/i:

bridge
X1-L1/i

■ ■ manual reset, reset with built-in reset button or remote reset with button connected to X1-L1/i

■—■ Automatic reset when system returns to correct load (cos φ)

Notes

To terminal X1 only the potential of L1/i must be connected.
When setting the response value on BA 9065 with frequency converters please note that the cos φ of the motor changes with the frequency.
The measurement of the cos φ is made by detecting the phase angle between current and voltage by monitoring the shift of the zero passage of current and voltage. Therefore the measurement is independent of frequency and voltage amplitude.
When using the model BA 9065.11/001 with separate auxiliary supply, the measuring circuit (L1/i-L1/k; L2-L3) can also monitor variable frequencies and voltages on the output of a frequency converter. As the cos φ of squirrel cage motors varies with the frequency and with the load, it must be checked for each application if the BA 9065 is suitable. When a current transformer is used with variable frequency, this must also be a special one, that can transmit also low frequencies.

Please note when using a current transformer:
- the phase position must be correct (see Connection Examples), if not there will be no or permanent alarm
- there must be a connection from L1 to the secondary side of the CT (see Connection Examples)

Technical Data

Input Circuit

Nominal voltage U_N:	AC / 3 AC 220 ... 254 V, 380 ... 440 V, 480 ... 550 V, 600 ... 690 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal frequency of U_N:	45 ... 400 Hz	
Nominal consumption:	2.5 VA (terminals L1/i-L2, A1-A2)	
Current range (L1/i-L1/k):	0.1 ... 2 A	0.5 ... 10 A *
Internal resistance L1/i-L1/k:	approx. 30 mΩ	approx. 10 mΩ
Consumption L1/i-L1/k:	max. 0.12 VA	max. 1.1 VA
	* (higher currents using external current transformers, see connection examples)	
Short time overload:	see diagram short time overload	
Usable current transformers:	1 A or 5 A type Class 3 or better with necessary power	
Setting range cos φ:	0 ... 0.9 ; infinite variable	
Operate delay t_v:	1 ... 40 s; infinite variable	

Output

Contacts		
BA 9065.20:	1 changeover contact, 1 NO contact	
BA 9065.11/001:	1 changeover contact	
Thermal current I_{th}:	6 A (up to 25°C, see also derating curve)	
Switching capacity		
to AC 15		
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	1.5 x 10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	270 g	

Dimensions

Width x height x depth: 45 x 74 x 124 mm

Standard Type

BA 9065.20 3 AC 380 ... 440 V 0.5 ... 10 A

Article number:	0039727	stock item
• Output:	1 changeover contact, 1 NO contact	
• Nominal voltage U_N:	3 AC 380 ... 440 V	
• Current range:	0.5 ... 10 A	
• Width:	45 mm	

Variants

BA 9065.11/001:
for motors with frequency converters, separate auxiliary supply is necessary

Auxiliary voltage U_H:	AC 220 ... 254 V AC 380 ... 440 V
Nominal frequency of U_H:	45 ... 400 Hz
Motorvoltage U_N:	3 AC 40 ... 660 V without neutral
Nominal frequnecy of U_N:	10 ... 100 Hz
Contacts:	1 changeover contact

Ordering example for variants

BA 9065 .20 AC / 3 AC 380 ... 440 V 0.5 ... 10 A 45 ... 400 Hz

Nominal frequency
Current range
Nominal voltage
Contacts
Type

Accessories

ET 4762-5: Adapter for screw fixing
Article number: 0023119

Characteristics

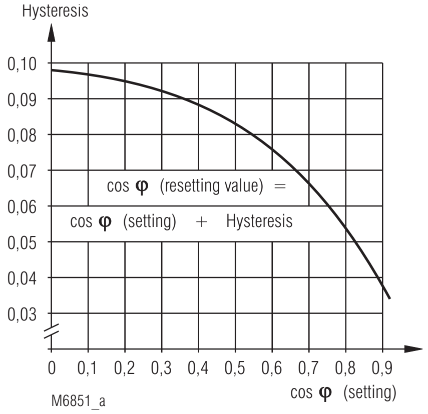


Diagram for hysteresis

Hysteresis depending on adjusted cos φ setpoint. The hysteresis is the switching difference between alarm on (cos φ setting) and alarm off (cos φ reset value).

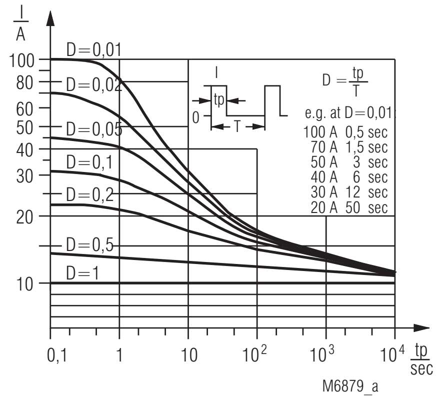
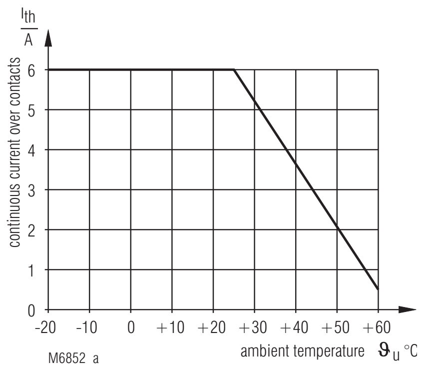


Diagram for short-time overload of the current input L1/i-L1/k (0.5 ... 10 A)



Continuous current limit curve for contacts

Operating Instructions

The example of a frequency controlled fan motor shows how to set up the unit.

1) Setting on BA 9065
   - set BA 9065 to automatic restart (bridge X1-L/i; or while doing below mentioned tests press the reset button continuously)
   - adjust time delay to minimum (left position)
   - adjust cos φ potentiometer to 0 (left position)

2) Setting on Motor:
   - simulate broken belt (motor runs without load)
   - run motor on lowest frequency

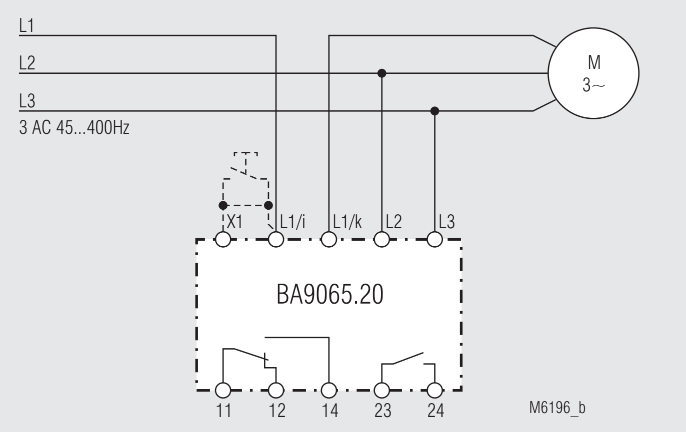
   When the motor runs without load and lowest possible frequency, this is the worst case to detect broken belt.

3) Keep the conditions of 2) and turn the cos φ potentiometer slowly(because of time delay) to the right (to higher value) until the contac switches. Please note this setting and keep it.

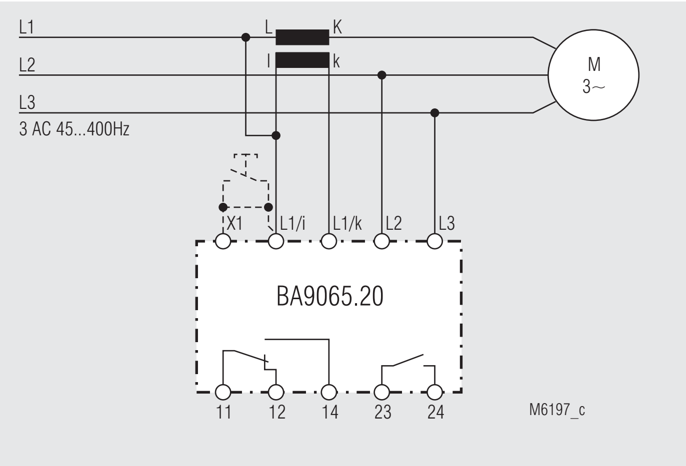
4) - remount the belt (normal working condition)
   - at the lowest frequency and automatic reset or pressed reset button the monitor should show "good" condition, because the cos φ rises.
     If the Monitor does not show "good" condition the change of cos φ is obviously smaller then the hysteresis.
     Now set potentiometer back to 0 again and turn is slowly to higher values to check the alarm value.
     Finally turn the potentiometer again to 0 and then set it to the value found under 3) as this is the optimum setting.

5) Rise the frequency under normal conditions to maximum. The Alarm state should reset. Lower the frequency to minimum, no alarm should occur. At last set the time delay to a higher value, because the motor runs as generator for a short time when the frequency is lowered and the BA 9065 would react immediately.

Connection Examples

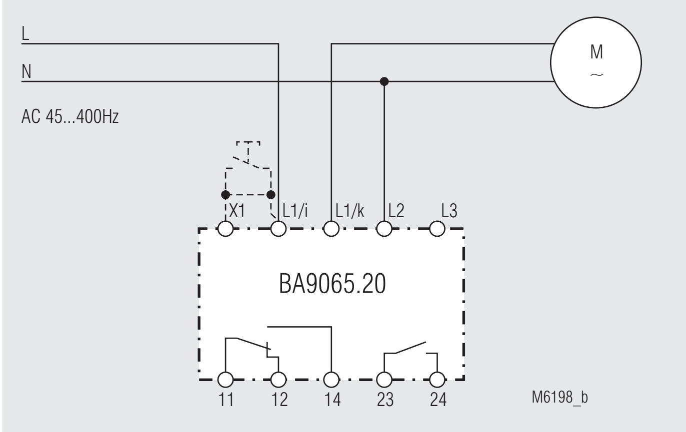


Without current transformer (I_{Mot} = 0.5 ... 10 A)
Please note:
The nominal voltage is the phase to phase voltage

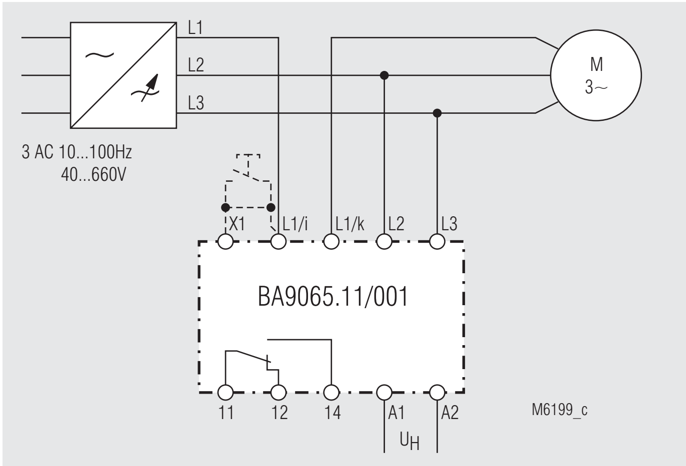


With current transformer (I_{Mot} > 10 A)
Please note:
The nominal voltage is the phase to phase voltage.
The sens of winding of the CT is of impartance!

Connection Examples



Single phase connection
Please note:
The nominal voltage is the phase to neutral voltage



Connection with CT or single phase see BA 9065.20

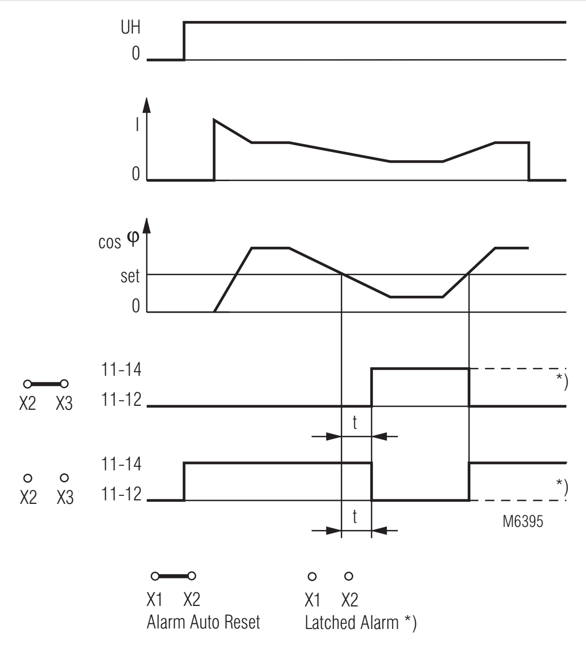
VARIMETER
Underload Monitor
MK 9065

DOLD

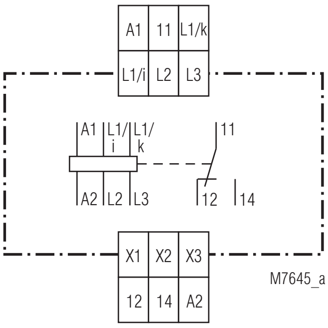
0225153

- According to IEC/EN 60 255, DIN VDE 0435-303
- Detection of underload (cos φ)
- Current ranges up to 10 A
- Adjustable response value
- Programmable functions:
  - automatic or manual reset
  - closed or open circuit operation
- Manual remote reset
- Adjustable operate delay up to 100 s
- For single and 3-phase AC-systems without neutral
- Independent of phase sequence
- Also for 400 Hz systems
- MK 9065.11 can be used for motors with frequency converters 2 ... 200 Hz)
- Optionally with sealable cover
- Green indicator LED for operational mode
- Red indicator LED for underload monitoring
- Width 22.5 mm

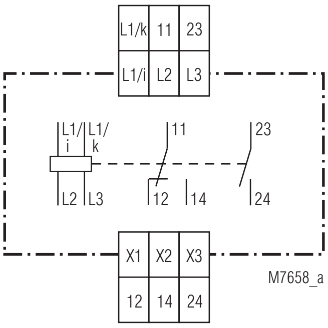
Function Diagram



Circuit Diagrams



MK 9065.11



MK 9065.20

Approvals and Markings

Applications

Monitors underload and no load on squirrel cage motors e.g.
- fan monitoring (broken belt)
- filter monitoring (blocked filter)
- pump monitoring (blocked valve, dry running)

Indicators

green LED:	on, when supply connected
red LED:	on, when underload detected

Function

The underload monitor MK 9065 measures the phase shift between voltage and current. The phase angle changes with changing load. This measuring method is suitable to monitor asynchronous motors on underload and no load independent of motor size. In some cases the cos φ does not change much with load change on the motor, e.g.:

- small load change on oversized motor
- single phase chaded-pole and collector motors

In these cases we recommend the use of motor load monitor BA 9067.

Programmable by bridging terminals:
- X1 - X2 bridged: alarm not stored (auto reset)
- X1 - X2 open: stored alarm: reset by external or internal reset button
- X2 - X3 bridged: open circuit operation (relay energized on underload)
- X2 - X3 open: closed circuit operation (relay de-energized on underload)

When setting the MK 9065 in a system with frequency converters please note that the cos φ varies with the frequency.

Technical Data

Input (L1-L2-L3)

Nominal voltage U_N:	(= Motor voltage)	
MK 9065.11:	AC or 3 AC 15 ... 690 V	
MK 9065.20:	AC or 3 AC 110 ... 127 V, 220 ... 240 V, 380 ... 415 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal frequency of U_N		
MK 9065.11:	2 ... 200 Hz	
MK 9065.20:	45 ... 400 Hz	
Nominal consumption:	2 VA	
Current range (L1/i-L1/k):	0.1 ... 2 A	0.5 ... 10 A*
Internal resistance (L1/i-L1/k):	approx. 30 mΩ	approx. 10 mΩ
Consumption (L1/i-L1/k):	max. 0.12 VA	max. 1.1 VA
Short time overload:	see diagram (for 2 A range reduced)	
	* for higher currents use external current transformer (see connection diagram)	
	Suitable current transformers: 1 A or 5 A types, class 3, with necessary load capacity	

Setting Ranges

Setting range cos φ:	0 ... 0.97 infinite variable
Operate delay t_v:	approx. 1 ... 100 s infinite variable

Auxiliary circuit

Auxiliary voltage U_H (A1 - A2)	
MK 9065.11:	AC 110 ... 127 V, 220 ... 240 V, 380 ... 415 V
MK 9065.20:	$U_H = U_N$
Voltage range:	0.8 ... 1.1 U_H
Frequency range:	45 ... 400 Hz

Output

Contacts		
MK 9065.11:	1 changeover contact	
MK 9065.20:	1 changeover contact, 1 NO contact	
Thermal current I_{th}:	4 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switching cycles	
Short-circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 50°C with a distance of ≥ 10 mm to the next units a max. ambient temperature of 60°C is possible	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	4 kV (air)	IEC/EN 61 000-4-2
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6

Technical Data

Climate resistance:	20 / 050 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 1.5 mm² solid or 2 x 1.0 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	155 g	

Dimensions

Width x height x depth:	22.5 x 82 x 99 mm

Standard Type

MK 9065.20 3 AC 380 ... 415 V 0.5 ... 10 A 1 ... 100 s

Article number:	0045108
• Output:	1 changeover contact, 1 NO contact
• Nominal voltage U_N:	3 AC 380 ... 415 V
• Current range:	0.5 ... 10 A
• Width:	22.5 mm

Variants

MK 9065.11:	Output 1 changeover contact, auxiliary supply separated from measuring input, standard unit can be used also with frequency converters
MK 9065.20:	Model with 1 changeover contact and 1 separate NO contact, auxiliary supply is taken from measuring input, cannot be used with frequency converters
MK 9065. _ _ /400:	with transparent sealable cover

Ordering example for variants

MK 9065 .11 /400 3 AC 15 ... 690 V AC 220 ... 240 V 0.5 ... 10A

- Current range
- Auxiliary voltage
- Nominal voltage
- Variant, if required
- Contacts
- Type

Characteristics

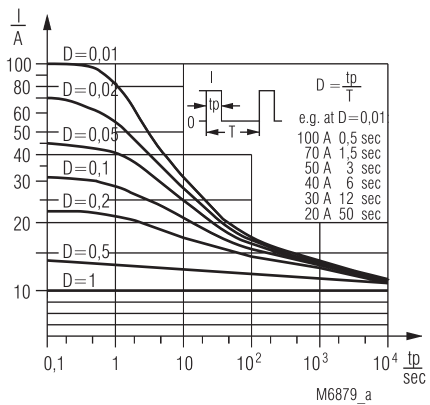
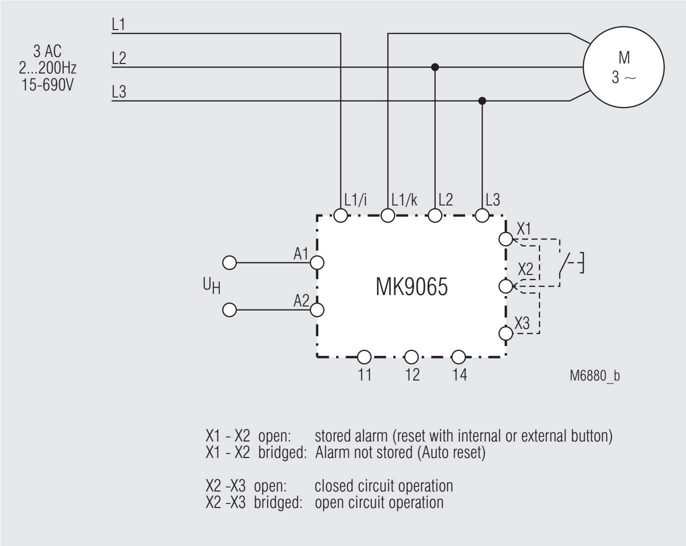
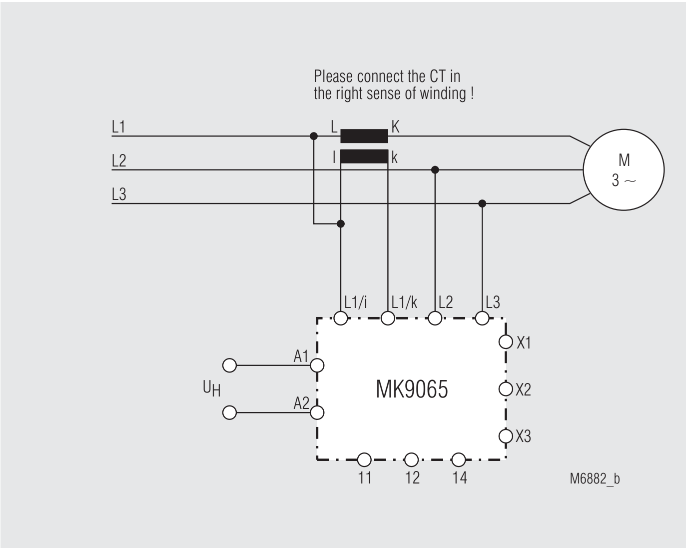


diagram for short-time overload of the current input L1/i-L1/k (0.5 ... 10 A)

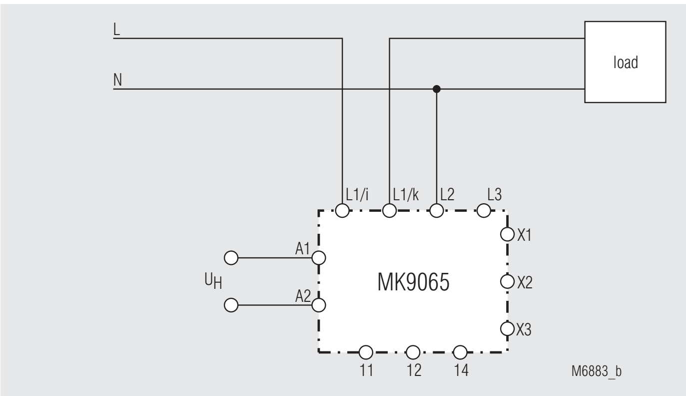
Connection Examples



Standard circuit with MK 9065.11

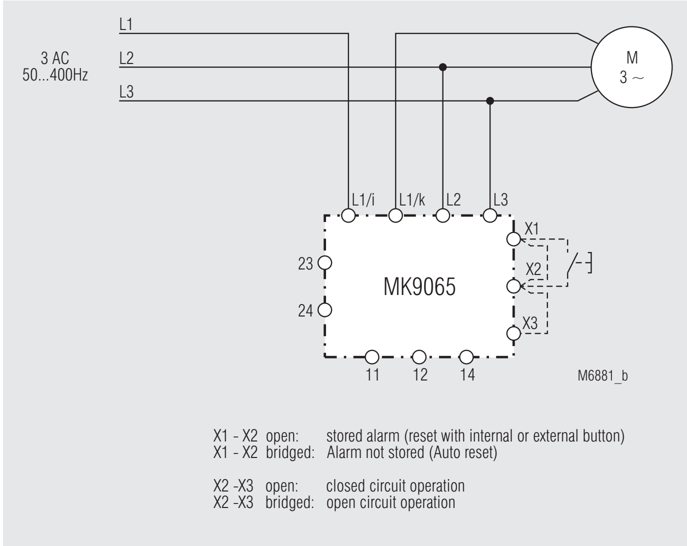


Connection Example for MK 9065.11 with current transformer

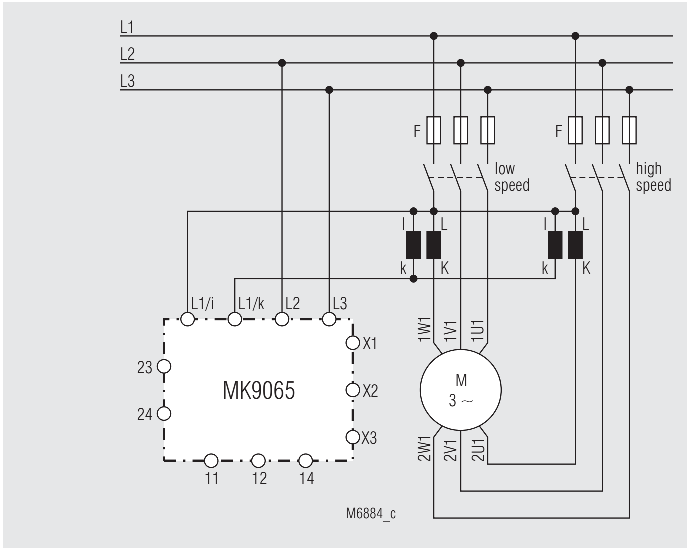


Connection Example for MK 9065.11 with single phase connection

Connection Examples



Standard circuit with MK 9065.20



Connection Example for MK 9065.20 for motors with separate windings

VARIMETER
Underload Monitor (cos φ Monitor)
IK 9065, SK 9065, SL 9065CT

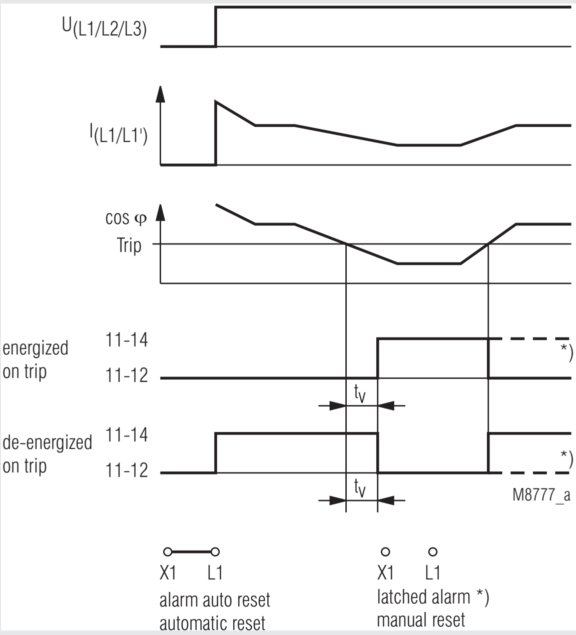
DOLD

IK 9065 SK 9065 SL 9065CT

- According to EN 60 255-1
- Detection of underload (cos φ)
- Without auxiliary supply
- Current up to 8 A
  Motors up to 5 A nominal current can be connected directly
- Higher currents via current transformer
- SL 9065CT with integrated current transformer for currents up to 100 A
- Adjustable response value
- Automatic reset (Alarm auto reset)
- Adjustable operate delay up to 100 s
- De-energized on trip
- For single and 3-phase loads e.g. motors
- Independent of phase sequence
- 1 changeover contact
- LED indicator voltage supply and alarm
- DIN rail or screw mounting
- Devices available in 2 enclosure versions:
  IK 9065: depth 58 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9065, SL 9065CT: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- IK 9065, SK 9065 width 17.5 mm
  SL 9065CT width 35 mm

IK/SK 9065/100: as IK/SK 9065 but:
- programmable for
  - automatic reset or manual reset (latched alarm)
  - energized or de-energized on trip
- With reset button
- Remote reset

Function Diagram



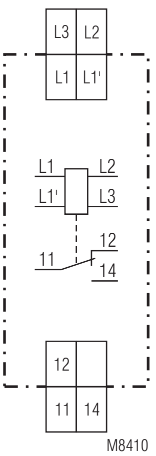
Approvals and Markings

CE

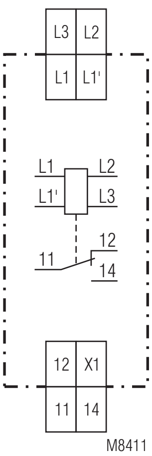
Applications

Monitors underload and no load on squirrel cage motors e.g.
- fan monitoring (broken belt)
- filter monitoring (blocked filter)
- pump monitoring (blocked valve, dry running)
- general cos phi monitoring
- for industrial and railway applications

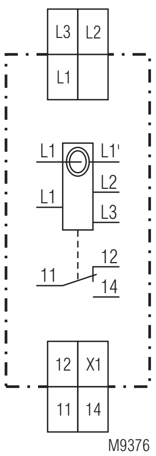
Circuit Diagrams



IK/SK 9065.11



IK/SK 9065.11/100



SL 9065.11CT/100

Function

The underload monitor IK/SK/SL 9065 measures the phase shift between voltage and current. The phase angle changes with changing load. This measuring method is suitable to monitor asynchronous motors on underload and no load independent of motor size. In some cases the cos φ does not change much with load change on the motor, e.g.:

- small load change on oversized motor
- single phase chaded-pole and collector motors

For these cases we recommend the use of our motor load monitor BH 9097.

If a cos phi value lower then the adjusted value is detected the output relay changes into alarm state after the adjusted time delay t_v and the red LED “Alarm” lights up. If the underload monitor is in auto reset mode it changes back to normal state without delay when the cos phi rises above the adjusted cos phi value.

Indicators

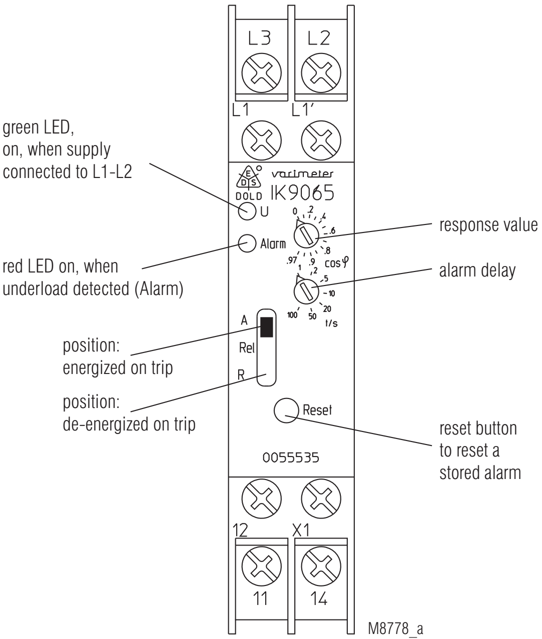
green LED:	on, when supply connected to L1-L2
red LED:	on, when underload detected (Alarm)

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Connection for 3-phase systems
L1‘, L1 [1)]	Current measuring circuit, connection for external current transformer possible [1)]
X1, L1 [2)]	Control input (manual reset / auto-Reset) [2)] X1/L1 not bridged: manual reset X1/L1 bridged: auto-reset
11, 12, 14	Changeover contact

[1)] Only at IK/SK 9065
[2)] Only at IK/SK/SL 9065.11/100

Setting



Notes

Monitoring of single phase load is also possible. The terminal L3 is not connected in this case (see connection diagram). The underload monitor must be ordered for the right voltage e.g. a unit for 3 AC 230 V for a single phase 230 V application.
When the underload monitor IK/SK 9065 is connected to the supply voltage L1-L2-L3 and no current is flowing in the current path L1-L1' the unit changes also in alarm state.
The current path L1-L1' allows to connect currents up to 8 A directly at IK/SK 9065. When connecting asynchronous motors not only the nominal current is important, but also the much higher starting current. The overload characteristic of the current input allows to connect motors with nominal current up to 4..5 A depending on the starting conditions. This is at 3 AC 400 V a motor load of 1.5 … 2.2 kW.
It is important that the motor is connected to L1' and **not** to L1. On wrong connection the phase angle will be measured in a wrong way and the underload monitor IK/SK 9065 will not work.

For higher currents over 8 A (nominal motor current over 5 A) external current transformers can be used (see Connection Examples). Also here the current transformers have to be connected with the right polarity. All standard current transformers of class 3 or better can be used (1 A or 5 A types).
The integrated current transformer at SL 9065CT allows to connect currents up to 100 A directly.

The variant IK/SK/SL 9065.11/100 allows the following settings:
Bridge
X1-L1

•—•	Automatic restart (Alarm auto reset)
• •	Manual restart (Latched Alarm), reset with built in push button, external push button on X1-L1 or by disconnecting the supply voltage.

Switch “REL” on front side
- Position “A”: energized on trip (relay energizes on underload-alarm)
- Position “R”: de-energized on trip (relay de-energizes on under load-alarm)

Technical Data

Input

Nominal voltage U_N:	(= Motor voltage) 3 AC (or AC) 110, 230, 400 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal frequency of U_N:	45 ... 65 Hz	
Nominal consumption (L1-L2):	max. approx. 11 VA	

Current Path

Current range		
IK 9065, SK 9065:	0.1 ... 2 A	0.5 ... 8 A*
Internal resistance:	approx. 30 mΩ	approx. 10 mΩ
Consumption:	max. 0.14 VA	max. 0.7 VA
	* (for higher currents use external current transformer see connection diagram)	
Short time overload:	2.5 x I_{max} for 2 s, 5 x I_{max} for 0.5 s	
Suitable current transformers:	1 A or 5 A types, class 3, with necessary load capacity	
Current range SL 9065CT:	5 ... 100 A via integrated current transformer in the base (max. wire-diameter: 10 mm)	
Setting range cos φ:	0 ... 0.97 infinite variable	
Operate delay t_v:	1 ... 100 s infinite variable	

Output

Contacts:	1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	1.5 x 10^5 switching cycles	IEC/EC 60 947-5-1
Short-circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation	- 25 ... + 60°C	
Storage:	- 25 ... + 60°C	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:		
80 MHz ... 1 GHz:	20 V / m	IEC/EN 61 000-4-3
1.4 GHz ... 2 GHz:	20 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.5 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class A*)	
	*) The device is designed for the usage under industrial conditions (Class A, EN 55011). When connected to a low voltage public system (Class B, EN 55011) radio interference can be generated. To avoid this, appropriate measures have to be taken.	
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	40 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		
Cross section:	2 x 2.5 mm² solid or 1 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Stripping length:	10 mm	

Technical Data

Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0,8 Nm	
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight:		
IK 9065:	approx 65 g	
SK 9065:	approx 84 g	
SL 9065CT:	approx. 195 g	

Dimensions

Width x height x depth:

IK 9065:	17.5 x 90 x 58 mm
SK 9065:	17.5 x 90 x 98 mm
SL 9065CT:	35 x 90 x 98 mm

Classification to DIN EN 50155 for IK 9065 and SK 9065

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1, T2 compliant T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Types

IK 9065.11 3 AC 400 V 0.4 ... 8 A 1 ... 100 s

Article number: 0055534

- Output: 1 changeover contact
- De-energized on trip:
- Nominal voltage U_N: 3 AC 400 V
- Current range: 0.4 ... 8 A
- Operate delay: 1 ... 100 s
- Width: 17.5 mm

SK 9065.11 3 AC 400 V 0.4 ... 8 A 1 ... 100 s

Article number: 0055816

- Output: 1 changeover contact
- De-energized on trip
- Nominal voltage U_N: 3 AC 400 V
- Current range: 0.4 ... 8 A
- Operate delay: 1 ... 100 s
- Width: 17.5 mm

SL 9065.11CT/100 3 AC 400 V 5 ... 100 A 1 ... 100 s

Article number: 0059410

- Output: 1 changeover contact
- Nominal voltage U_N: 3 AC 400 V
- Current range: 5 ... 100 A
- Operate delay: 1 ... 100 s
- programmable for: manual reset with built in or external push button, energized or de-energized on trip, selection via switch on the front
- Width: 35 mm

Variants

IK 9065.11/100,
SK 9065.11/100: programmable for: manual reset with built in or external push button, energized or de-energized on trip, selection via switch on the front

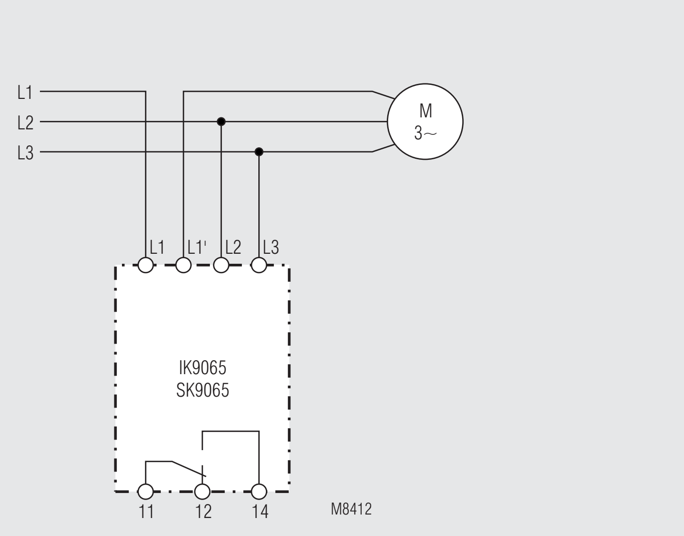
Ordering example for variants

IK 9065 .11 /_ _ _ 3 AC 400 V 0.4 ... 8 A 1 ... 100 s

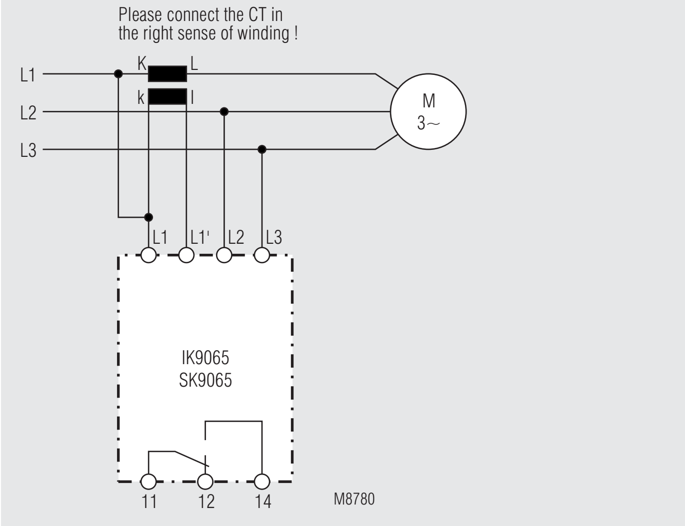
- 1 ... 100 s — Operate delay
- 0.4 ... 8 A — Current range
- 3 AC 400 V — Nominal voltage
- /_ _ _ — Variant, if required
- .11 — Contacts
- IK 9065 — Type

Accessories

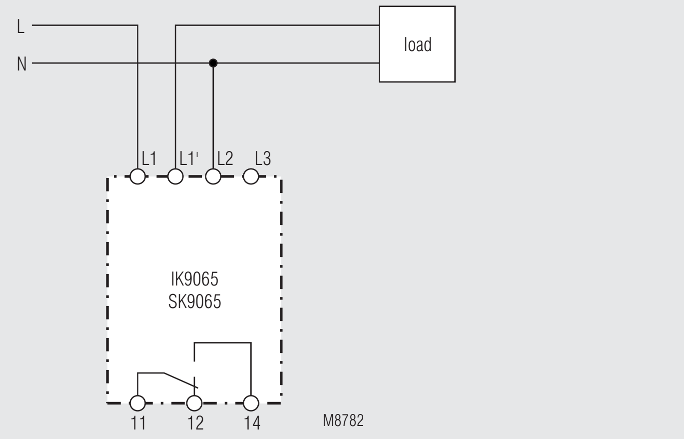
ET 4086-0-2: Additional clip for screw mounting
Article number: 0046578



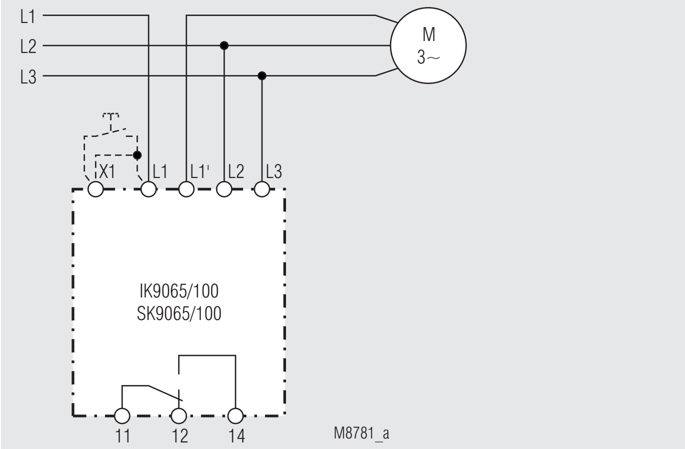
IK 9065.11 with 3-phase load



IK/SK 9065.11 with 3-phase load and external current transformer



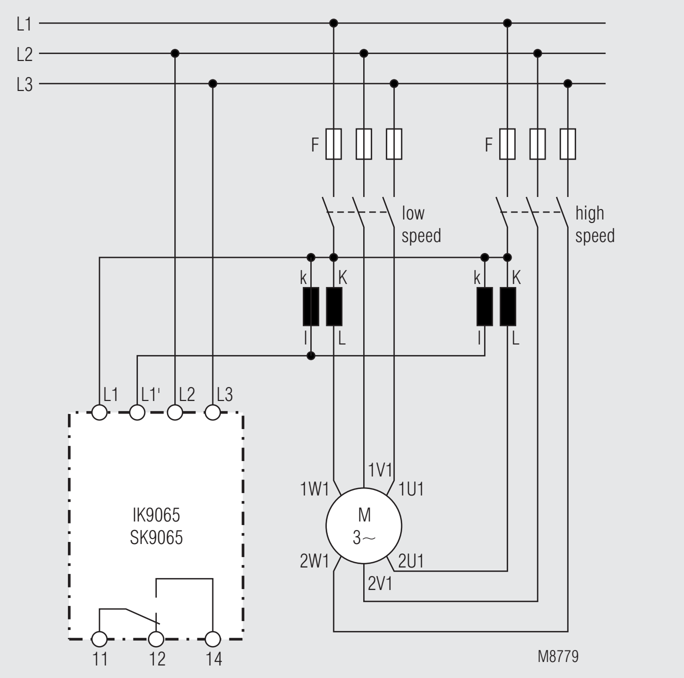
IK 9065.11 with single-phase load



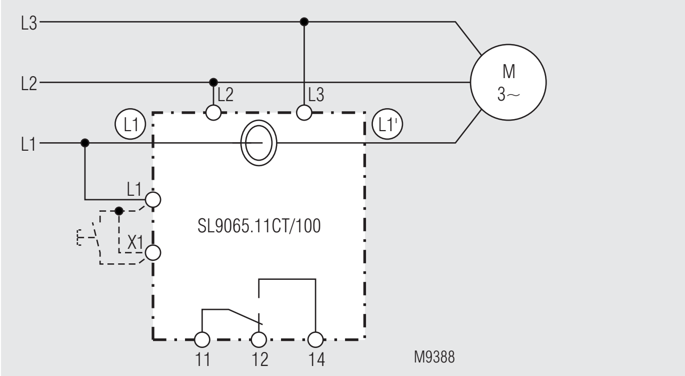
X1 - L1 open : manual reset / latched alarm
(reset with internal or external push button)

X1 - L1 connected : automatic reset (auto - reset)

IK/SK 9065.11/100 with 3-phase load



IK/SK 9065.11 for motors with separate windings



X1 - L1 open : manual reset / latched alarm
(reset with internal or external push button)

X1 - L1 connected : automatic reset (auto - reset)

SL 9065.11CT/100

VARIMETER
Reverse Power Monitoring
BH 9140, RP 9140

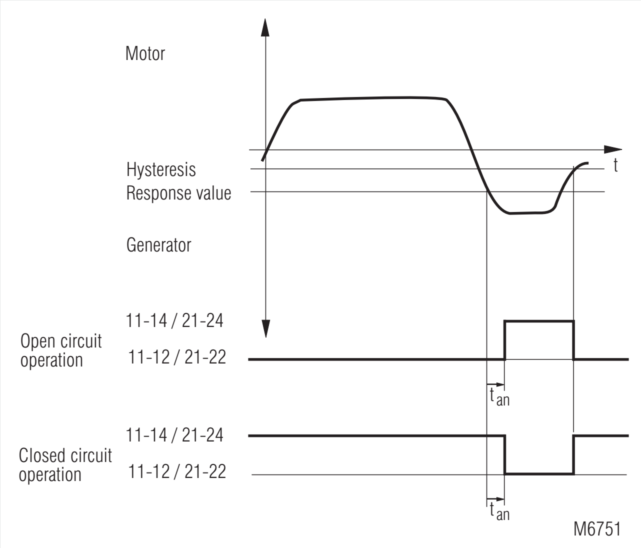
0257041


BH 9140


RP 9140

- According to IEC/EN 60 255, DIN VDE 0435-303
- Effective power measuring
- For single and 3-phases
- Adjustable response value 2 ... 20 % reverse power
- Hysteresis 12.5 %
- Rated current BH 9140: 5 A or 40 A
  Rated current RP 9140: 5 A
- Adjustable on delay
- Open circuit operation
- LED indication for voltage supply and contact position
- 2 changeover contacts
- As option closed circuit operation
- Width:
  BH 9140: 45 mm
  RP 9140: 70 mm

Function Diagram



Approvals and Markings

CE

Application

The reverse power relais BH 9140 and RP 9140 monitor the direction of the energy transport in an electrical system. This could be necessary at connection points between public supply and industrial mains e. g. when operating emergancy power supplies, to avoid taht generators run as motors.

Function

The response value can be adjusted on P_R from 2 ... 20 %. The reverse power is calculated for 3p4w and 3p3w units according to the formula:

U_{star} x I_u x cos φ x response value (%)

At a setting of 20 % and cos φ = 1 this is for BH 9140 max.:
230 V x 5 A x 0.2 = 230 W
230 V x 40 A x 0.2 = 1840 W

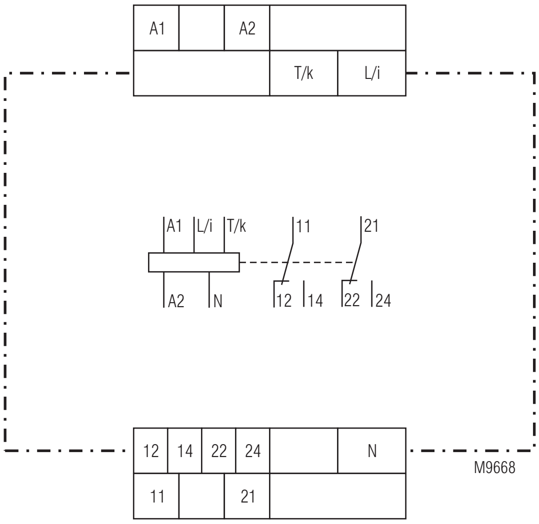
and for RP 9140 max. :
230 V x 5 A x 0.2 = 230 W

Indication

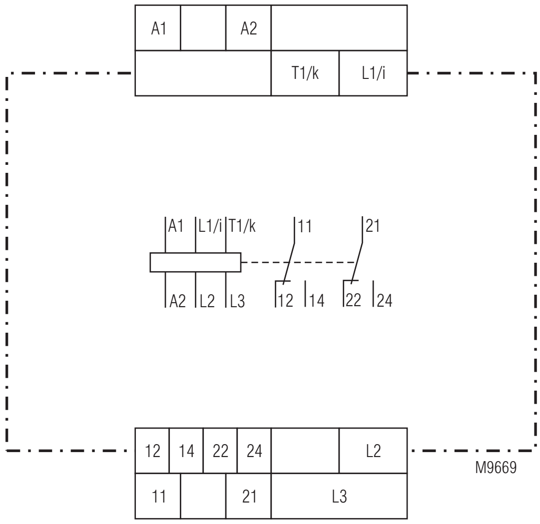
LED green:	on, when auxiliary supply connected
LED green/red:	on, when corresponding output relay is active

Notes

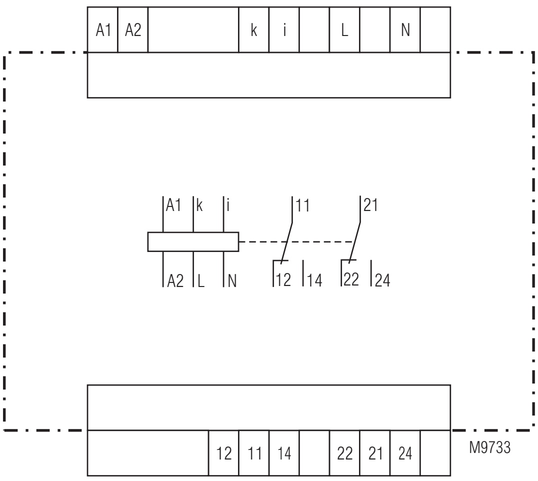
If the current is higher than the nominal current of the device an external current transformer can be used with min. 2.5 VA. The direction of the current has to be observed.



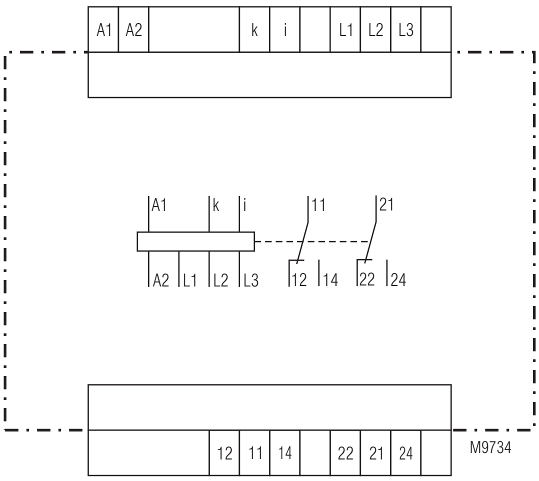
BH 9140: Version for single- and 3-phase connection with N



BH 9140: Version for 3-phase connection without N



RP 9140: Version for single- and 3-phase connection with N



RP 9140: Version for 3-phase connection without N

Technical Data

Measuring Ciruit

Voltage

Nominal voltage U_N		
L1-N:	AC 110, 230 V	
L1-L2-L3:	3 AC 110, 230, 400, 440 V	
max. overload:	1.1 U_N	
Current		
Nominal current:	5 A / (40 A only for BH 9140)	
max. overload:	15 A	
Power		
Response value:	2 ... 20 % reverse power	
Hysteresis:	12.5 % of set response value	
Frequency range:	45 ... 65 Hz	
On delay t_{an}:	adjustable 0.2 ... 10 s	

Auxiliary Circuit

Auxiliary voltage A1, A2:	AC 110, 230, 400, 440 V, DC 24 V*)	
	*) only for BH 9140	
Voltage range:	0.8 ... 1.1 U_H	
Frequency range:	45 ... 65 Hz	
Nominal consumption:	< 4 VA	

Output

Contacts:	2 changeover contacts	
Thermal current I_{th}:	2 x 5 A	
Switching capacity		
according to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
according to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
acc. to AC 15 at 3 A, AC 230 V:	2 x 10^5 switching cycles	
Permissible switching frequency:	1800 switching cycle/H	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^6 switching cycles	

General Data

Nominal operating mode:	continuous operation	
Permissible ambient-/ storage temperature:	- 20 ... + 60°C	
Clearance and creepage distance		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge		
between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection BH 9140		
load terminals:	1 x 10 mm² solid or 1 x 6 mm² stranded wire with sleeve	
control terminal:	1 x 4 mm² solid or 2 x 1.5 mm² stranded wire with sleeve or 1 x 2.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing BH 9140:	Box terminals with self-lifting wire protection and Plus-minus terminal screws M3.5	

Technical Data

Wire connection RP 9140:		
fixed screw terminal (S):	0.2 ... 4 mm² solid or 0.2 ... 1.5 mm² stranded wire with sleeve	
Wire fixing RP 9140:	Flat screws M 2,5 box terminals with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BH 9140:	430 g	
RP 9140:	250 g	

Dimensions

Width x heigh x depth:	
BH 9140:	45 x 84 x 121 mm
RP 9140:	70 x 90 x 71 mm

Standard Types

BH 9140.12/001 3 AC 400 V 5 A AC 230 V 10 s
Article number: 0060919

- open circuit operation
- 3-phase connection without neutral
- Response value: 2 ... 20 %
- Nominal voltage U_N: 3 AC 400 V
- Nominal current: 5 A
- Auxiliary voltage U_H: AC 230 V
- On delay: 0.2 ... 10 s
- Width: 45 mm

RP 9140.12/201 3 AC 400 V 5 A AC 230 V 10 s
Article number: 0061258

- Open circuit operation
- 3-phase connection without neutral
- Response value: 2 ... 20 %
- Nominal voltage U_N: 3 AC 400 V
- Nominal current: 5 A
- Auxiliary voltage U_H: AC 230 V
- On delay: 0.2 ... 10 s
- Width: 70 mm

Variants

_ _ 9140.12 / _ _ _

0 single-phase connection with neutral
1 3-phase connection without neutral

0 open circuit operation
1 closed circuit operation

0 current path not galvanic separation (only available for BH 9140)
2 current path galvanic separation (only available for RP 9140)

BH: 45 mm width
RP: 70 mm width

Ordering example for variants

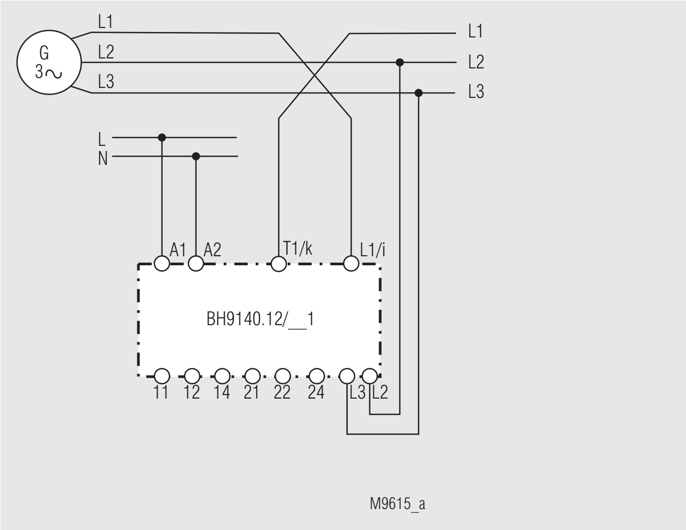
_ _ 9140 .12 /_ _ _ 3 AC 400 V 5 A AC 230 V 10 s

On delay
Auxiliary voltage
Nominal current
Nominal cvoltage
Variant on request
Contacts
BH: 45 mm width
RP: 70 mm width

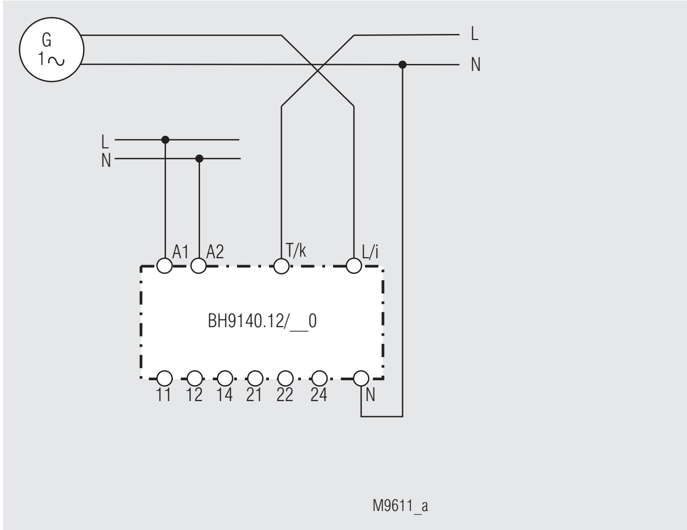
Setting Facilities

Response value	
Reverse power:	2 ... 20 %
On delay:	0.2 ... 10 s

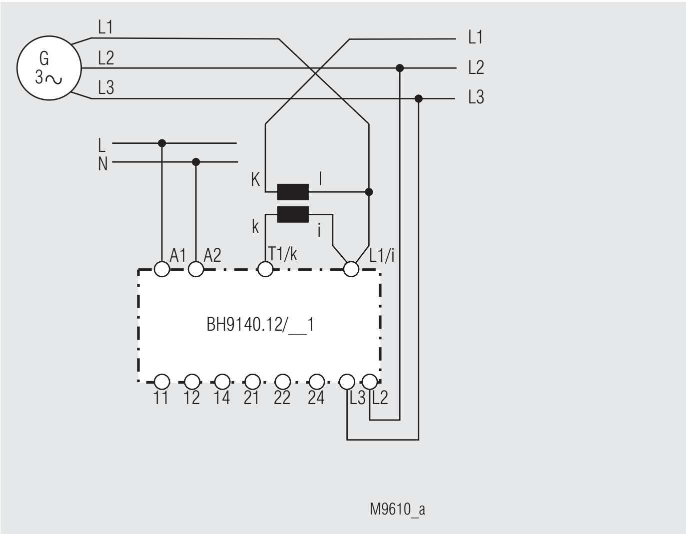
Connection Examples BH 9140



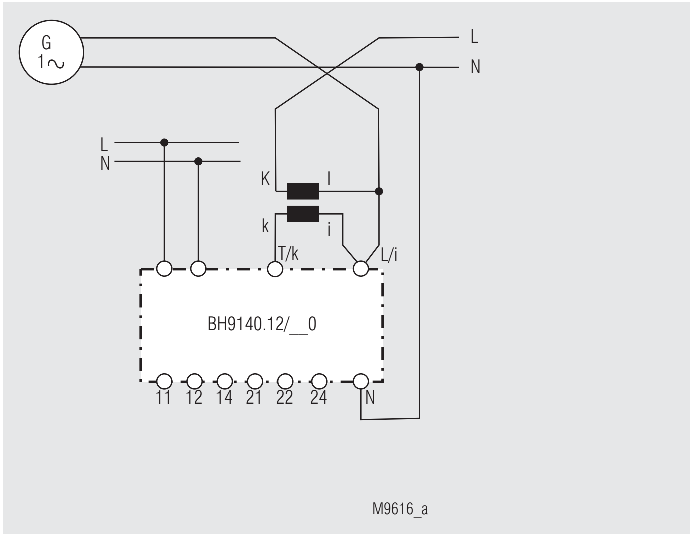
For 3-phase connection without N



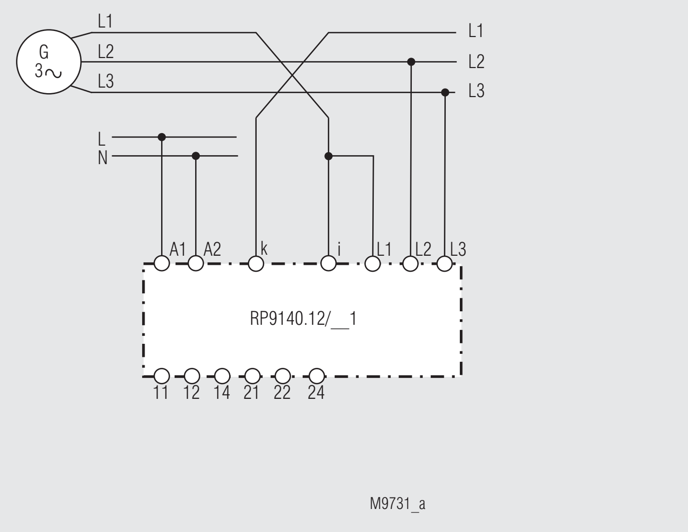
For single or 3-phase connection with N



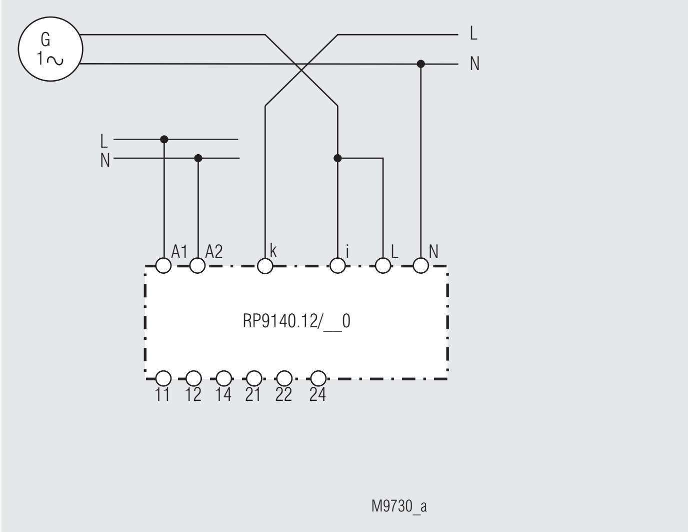
For 3-phase connections with current transformer (external).



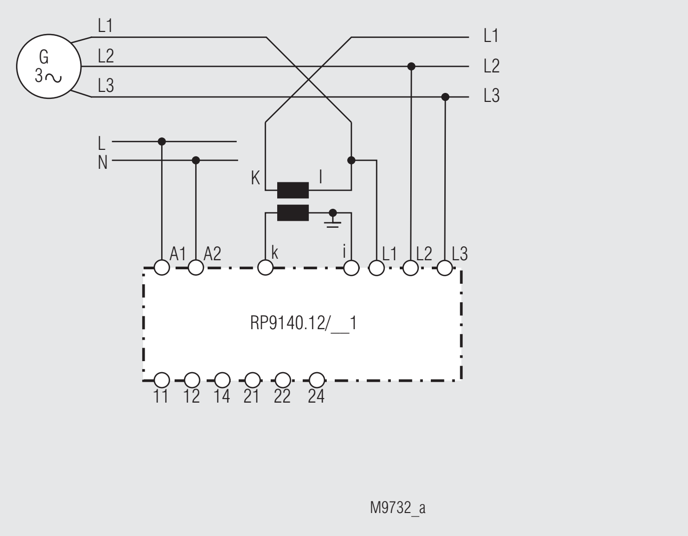
For single or 3-phase connections with current transformer (external)



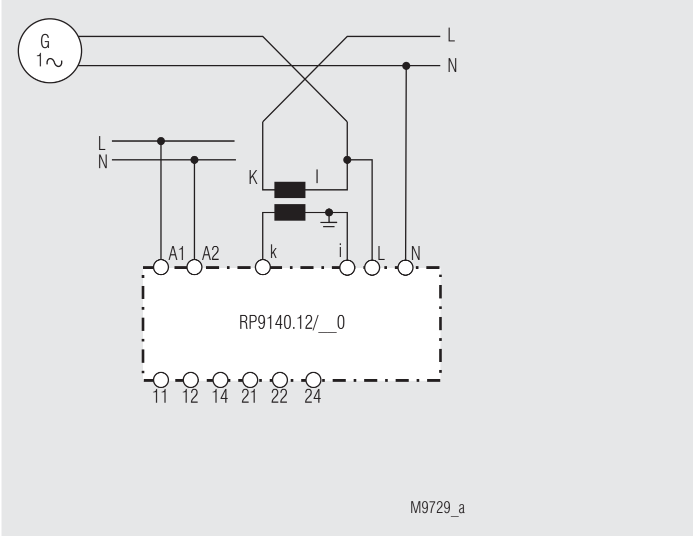
For 3-phase connection without N



For single or 3-phase connection without N



For 3-phase connections with current transformer (external).



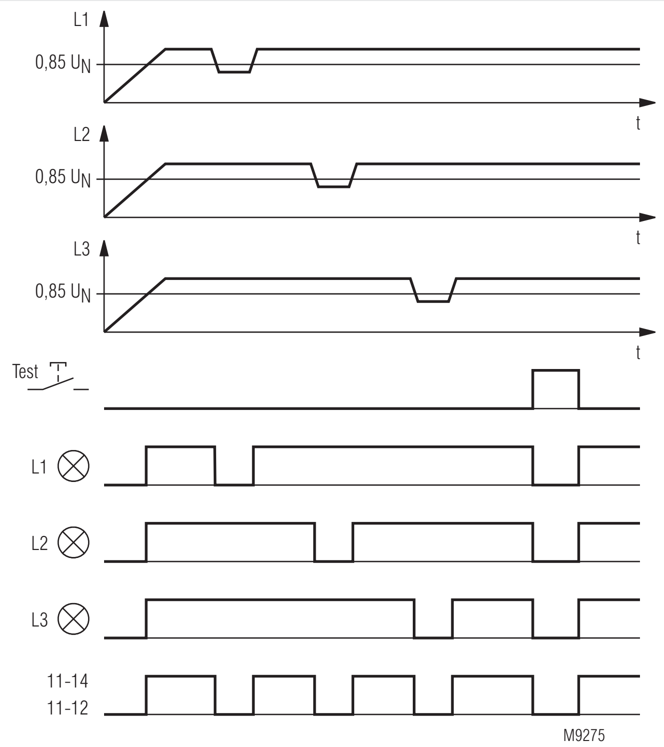
For single or 3-phase connections with current transformer (external)

VARIMETER
Undervoltage Relay, 3-Phase With Test Key
IL 9176

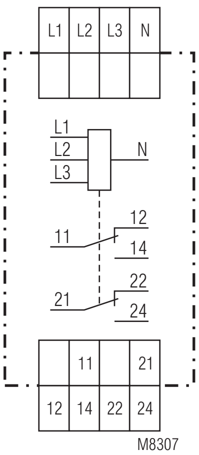
0255164

- According to IEC/EN 60 255
- Detection of
  - undervoltage 1 up to 3-phase, 0.85 x U_N
  - phase failure
- Without auxiliary voltage
- De-energized on trip
- LED indicator for L1, L2, L3 with test key to simulate failure
- 2 changeover contacts
- Width 35 mm

Function Diagram



Circuit Diagram



Approvals and Markings

CE

Application

Voltage monitoring of 3-phase systems
IL 9176.12/108 for installations according to DIN VDE 0108

Function

On a healthy voltage system all 3 LEDs are on. The output contacts 11-14 and 21-24 are closed. By presssing the test button a failure is simulated and the relay contacts de-energise. This allows to test the circuit. When having asymmetric loads in the circuit the unit detects also a broken neutral wire. If the voltage drops below 0.85 x U_N in one phase, the corresponding LED and the relay contacts switch off.

Indication

L1:	phase voltage L1 present
L2:	phase voltage L2 present
L3:	phase voltage L3 present

Technical Data

Input (L1, L2, L3, N)

Nominal voltage U_N:	3/N AC 400 / 230 V
Max. overload:	1.1 U_N, continuously
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 65 Hz
Input current	
L1:	25 mA / AC 230 V
L2:	1 mA / AC 230 V
L3:	1 mA / AC 230 V
Nominal consumption:	2 W
Response value:	0.85 U_N, fixed
Hysteresis:	approx. 5 % U_N
Start up delay ($0_V \rightarrow U_N$):	approx. 500 ms
Release delay ($U_N \rightarrow 0_V$)	approx. 70 ms

Output

Contact:	2 changeover contacts	
Thermal current I_{th}:	2 x 4 A	
switching capacity according to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
acc.to AC 15 bei 1 A / AC 230 V:	5 x 10^6 switching cycles	IEC/EN 60 947-5-1

Technical Data

Short circuit strength

Max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	30 x 10^8 switching cycles	

General Data

Temperature range:	- 20 ... + 60°C	
Clearance and creepage distance		
rated rated impulse voltage voltage / pollution degree:	4 kV / 2	IEC 60 664-1
Test voltage		
Input / output	AC 2.5 kV	IEC/EN 61 810-4-2
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Leiteranschluß:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire connection:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	105 g	

Dimensions

Width x height x depth: 35 x 90 x 59 mm

Standard Type

IL 9176.12 3/N AC 400/230V	50/60 Hz
Article number:	0059134
• Nominal voltage U_N:	3/N AC 400/230 V
• Output:	2 changeover contacts
• Width:	35 mm

Variant

IL 9176.12/108: with Marking „Für Anlagen nach DIN VDE 0108“ (for systems according to DIN VDE 0108)

VARIMETER
Phase Indicator
IK 9168, SK 9168

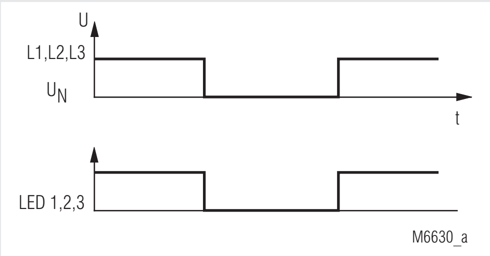
DOLD

0225116

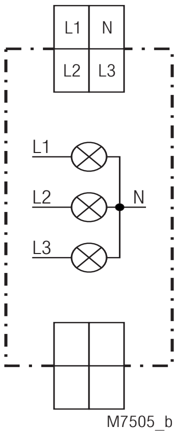

IK 9168 SK 9168

- According to IEC/EN 60 255, DIN VDE 0435-303
- Indication of phase failure in 3-phase systems
- Single phase connection possible
- Independent of phase sequence
- LED indicator for each phase
- **Devices available in 2 enclosure versions:**
  IK 9168: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9168: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9168, SK 9168

Approvals and Markings

CE

Applications

Indication of phase failure in 3-phase systems

Indicators

LED L1, L2, L3:	on when corresponding phase is present

Technical Data

Input

Nominal voltage U_N:	3/N AC 400 / 230 V
Voltage range:	0.8 ... 1.1 U_N
Input current at U_N:	0.2 mA
Nominal consumption:	0.5 VA per input
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 65 Hz
Operate value:	0.5 U_N ± 10 %

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree (between L1-L2-L3-N):	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4
Wire fixing:	Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Mounting:	DIN rail IEC/EN 60 715
Weight	
IK 9168:	50 g
SK 9168:	70 g

Dimensions

Width x height x depth	
IK 9168:	17.5 x 90 x 59 mm
SK 9168:	17.5 x 90 x 98 mm

Standard Type

IK 9168 3/N AC 400 / 230 V 50/60 Hz

Article number:	0049174	stock item
• Nominal voltage U_N:	3/N AC 400 / 230 V	
• Width:	17.5 mm	

SK 9168 3/N AC 400 / 230 V 50/60Hz

Article number:	0054712
• Nominal voltage U_N:	3/N AC 400 / 230 V

Ordering example

<u>IK 9168</u> <u>3/N AC 400/230 V</u> <u>50/60 Hz</u>

Nominal frequency
Nominal voltage
Type

VARIMETER
Phase Monitor
RK 9872

DOLD

0272136

Your Advantages
- Reliability monitoring of 3- or 1-phase voltage systems on:
  - Undervoltage
  - Overvoltage
  - Phase sequence (at 3-phase voltage system)
- Fast fault location
- Preventive maintenance
- Space saving

Features
- According to IEC/EN 60255-1
- Detection of under-/overvoltage and phase sequence in 3-phase voltage systems
- Without separate auxiliary voltage
- LED-Indication for operation voltage and contact position
- De-energized on trip
- Withfixed response value for undervoltage
- Withfixed response value for overvoltage
- Width: 17,5 mm

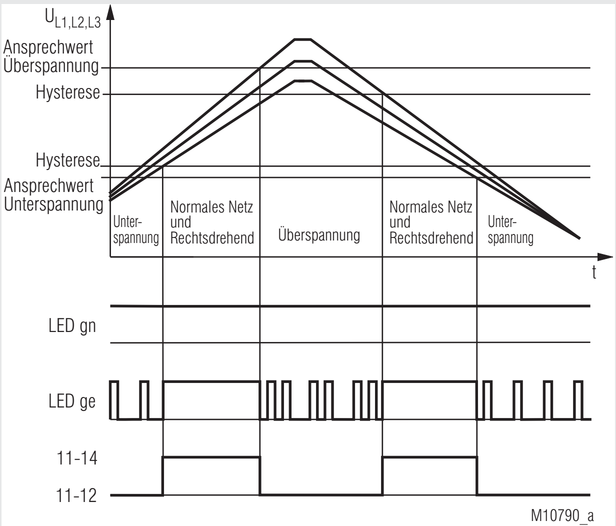
Product Description

The space saving phase monitor RK9872/800 from the Varimeter family monitors under- amd overvoltage as well as phase sequence in 3-phase systems.
The response values are fixed. When connecting the measuring voltage to the inputs L1-L2-L3 and fault free system the relay switches on.
When the measuring voltage is connected the unit checks a clockwise phase sequence. If this is not the case the yellow LED flashes. The output relay will not energise. After detection of under- or overvoltage on one or more phases for more the 5 sec. the relay switches off. The relay stays off for at least 2 seconds. The phase monitor measures the arithmetic mean value of the 3 phases against neutral.

Approvals and Markings

CE

Function Diagramm



Application

Monitoring of voltage systems on undervoltage, overvoltage and phase sequence, e. g. for applications with squirrel cage motors and -machines, cranes, elevator, escalator, pumps, aircondition.

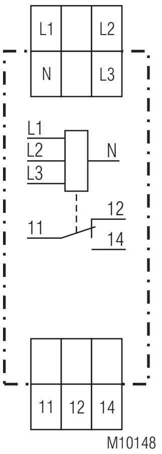
Indicators

green LED:	on, when nominal voltage connected
yellow LED:	on, when corresponding output relay is active
yellow LED:	flashes at failure with code: 1 x at undervoltage 2 x at overvoltage 3 x at phase reversal

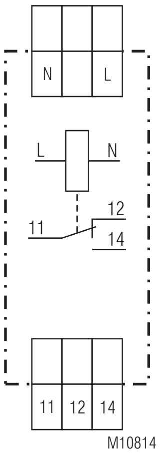
Safety Notes

- Faults must only be removed when the relay is disconnected.
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety).
- Settings must only be changed by trained staff taking into account the safety regulations. Installation work must only be done when power is disconnected.
- If the connected system creates a reverse voltage above the undervoltage response value the failure cannot be detected.

Circuit Diagram



3-phase



1-phase

Connection Terminals

Terminal designation	Signal designation
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
L	Phase voltage L
N	Neutral
11, 12, 14	Changeover contact (output relay)

Technical Data

Input

Measuring voltage = supply voltage
Nominal voltage U_N: 3/N AC 400/230V
Max. overload: 1.15 U_N continuously
Nominal consumption: approx. 6 VA
Nominal frequency: 50 / 60 Hz
Measuring frequency range: 45 ... 65 Hz

Response value*):	**3-phase**	**1-phase**	
	3N AC 400 / 230 V	AC 400 V	AC 110 V
Undervoltage:	195.5 V	360 V	99 V
Overvoltage:	253 V	440 V	121 V
Hysteresis:	2.5 %	1.5 %	2.0 %
Accuracy:	± 3%		
Repeat accuracy:	< 2%		
Temperature influence:	< 1%		

*) the response values are fixed and measured against N

Reaction time: ≤ 50 ms
Overvoltage category: III (according to IEC 60664-1)

Output

Contacts: 1 changeover contact
Thermal current I_{th}: 4 A
Switching capacity
to AC 15:
NO contacts: 2 A / AC 230 V IEC/EN 60 947-5-1
NC contacts: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V: 1 x 10^5 switch. cycl. IEC/EN 60 947-5-1
Mechanical life: 1 x 10^6 switching cycles

Technical Data

General Data

Nominal operating mode: continuous operation
Temperature range:
Operation: - 25 ... + 60°C
Storage: - 25 ... + 70°C
Clearance and creepage distance
contact / measuring voltage
rated impuls voltage /
pollution degree: 6 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages
between power sypply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection
Enclosure: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: thermoplastic with VO behaviour acc. to UL subject 94
Vibration resistance: Amplitude 0.35 mm, Frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 25 / 060 /04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: DIN 46 228-1/-2/-3/-4
Fixed screw terminals
Cross section: 0.34 ... 2.5 mm² (AWG 22 - 14) solid or 0.34 ... 2.5 mm² (AWG 22 - 14) stranded wire with and without ferrules
Stripping length: 7 mm
Fixing torque: 0.5 Nm EN 60 999-1
Wire fixing: Captive slotted screw / M2.5
Mounting: DIN-rail IEC/EN 60 715
Weight: approx. 70 g

Dimensions

Width x height x depth: 17.5 x 90 x 66 mm

Standard Type

RK 9872.11 3/N AC 400/230 V 50 / 60 Hz
Article number:: 0065075
- Output: 1 changeover contact
- Nominal voltage U_N: 3/N AC 400/230 V
- Width: 17.5 mm

Variant

RK 9872.11/100: Undervoltage / overvoltage monitoring

Ordering example for variant

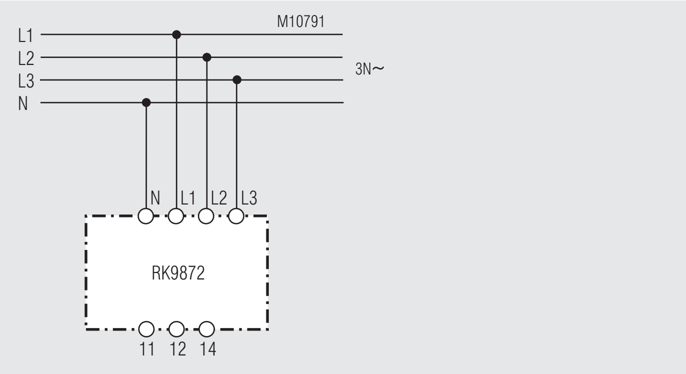
RK 9872 / _ _ 0

0 Standard

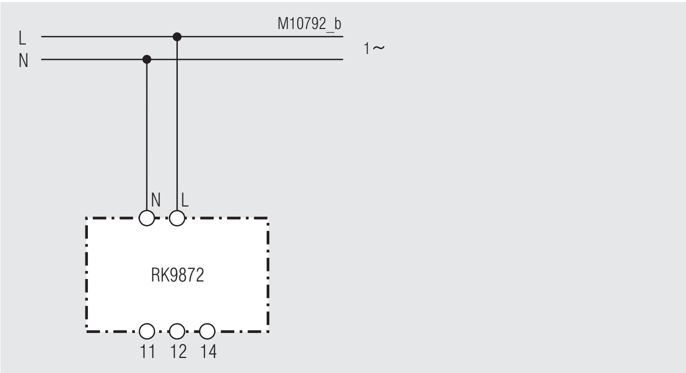
0 without time delay
1 with time delay 0.5 s

0 Function undervoltage
overvoltage
phase sequence
1 Function undervoltage
overvoltage

Connection Examples



3-phase



1-phase

VARIMETER
Phase Monitor
IK 9169, RK 9169, SK 9169

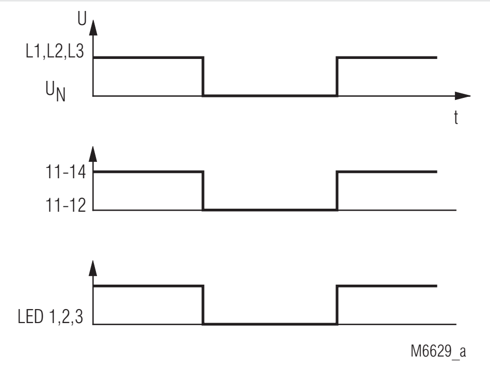
DOLD

0225117

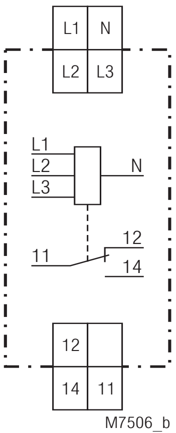
IK 9169 RK 9169 SK 9169

- According to IEC/EN 60 255-1
- Detection of phase failure in 3-phase systems
- Single phase connection possible
- Closed circuit operation
- Independent of phase sequence
- LED indicator for each phase
- Output 1 changeover contact
- Devices available in 2 enclosure versions:
  - I- and R-versions, e.g. IK 9169 with depth 61 mm or RK 9169 with depth 71 mm with terminls at the bottom for installation systems and industrial distribution systems according to DIN 43880
  - S-version, e.g. SK 9169: depth 100 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9169, RK 9169, SK 9169

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3, N	Measuring input or. supply voltage
11, 12 ,14	Changeover contact

Approvals and Markings

CE

Applications

Detection of phase failure in 3-phase systems

Indicators

LED L1, L2, L3:	on, when phase is present

Notes

On broken or disconnected neutral the LEDs are off although the 3 phases are present.
In this case measurement is necessary to prove that no voltage is present.

Technical Data

Input

Nominal voltage U_N:	3/N AC 380 ... 415 / 220 ... 240 V
Voltage range:	0.8 ... 1.1 U_N
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 65 Hz
Response value:	0.7 U_N ± 10 %

Output

Contact		
IK 9169, RK 9169, SK 9169:	1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	typ. 300 000 switching cycles	
Short-circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60°C	
Storage:	- 25 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree (between L1-L2-L3-N):	4 kV / 2	IEC 60 664-1
input / output:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation 80 MHz ... 2.7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6

The 1 MHz slow damped oscillator test according to IEC/EN 60255-1 has not been made.

Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	DIN 46 228-1/-2/-3/-4	
IK 9169, SK 9169		
Cross section:	2 x 0,6 ... 2,5 mm² solid or 2 x 0,28 ... 1,5 mm² stranded wire with and without ferrules	
Stripping length:	10 mm	
Leiterbefestigung:	Plus-Minus-terminal screws M3,5 with self-lifting clamping piece	
RK 9169		
Cross section:	0,5 ... 10 mm² solid or 0,5 ... 6 mm² mm² stranded wire with and without ferrules	
Stripping length:	10 mm	
Wire fixing:	Captive slotted screw / M3,5	
Fixing torque:	0.8 Nm	
M**ounting:**	DIN rail	IEC/EN 60 715
Weight		
IK 9169:	60 g	
RK 9169:	75 g	
SK 9169:	80 g	

Dimensions

Width x height x depth

IK 9169:	17.5 x 90 x 59 mm
RK 9169:	17.5 x 90 x 71 mm
SK 9169:	17.5 x 90 x 98 mm

Standard Types

IK 9169.11 3/N AC 380 ... 415 / 220 ... 240 V 50/60 Hz
Article number: 0049177
RK 9169.11 3/N AC 380 ... 415 / 220 ... 240 V 50/60 Hz
Article number: 0060316
SK 9169.11 3/N AC 380 ... 415 / 220 ... 240 V 50/60Hz
Article number: 0054713

- Output: 1 changeover contact
- Nominal voltage U_N: 3/N AC 380 ... 415 / 220 ... 240 V
- Width: 17.5 mm

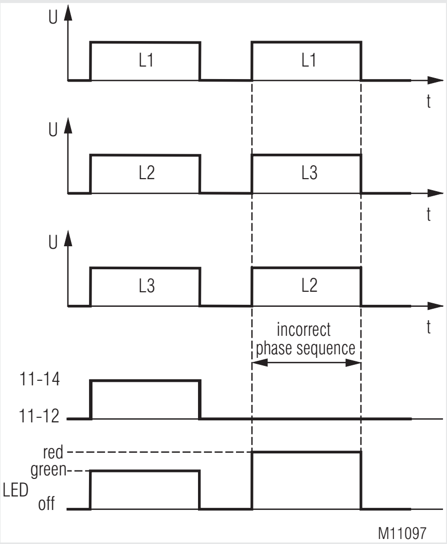
VARIMETER
Phase Sequence Module
IL 9059, SL 9059, OA 9059

DOLD

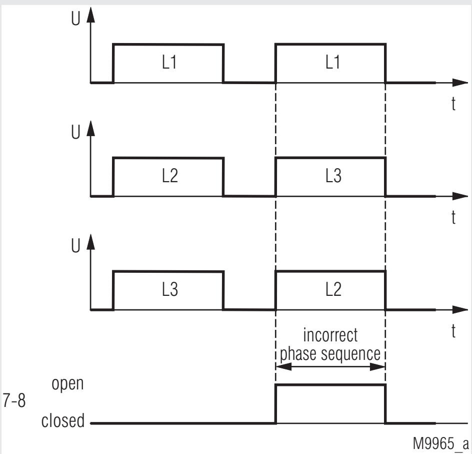
0269442

IL 9059 SL 9059 OA 9059

Function Diagrams



IL 9059, SL 9059



OA 9059/001

Your Advantages

- Protects mobile equipment against damage or destruction coming from wrong phase sequence
- OA 9059: reduced wiring by mounting directly in the motor connection box

Features

- According to IEC/EN 60255-1
- Detection of incorrect phase sequence
- No separately auxiliary voltage necessary
- Nominal voltage range 3 AC 380 ... 690 V
- Suitable for operation with inverters (f = 40 ... 80 Hz)
- Relay output:
  - IL/SL 9059: 1 changeover contact
  - OA 9059: 1 NC contact
- Extended temperature range
- Devices available in 3 enclosure versions:
  IL 9059: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9059: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- OA 9059: sealed modul with stranded wire connection suitable for mounting in terminal box
- Width
  - IL/SL 9059: 35 mm
  - OA 9059: 62 mm

Approvals and Markings

A025518

*) only IL 9059

Applications

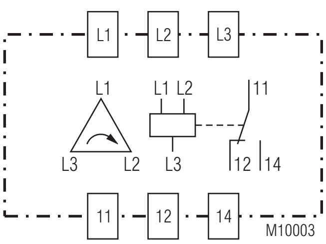
In many application with pumps, conveyors and fans efficient monitoring systems should help to detect failures and misfunctions in time, to avoid damage and long times of non-operation.
Besides speed and frequency the monitoring of phase sequence is very important.
The phase sequence relay with it's wide voltage range of 3AC380-690V detects a wrong phase sequence and signals via a galvanically separated relay contact the wrong rotation of a motor.
By integrating the relay output into the enabling circuit of a plant, the unit disables the start of the plant in the case of wrong phase sequence. especially portable equipment can be protected in this way.

Indicators

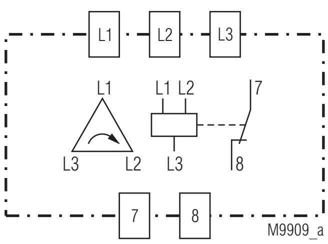
2-colour LED at IL/SL 9059

green:	correct phase sequence contacts 11-14 closed
red:	incorrect phase sequence contacts 11-12 closed

Circuit Diagrams



IL 9059, SL 9059



OA 9059

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Input circuit OA 9059: L1 (red), L2 (blue), L3 (grey)
7, 8 (OA 9059)	NO contact: 7 (yellow), 8 (green)
11,12,14 (IL/SL 9059)	Changeover contact

Technical Data

Input circuit

Nominal voltage U_N: 3 AC 380 ... 690 V
Voltage range: 0.85 ... 1.1 U_N (3 AC 320 ... 760 V)
Nominal frequency: ca. 3 VA
Frequency range: 40 ... 80 Hz (main frequency); suitable for operation with inverters with independant pulse frequency

Output

Contact
IL/SL 9059: 1 changeover contacts
OA 9059: 1 NC contact
Contact material: AgNi 0.15 gold plated
Switching voltage: AC 250 V
Response time: After connection of all 3 phase with incorrect phase sequence until NC contact at OA 9059/001 opens: approx. 100 ms
Thermal current I_{th}:
IL/SL 9059: 5 A
OA 9059: 2 A
Switching capacity IL/SL 9059
to AC 15: 2 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: 2 A / DC 24 V IEC/EN 60 947-5-1
Switching capacity OA 9059
to AC 15: 1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13: 1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life: 1.5 x 10^5 switching cycles
Short circuit strength max. fuse rating:
IL/SL 9059: 4 A gL IEC/EN 60 947-5-1
OA 9059: 2 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range
Operation
IL/SL 9059: - 30 ... + 70°C
OA 9059: - 30 ... + 75°C
Storage
IL/SL 9059: - 40 ... + 70°C
OA 9059: - 45 ... + 75°C
Relative air humidity: 93 % at 40 °C
Altitude: < 2,000 m
Clearance and creepage distances
rated rated impulse voltage voltage / pollution degree;
Output to Input: 6 kV / 3 IEC 60 664-1
EMC
Statische Entladung (ESD): 8 kV (Luftentladung) IEC/EN 61 000-4-2
HF irratiation
80 MHz ... 1 GHz: 10 V / m IEC/EN 61 000-4-3
IL/SL 9059:
1 GHz ... 2 GHz: 3 V / m IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz: 3 V / m IEC/EN 61 000-4-3
OA 9059:
1 GHz ... 2 GHz: 10 V / m IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
HF-wire guided
IL/SL 9059: 30 V / m IEC/EN 61 000-4-6
OA 9059: 10 V / m IEC/EN 61 000-4-6
Surge voltages: 2 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011

Technical Data

Degree of protection:
IL/SL 9059: Housing: IP 40 EN 60 529
Terminals: IP 20 EN 60 529
OA 9059: Module is completed sealed-in
Housing:
IL/SL 9059: Thermoplastic with V0 behaviour according to UL subject 94
OA 9059: Potting compound UL approval
Vibration resistance: Amplitude 0.35 mm, frequency 10 ... 55 Hz,IEC/EN 60 068-2-6
Climate resistance:
IL/SL 9059: 30 / 070 / 04 IEC/EN 60 068-1
OA 9059: 30 / 075 / 04 IEC/EN 60 068-1
Wire connection:
IL/SL 9059: 2 x 2.5 mm² solid DIN 46 228
2 x 1.5 mm² stranded ferruled DIN 46 228-1 /-2 /-3
OA 9059:
L1; L2; L3: 0.5 mm², double insulation
7; 8: 0.25 mm², double insulation
wire length: 25 cm
Wire fixing IL/SL 9059: Flat terminals with self-lifting clamping piece EN 60 999
Fixing torque:
IL/SL 9059: 0.8 Nm
Mounting
IL/SL 9059: DIN rail IEC/EN 60 715
OA 9059
Mounting screws: M4 x 25 mm
Mounting torque: 1.2 Nm

Weight:
IL 9059: approx. 215 g
SL 9059: approx. 245 g
OA 9059: approx. 180 g

Dimensions

Width x height x depth:
IL 9059: 35 x 90 x 59 mm
SL 9059: 35 x 90 x 98 mm
OA 9059: 62 x 62 x 25 mm

Standard Type

IL 9059.11 3 AC 380 ... 690 V 40 ... 80 Hz
for mounting in consumer units or industrial distribution systems
Article number: 0062239

- Output: 1 changeover contact
- Nominal voltage U_N: 3 AC 380 ... 690 V
- Frequency range: 40 ... 80 Hz
- De-energized on trip
- Width: 35 mm

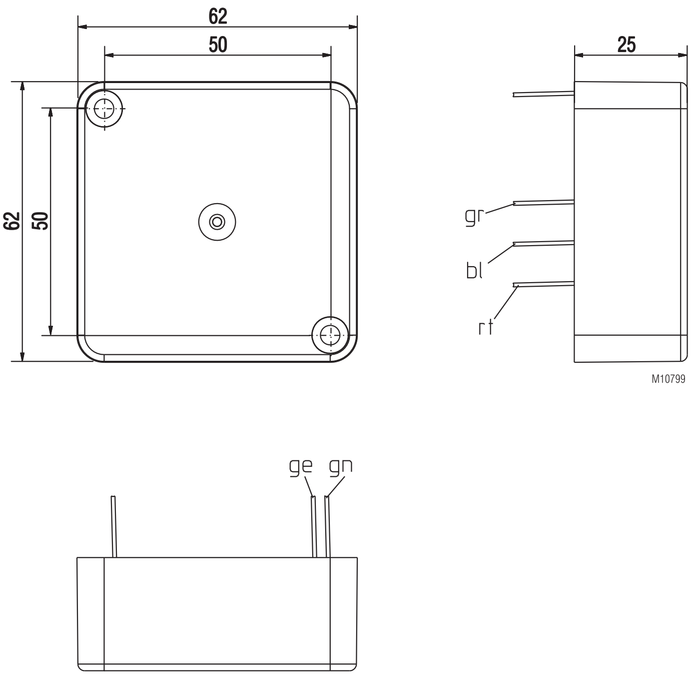
SL 9059.11 3 AC 380 ... 690 V 40 ... 80 Hz
for cabinets with mounting plate
Article number: 0065771

- Output: 1 changeover contact
- Nominal voltage U_N: 3 AC 380 ... 690 V
- Frequency range: 40 ... 80 Hz
- De-energized on trip
- Width: 35 mm

OA 9059.05/001 3 AC 380 ... 690 V 40 ... 80 Hz
for mounting in terminal box
Article number: 0065777

- Output: 1 NC contact
- Nominal voltage U_N: 3 AC 380 ... 690 V
- Frequency range: 40 ... 80 Hz
- Energized on trip
- Width: 62 mm

Dimension OA 9059



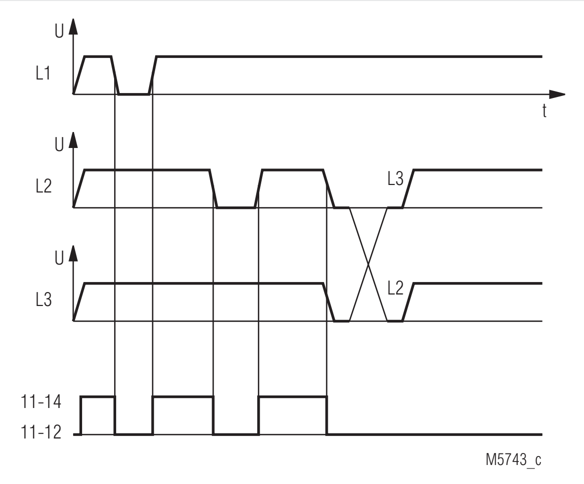
VARIMETER
Phase Sequence Relay
BA 9041, AI 941 N

0225150

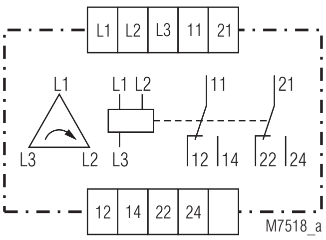
BA 9041 AI 941 N

- According to IEC 255, EN 60 255, VDE 0435 part 303
- Detection of wrong phase sequence
- 1 or 2 changeover contacts
- Width 45 mm

Function Diagram



Circuit Diagram



BA 9041, AI 941 N.002

Approvals and Markings

CE

Application

Monitoring three-phase mains for incorret phase sequence

Function

The phase sequence relays BA 9041 and AI 941N monitor the right order of the phases in a 3-phase system. When all 3 phases are connected to the device and the phase sequence is correct the output contacts are activated, 11-14 and 21-24 close and a green LED comes on.

When the voltage in one phase drops below 60 % of the nominal voltage the relay is de-energized. If a load feeds back a voltage that is higher then 60 % U_N the fault is not detected. To avoid this problem an asymmetry relay BA 9040 should be used.

In systems with commutation peaks (thyristor controlled drives) the device can falsely detect a phase failure.

In this case it is helpful to know as much as possible about the actual conditions in the system.

Technical Data

Input

Nominal voltage U_N:	3 AC 190, 230, 400, 415, 440, 500 V
Voltage range:	0.8 ... 1.1 U_N
Nominal frequency of U_N:	50 Hz (60 Hz on request)
Frequency range:	± 5 %
Nominal consumption:	< 3.5 VA

Output

Contacts		
AI 941 N.001:	1 changeover contact	
AI 941 N.002, BA 9041:	2 changeover contacts	
Operate-/release delay:	< 100 / < 50 ms	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	2.5×10^5 switching cycles	
Short-circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	50×10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:	Housing: IP 40	IEC/EN 60 529
	Terminals:IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Screw mounting:		
AI 941 N:	35 x 50 mm and 35 x 60 mm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BA 9041:	310 g	
AI 941 N:	300 g	

Dimensions

Width x height x depth

BA 9041:	45 x 74 x 124 mm
AI 941 N:	45 x 77 x 127 mm

Standard Types

BA 9041 AC 400 V 50 Hz

Article number:	0041732	stock item
• Output:	2 changeover contacts	
• Nominal voltage U_N:	AC 400 V	
• Width:	45 mm	

AI 941N.001 AC 400 V 50 Hz

Article number:	0040771	stock item
• Output:	1 changeover contact	
• Nominal voltage U_N:	AC 400 V	
• Width:	45 mm	

Variant

AI 941 N. _ _ _ /03:	Nominal frequency 50 ... 60 Hz, phase failure cannot be detected with this unit

Ordering example for variants

BA 9041 AC 400 V 50 Hz

- 50 Hz — Nominal frequency
- AC 400 V — Nominal voltage
- BA 9041 — Type

AI 941 N .001 /_ _ AC 400 V 50 Hz

- 50 Hz — Nominal frequency
- AC 400 V — Nominal voltage
- /_ _ — Variant, if required
- .001 — Contacts
- AI 941 N — Type

Monitoring Technique

VARIMETER
Phase Sequence Relay
MK 9056N

DOLD

0275083

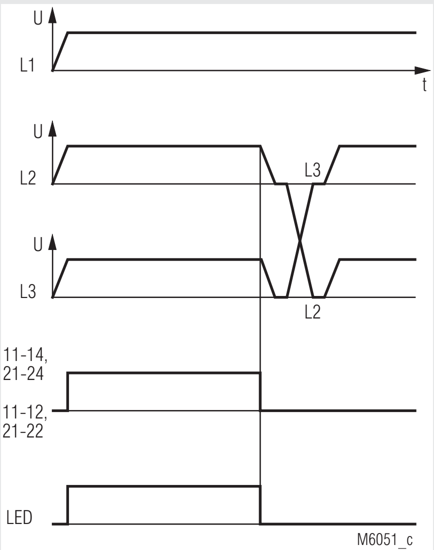
Your Advantage
- Correct sense of rotation of motors
- Simple wiring

Features
- According to IEC/EN 60 255-1
- Detection of wrong phase sequence
- LED indication of rotation
- 2 changeover contacts
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 22.5 mm

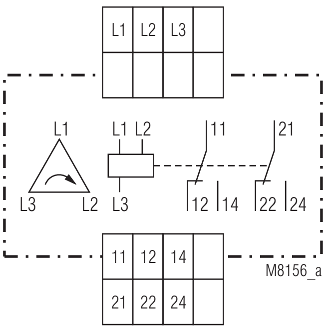
Product Description

The MK 9056N detect wrong phase sequence in 3-phase systems. To monitor phase failure it is more suitable to use an Asymmetry relay e.g. MK 9040N.

Function Diagram



Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Connection of the monitoring 3-phase system
11, 12, 14, 21, 22, 24	"incorrect phase sequence-signaling relais (2 changeover contacts)"

Approvals and Markings

A025518

Indicators

green LED:	on, when corresponding output relay is active

Technical Data

Input

Nominal voltage U_N:	3 AC 42 ... 60 V, 100 ... 127 V 3 AC 220 ... 240, 380 ... 500 V
Voltage range:	0.9 ... 1.1 U_N
Nominal frequency of U_N:	50 / 60 Hz
Nominal consumption:	approx. 2 W

Output

Contact:	2 changeover contacts	
Operate / release delay:	< 100 / 50 ms	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switch. cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 20 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60°C	
Storage:	- 20 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1

Technical Data

EMC

Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled or 2 x 1.5 mm² stranded ferruled or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled	
min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	$12^{\pm 0.5}$ mm	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	approx. 140 g	

Dimensions

Width x height x depth:	
MK 9056N:	22.5 x 90 x 97 mm
MK 9056N PC:	22.5 x 111 x 97 mm
MK 9056N PS:	22.5 x 104 x 97 mm

CCC-Data

Auxiliary voltage U_N:	3 AC 42-60 V, 3 AC 100-127V, 3 AC 220-240 V	
Switching capacity		
to AC 15		
NO contact:	1,5 A / AC 230 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

MK 9056N.12 AC 380 ... 500 V 50 / 60 Hz

Article number:	0054183
• Output:	2 changeover contacts
• Nominal voltage U_N:	AC 380 ... 500 V
• Width:	22.5 mm

Ordering Ecample

MK 9056N. 12 _ _ / 3 AC 380 ... 500 V 50 / 60 Hz

- Nominal frequency
- Nominal voltage
- Type of terminals
  - without indication:
    - terminal blocks fixed with screw terminals
  - PC (plug in cageclamp):
    - pluggable terminal blocks with cage clamp terminals
  - PS (plug in screw):
    - pluggable terminal blocks with screw terminals
- Contacts
- Type

Options with Pluggable Terminal Blocks

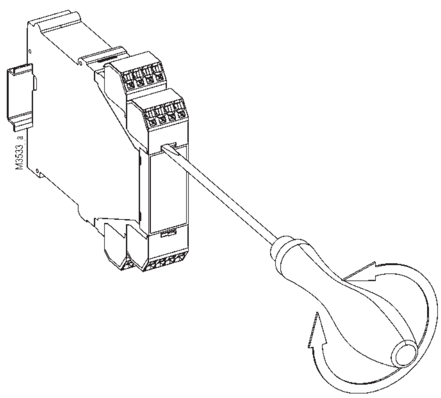
Screw terminal
(PS/plugin screw)

Cage clamp
(PC/plugin cage clamp)

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



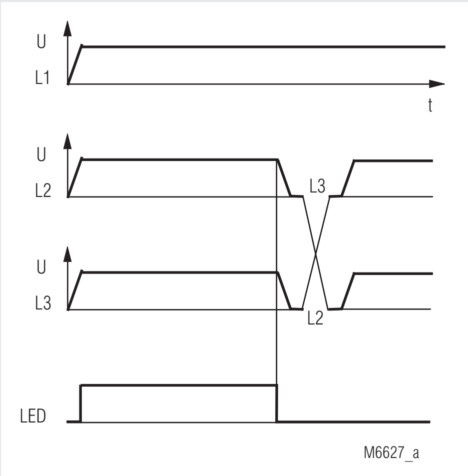
VARIMETER
Phase Sequence Indicator
IK 9178, SK 9178

0225106

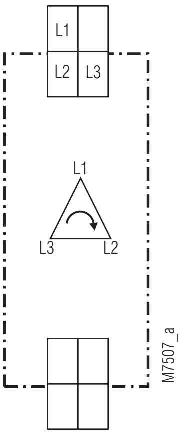
IK 9178 SK 9178

- According to IEC/EN 60 255, DIN VDE 0435-303
- Indication of phase sequence in 3-phase systems
- Without auxiliary supply
- LED indicator for phase sequence
- **Devices available in 2 enclosure versions:**
  IK 9178: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9178: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram



IK 9178, SK 9178

Approvals and Markings

CE

Applications

Indication of phase sequence in 3-phase systems

Indicators

LED: on when phase sequence is right

Technical Data

Input

Nominal voltage U_N:	3 AC 400 V
Voltage range:	0.8 ... 1.1 U_N
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 65 Hz

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree (between L1-L2-L3):	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715

Technical Data

Weight

IK 9178:	50 g
SK 9178:	69 g

Dimensions

Width x height x depth

IK 9178:	17.5 x 90 x 59 mm
SK 9178:	17.5 x 90 x 98 mm

Standard Types

IK 9178 3 AC 400 V 50/60 Hz

Article number:	0049102	stock item
• Nominal voltage U_N:	3 AC 400 V	
• Width:	17.5 mm	

SK 9178 3 AC 400 V 50/60 Hz

Article number:	0054760
• Nominal voltage U_N:	3 AC 400 V
• Width:	17.5 mm

Ordering example

<u>IK 9178</u> <u>3 AC 400 V</u> <u>50/60 Hz</u>

Nominal frequency
Nominal voltage
Type

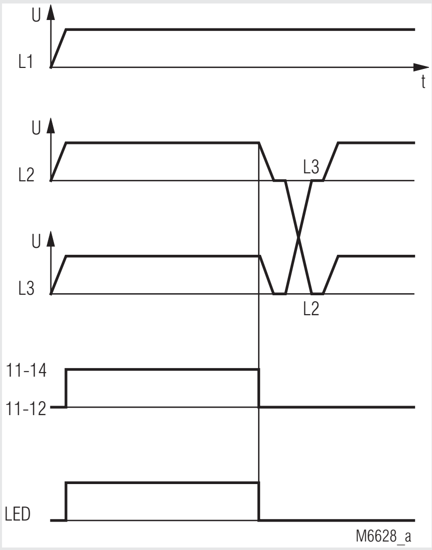
VARIMETER
Phase Sequence Monitor (Phase Sequence Relay)
IK 9179, RK 9179, SK 9179

0225107

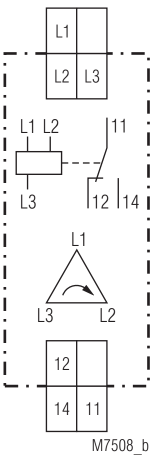
IK 9179 RK 9179 SK 9179

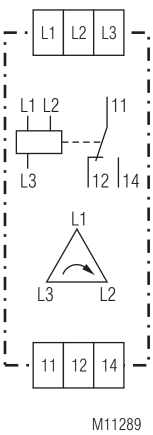
- According to IEC/EN 60255-1
- Detection of phase sequence in 3-phase systems
- Without auxiliary voltage
- Closed circuit operation
- LED indicator for phase sequence
- Output 1 changeover contact
- Devices available in 2 enclosure versions:
  - I- and R-model, e.g. IK 9169 with depth 61 mm or RK 9169 with depth 71 mm with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  - S-model, e.g. SK 9169 depth 100 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Circuit Diagram





IK 9179, SK 9179 RK 9179

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Measuring input or. supply voltage
11, 12 ,14	Changeover contact

Approvals and Markings

CE

Applications

Detection of phase sequence in 3-phase systems. Disable start of motors with fixed direction of rotation in the case of wrong phase sequence

Indicators

LED: on, when output relay active (contact 11-14 closed)

Technical Data

Input

Nominal voltage U_N: 3 AC 400 V
Voltage range: 0.8 ... 1.1 U_N
Nominal frequency: 50 / 60 Hz
Frequency range: 45 ... 65 Hz

Output

Contact:
IK 9179.11, RK 9169, SK 9179: 1 changeover contact
Thermal current I_{th}: 4 A
Switching capacity
to AC 15:
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V: typ. 300 000 switching cycles
Short-circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 switching cycles

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
(between L1-L2-L3):	4 kV / 2	IEC 60 664-1
input/output:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 2,7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	20 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6

The 1 MHz slow damped oscillator test according to IEC/EN 60255-1 has not been made.

Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	DIN 46 228-1/-2/-3/-4	
IK 9179, SK 9179		
Cross section:	2 x 0,6 ... 2,5 mm² solid or 2 x 0,28 ... 1,5 mm² stranded wire with and without ferrules	
Stripping length:	10 mm	
Leiterbefestigung:	Plus-Minus-terminal screws M3,5 with self-lifting clamping piece	
Fixing torque:	0.8 Nm	
RK 9179		
Cross section:	0,34 ... 2,5 mm² solid or 0,34 ... 2,5 mm² stranded wire with and without ferrules	
Stripping length:	7 mm	
Wire fixing:	Captive slotted screw / M2,5	
Fixing torque:	0.5 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9179:	60 g	
RK 9179:	74 g	
SK 9179:	77 g	

Dimensions

Width x height x depth

IK 9179:	17.5 x 90 x 61 mm
RK 9179:	17.5 x 90 x 71 mm
SK 9179:	17.5 x 90 x 100 mm

Standard Types

IK 9179.11 3 AC 400 V 50/60 Hz
Article number: 0049182
RK 9179.11 3 AC 400 V 50/60 Hz
Article number: 0060282
SK 9179.11 3 AC 400 V 50/60 Hz
Article number: 0051576

- Output: 1 changeover contact
- Nominal voltage U_N: 3 AC 400 V
- Width: 17.5 mm

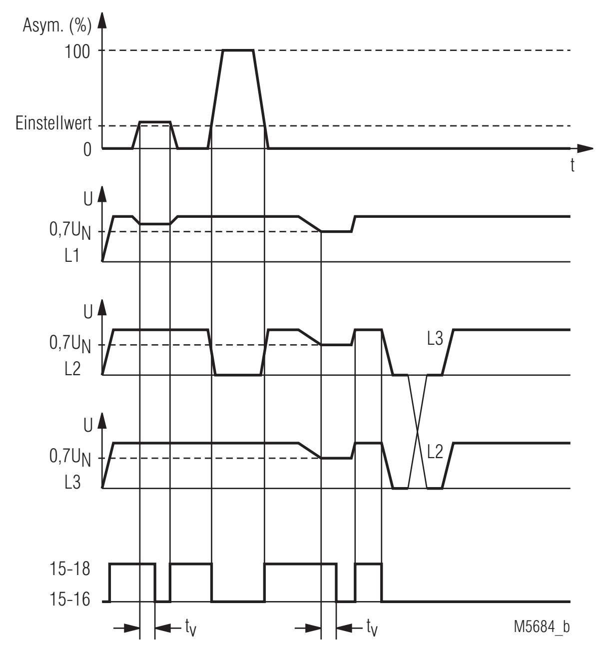
VARIMETER
Asymmetry Relay
AK 9840

DOLD

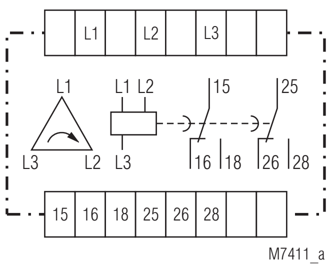
0260659

- According to EN 60 255-1
- For nominal voltages from 3 AC 230 up to 500 V
- Detection of
  - voltage asymmetry
  - incorrect phase sequence
  - phase failure
  - undervoltage
- Voltage feedback recognition
- Also suitable for harmonic industrial mains
- Closed circuit operation
- Contact position indication
- With adjustable delay
- 2 C/O contacts
- Width: 75 mm

Function Diagram



Circuit Diagram



AK 9840.82

Approvals and Markings

CE

Application

Monitoring three-phase mains for voltage asymmetry, phase failure or incorrect phase sequence.

Function

The AK 9840 asymmetry relay monitors the voltage symmetry of the phase voltages, the undervoltage and the correct phase sequence L1-L2-L3. Voltage asymmetry and undervoltage are determined by measuring the arithmetic average between the three phases.
If there is no fault in the system being monitored the output relay is energized (closed circuit principle), contact 15-18, 25-28 is closed, and this is indicated by a green LED. The instrument responds to asymmetrical voltage changes caused by unequal mains loading or failure of an outer conductor due to the melting of a fuse. An asymmetry relay always only detects the difference between two voltages, and hence does not react to symmetric voltage falls in the mains supply unless the voltage drops belowthe undervoltage recognition vaiue set at 0.7 U_N. If the set asymmetry is exceeded positively or negatively or if there is undervoltage, the output relay is deenergized alter the set response delay. If the phase sequence is incorrect, the output relay responds without delay. The LED indicator is extinguished. Thanks to the special circuitry which evaluates the phase angle, an a fault condition, the relay will not be affected by any voltage feedback. Depending an the mains conditions, the feedback is identified as asymmetry - delayed - or as incorrect phase sequence - non-delayed.
Mains supplies with a mid-point conductor can also be monitored with the Instrument. lt is not necessary to connect the neutral. The nominal voltage for this application must be converted to delta voltage when placing an order.
Industrial mains with thyristors, with automatic reactive current compensating plant and with emergency power generators have a high harmonic content. With the AK 9840 the measuring principle employed ensures that no errors occur in the response values. Also suitable for automatic changeoverto battery-powered operation of emergency lightings when the supply voltage drops by 30 % (to VDE 0108).

Indication

LED: on, when output relay active

Technical Data

Input

Nominal voltage U_N:	3 AC 400 V additional voltages for ranges 3 AC 100 ... 690 V are also available	
Voltage range:	0.7 ... 1.1 U_N / 0.7 ... 1.2 U_N to 1.5 s	
Nominal consumption:	≤ 7.1 VA	
Nominal frequency:	50 / 60 Hz	
Frequency range:	± 5 % / 10 % to 1.5 s	
Max. harmonics level:	distortion factor K ≤ 12 %	

Setting Ranges

Setting range:	5 ... 20 % U_N voltage asymmetry settable	
Hysteresis:	0.98 fixed	
Voltage feedback recognition:	up to 100 % - setting value, e.g. when setting value = 5 % asymmetry, 100 % - 5 % = 95 % Recognition of voltage feedback up to 95 %	
Undervoltage setting:	0.7 U_N	
Delay:	0.5 ... 5 s infinite variable	

Output

Contacts		
AK 9840.82:	2 changeover contacts	
Thermal current I_{th}:	6 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	≥ 2.5 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short-circuit strength		
max. fuse rating:	4 AgL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:		
Measuring input to contacts:	6 kV / 2	IEC 60 664-1
Relay contact to relay contact:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	3 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wire for powers supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour acccording to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	300 g	

Dimensions

Width x height x depth:	75 x 78 x 119 mm

Standard Type

AK 9840.82 3 AC 400 V 50 / 60 Hz

Article number:	0040621
• Output:	2 changeover contacts
• Nominal voltage U_N:	3 AC 400 V
• Width:	75 mm

Characteristic

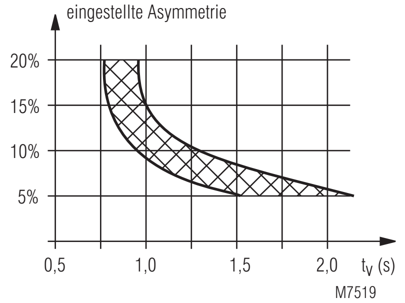


Diagramm Start up delay

The diagram shows the start delay in relation of the adjustet asymmetry when the unit is switched to the symmetric mains.

VARIMETER
Asymmetry Relay
BA 9040, MK 9040N

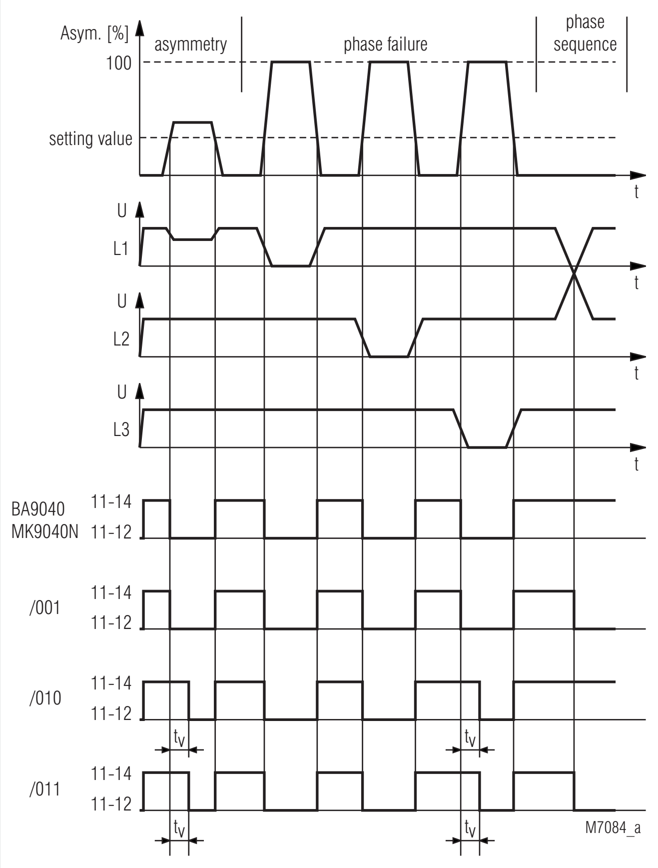
DOLD

0221538

BA 9040 MK 9040N

- According to IEC 255, EN 60 255, VDE 0435 part 303
- Recognition of
  - voltage asymmetry
  - phase failure
  - voltage feedback
  - optionally with phase sequence recognition
- Optionally with adjustable response delay
- 2 LED displays for power supply and state of contact
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- BA 9040: width 45 mm
  MK 9040N: width 22.5 mm

Function Diagram



Approvals and Markings

Canada / USA A025518 * see variants

Applications

Monitoring three-phase mains for voltage asymmetry, phase failure or incorrect phase sequence, e.g. in elevators, escalators, crane systems etc.

Indications

upper LED:	on when supply voltage connected
lower LED:	on when output relay energized

Technical Data

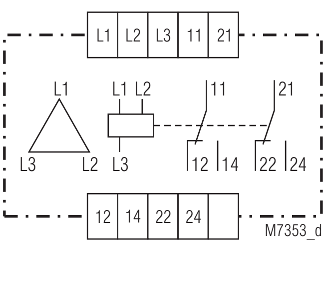
Input

Nominal voltage U_N:	3 AC 400 V
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption:	
BA 9040:	approx. 4.8 VA
MK 9040N:	7 VA
Nominal frequency:	50 / 60 Hz
Frequency range:	45 ... 65 Hz
Temperature influence:	< 0.05 % / K
Frequency influence:	< 0.02 % / Hz

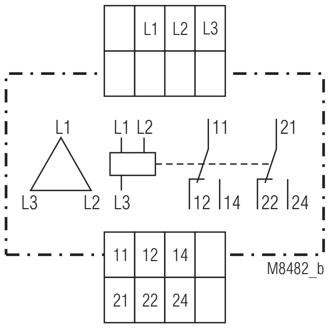
Setting Ranges

Setting range:	5 ... 15 % voltage asymmetry
Repeat accuracy:	≤ 0.5 %
Release ratio:	< 4 % U_N
Voltage feedback recognition:	up to 100 % - setting value, e.g. when setting value = 5 % asymmetry, 100 % - 5 % = 95 % Recognition of voltage feedback up to 95 %
Time delay t_v	
BA 9040:	0.5 ... 5 s
MK 9040N:	0.5 ... 10 s

Circuit Diagrams



BA 9040.12



MK 9040N.12

Technical Data

Output

Contacts	2 changeover contacts	
Response/release time:		
BA 9040:	≤ 1 s / ≤ 250 ms	
MK 9040N:	≤ 1.5 s / ≤ 250 ms	
Thermal current I_{th}:	6 A (see continuous current limit curve)	
Switching capacity		
to AC 15		
NO contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life:		
to AC 15 at 3 A, AC 230 V:	10^5 switching cycles	IEC/EN 60 947-5-1
Permissible switching frequency:	6 000 switching cycles / h	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60 °C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Frequency 10 ... 55 Hz, Amplitude 0.35 mm	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:		
BA 9040:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
MK 9040N:	Box terminal with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	325 g	

Dimensions

Width x height x depth:	
BA 9040:	45 x 74 x 133 mm
MK 9040N:	22.5 x 90 x 100 mm

CSA-Data

Switching capacity:	3A 230Vac
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 14 Sol Torque 0.8 Nm AWG 20 - 16 Str Torque 0.8 Nm

Technical data that is not stated in the CSA-Data, can be found in the technical data section.

CCC-Data

Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

BA 9040.12/001 3 AC 400 V 50/60 Hz
Article number: 0043764 stock item

- With phase sequence detection
- Without operate delay
- Output: 2 changeover contacts
- Nominal voltage U_N: 3 AC 400 V
- Width: 45 mm

MK 9040N.12/001 3AC 400 V 50/60 Hz
Article number: 0055712 stock item

- With phase sequence detection
- Without operate delay
- Output: 2 changeover contacts
- Nominal voltage U_N: 3 AC 400 V
- Width: 22.5 mm

Variants

BA 9040.12/60: with CSA approval on request
BA 9040: with CCC approval on request
BA 9040.12/0 _ 0: without phase sequence detection
BA 9040.12/0 _ 1: with phase sequence detection
BA 9040.12/00 _ : without time delay
BA 9040.12/01 _ : with adjustable time delay
t_v: 0 ... 5 s

MK 9040N.12/0 _ 0: without phase sequence detection
MK 9040N.12/0 _ 1: with phase sequence detection
MK 9040N.12/00 _: without time delay
MK 9040N.12/01 _: with adjustable time delay
t_v: 0 ... 10 s

Ordering example for variants

MK 9040N .12 /0 _ _ 3 AC 400 V 50 / 60 Hz

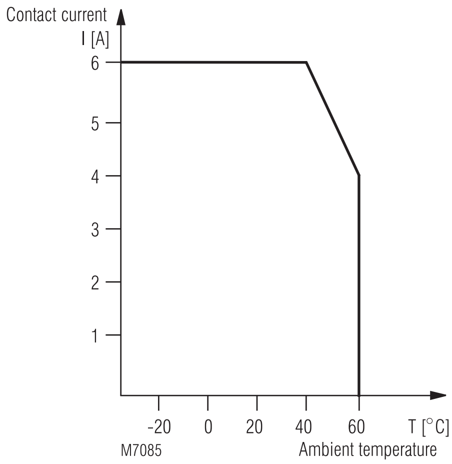
- 50 / 60 Hz — Nominal frequency
- 3 AC 400 V — Nominal voltage
  On request BA 9040:
  3 AC 230 V
  3 AC 440 V
  3 AC 660 V
  MK 9040N:
  3 AC 400 V
- last digit — 0: without phase sequence recognition
  1: with phase sequence recognition
- second-to-last digit — 0: without t_v
  1: with t_v
- .12 — Contacts
- MK 9040N — Type

Options with Pluggable Terminal Blocks

Screw terminal
(PS/plugin screw)

Cage clamp
(PC/plugin cage clamp)

Characteristics



Continuous current limit curve

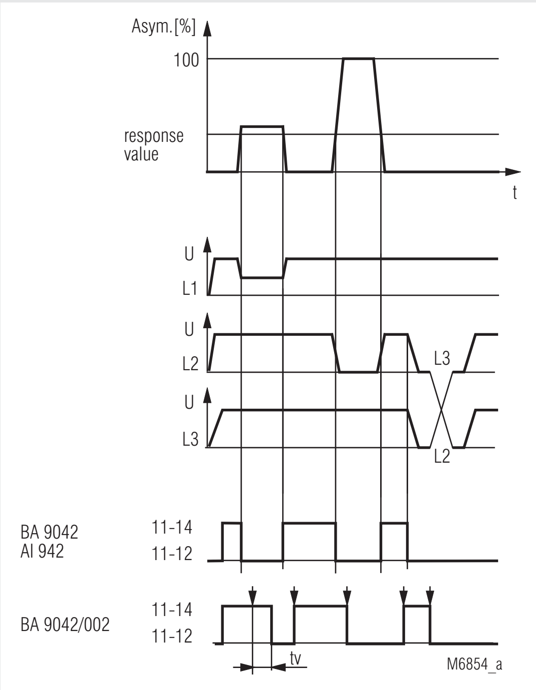
VARIMETER
Asymmetry Relay
BA 9042, AI 942

0225073

BA 9042 AI 942

- According to IEC 255, EN 60 255, VDE 0435 part 303
- For nominal voltage from 3 AC 230 V to 500 V
- Detection of
  - voltage asymmetry
  - wrong phase sequence
  - phase failure
- Detection of feedback voltage
- BA 9042 optionally with adjustable time delay
- Closed circuit operation
- BA 9042 LED indicators for operation and state of contacts
- Width 45 mm

Function Diagram



Approvals and Markings

CE

Application

Monitoring three-phase mains for voltage asymmetry, phase failure or incorrect phase sequence.

Function

The device responds to unsymmetric voltage changes, which can occur because of unbalanced load or phase failure (blown fuse). An asymmetry relay detects only the voltage difference between 2 phases and does not react on symmetric undervoltage.

Indicators

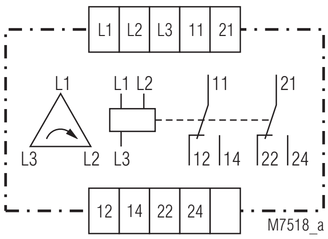
BA 9042

red LED:	on, when supply voltage connected
green LED:	on, when output relay energized

Notes

On ambient temperature > 20 °C overvoltage together with max. thermal current is not allowed. In industrial voltage systems with high harmonic content (content > 2 %) measuring faults can occur. Harmonics in industrial systems are caused by thyristor controls, emergency power supplies, reactive current compensators, etc.
Normally the harmonic content of a voltage system is unknown. We recommend therefore to test a sample in the actual circuit which we can provide with the right to return. If problems occur during the test we are able to offer other solutions.

Circuit Diagram



BA 9042 / AI 942

Technical Data

Input

Nominal voltage U_N:	3 AC 230, 240, 400, 415, 440, 500 V
Voltage range:	0.8 ... 1.1 U_N
Nominal consumption:	≤ 3.8 VA
Nominal frequency:	50 or 60 Hz
Frequency range:	± 5 %

Setting ranges

Setting range:	5 ... 15 % voltage asymmetry, settable
Hysteresis	
BA 9042 :	> 0.98
Voltage feedback recognition:	up to 100 % - setting value, e.g. when setting value = 5 % asymmetry, 100 % - 5 % = 95 % Recognition of voltage feedback up to 95 %

Technical Data

Output

Contacts

BA 9042:	2 changeover contacts	
AI 942.001:	1 changeover contact	
AI 942.002:	2 changeover contacts	
Release delay: (at phase failure or asymmetry)	≤ 150 ms If the voltage system becomes again symmetric before 150 ms the contacts may switch	
Operate delay: (delay of the contacts when switching on)	≤ 500 ms	
Thermal current I_{th}:	6 A	
Switching capacity to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 3 A, AC 230 V		IEC/EN 60 947-5-1
AI 942.001:	≥ 5 x 10^5 switching cycles	
to AC 15 at 1 A, AC 230 V		IEC/EN 60 947-5-1
BA 9042.12, AI 942.002:	≥ 2.5 x 10^5 switching cycles	
Short-circuit strength max. fuse rating:	4 AgL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wire for powers supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour acccording to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm^2 solid or 2 x 1.5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
BA 9042:	310 g	
AI 942:	300 g	

Dimensions

Width x height x depth

BA 9042:	45 x 73 x 132 mm
AI 942:	45 x 77 x 127 mm

Standard Type

BA 9042 3 AC 400 V 50 Hz

Article number:	0040770	stock item
• Output:	2 changeover contacts	
• Nominal voltage U_N:	3 AC 400 V	
• Width:	45 mm	

Variant

BA 9042/002:	with time delay t_v = 0.5 ... 10 s on asymmetry detection

Ordering example for variant

BA 9042 /002 3 AC 400 V 50 Hz
- 50 Hz: Nominal frequency
- 3 AC 400 V: Nominal voltage
- /002: Variant, if required
- BA 9042: Type

AI 942 .001 3 AC 400 V 50 Hz
- 50 Hz: Nominal frequency
- 3 AC 400 V: Nominal voltage
- .001: Contacts
- AI 942: Type

Accessories

AI 942:

K 70-34:	Cover Article number: 0011790

VARIMETER
Frequency Relay
BA 9837, AA 9837, AA 9838

DOLD

0225154

BA 9837

AA 9837

AA 9838

- According IEC/EN 60255-1
- Detection of under- or overfrequency
- Adjustable response value
- Optionally 1 or 2 changeover contacts
- Width 45 mm

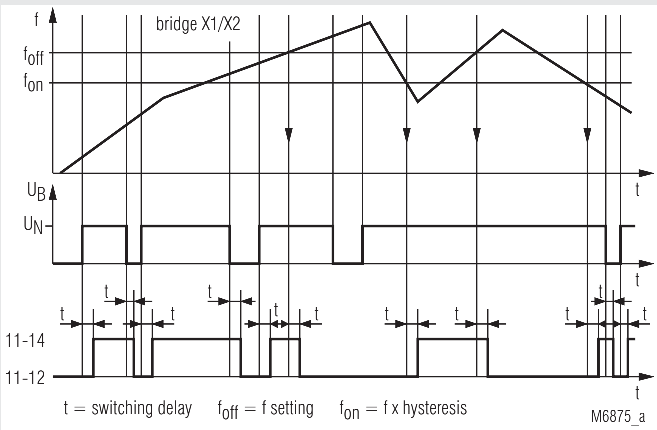
Approvals and Markings

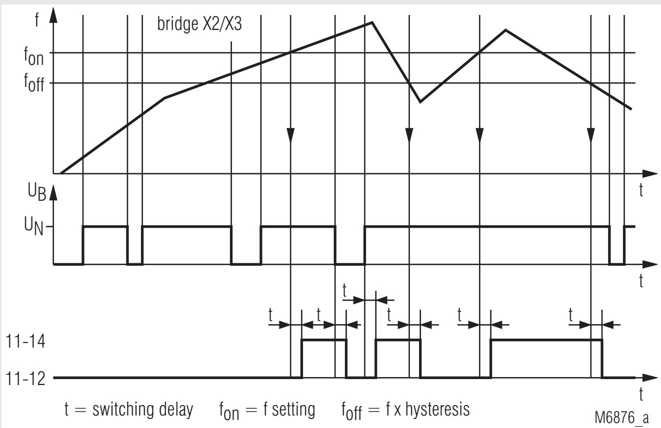
CE

Application

The frequency relay can be used especially in applications where the rotor frequency of a slip-ring motor must be measured. The rotor frequency is reciprocal proportional to the speed (see diagram rotor frequency at contercurrent braking).
This behaviour allows to find speed depending switching values and can be used for start up and contercurrent braking of motors on cranes.

Function Diagram





Function

The device compares 2 frequencies. The measuring frequency is compared to an internally generated, settable frequency reference.

With bridge on X1-X2 the output relay deenergises when the measuring frequency is higher then the setted frequency. The relay energises again when the measuring frequency drops under the setted frequency x hysteresis.

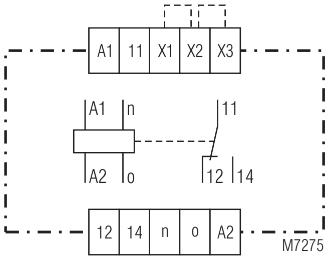
With bridge on X2-X3 the output relay energises when the measuring frequency is higher then the setted frequency. The relay deenergises again when the measuring frequency drops under the setted frequency x hysteresis.

An indicating LED shows that the frequency signal is connected. At low frequency the LED flashes. A second LED indicates the state of the output relay.

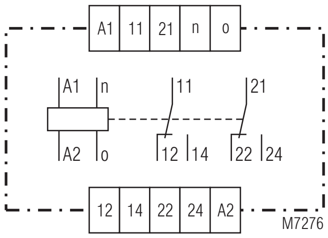
Notes

Terminals X1, X2, X3 should only be connected together with the corresponding wire links. Do not connect external voltage, neutral or ground.
The measuring input is designed for an amplitude of AC 8...500 V. Higher values AC 12...800 V can be achieved by connecting a series resistor, type IK 5110 into the measuring circuit either to terminal n or o.

Circuit Diagrams



BA 9837.11,
AA 9837.11, AA 9838.11



BA 9837.12,
AA 9837.12

Connection Terminals

Terminal designation	Signal designation
A1	+ / L
A2	- / N
n, o	Measuring input
X1, X3	Control input
X2	Control output
11, 12, 14, 21, 22, 24	Changeover contacts

Technical Data

Input

Measuring input: AC Amplitude AC 8 ... 500 V r.m.s
internal resistance: > 400 kΩ

Setting range:

BA 9837, AA 9837:	5 ... 15 Hz	40 ... 120 Hz
	10 ... 30 Hz	100 ... 300 Hz
	20 ... 60 Hz	200 ... 600 Hz
	30 ... 90 Hz	
AA 9838:	20 ... 80 Hz	

Setting: infinite on absolute scale
Response value: ≥ setting value
Hysteresis:
BA 9837, AA 9837: 0.8 ... 0.97 of response value
AA 9838: 0.96 of response value
Accuracy: < ± 1 %
Temperature influence: < ± 0.15 % /°C
Influence of auxiliary supply: < ± 0.5 % at 0.8 ... 1.1 U_N

Auxiliary Circuit

Auxiliary voltage U_H:
BA 9837, AA 9837: AC 24, 42, 110, 127, 230, 240 V
AA 9838: AC 48, 110, 230 V
Voltage range of U_H: 0.8 ... 1.1 U_H
Nominal consumption U_H: < 3 VA
Nominal frequency of U_H: 50 / 60 Hz ± 5 %

Output

Contacts
BA 9837.11, AA 9837.11, AA 9838.11: 1 changeover contact
BA 9837.12, AA 9837.12: 2 chanceover contacts
Switching delay:

setting range (Hz)	bridge X1-X2	bridge X2-X3
5 - 15	500 - 800	650 - 1 000
10 - 30	250 - 300	600 - 800
20 - 60	120 - 150	300 - 430
20 - 80	100 - 120	290 - 430
30 - 90	90 - 120	280 - 400
40 - 120	60 - 80	140 - 210
100 - 300	25 - 45	70 - 120
200 - 600	15 - 25	70 - 100

switching delay in ms

Technical Data

Thermal current I_{th}: 6 A
Switching capacity IEC/EN 60 947-5-1
to AC 15, AC 230 V: 3 A / AC 230 V
Electrical life IEC/EN 60 947-5-1
to AC 15, at 3 A, AC 230 V: 2.5 x 10^5 switching cycles
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: > 30 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range:
Operation: - 20 ... + 60°C
Storage: - 20 ... + 70°C
Altitude: < 2.000 m
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation
80 MHz ... 2,7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages
between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 2 x 2.5 mm² solid or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4
Wire fixing: Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Screw mounting: 35 x 50 mm and
35 x 60 mm
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715
Weight: 250 g

Dimensions

Width x height x depth: 45 x 77 x 127 mm

Standard Type

BA 9837.11 30 / 90 Hz AC 230 V AC 50 / 60 HZ
Article number: 0050216
- Output: 1 changeover contact
- Measuring frequency: 30 / 90 Hz
- Auxiliary voltage U_H: 230 V
- Width: 45 mm

Variants

	Frequency relay with 2 changeover contacts and internal bridges (X1, X2, X3)
BA 9837.12/010:	with internal bridge X1 - X2
BA 9837.12/020:	with internal bridge X2 - X3
AA 9837.12/010:	with internal bridge X1 - X2
AA 9837.12/020:	with internal bridge X2 - X3

Ordering example for variants

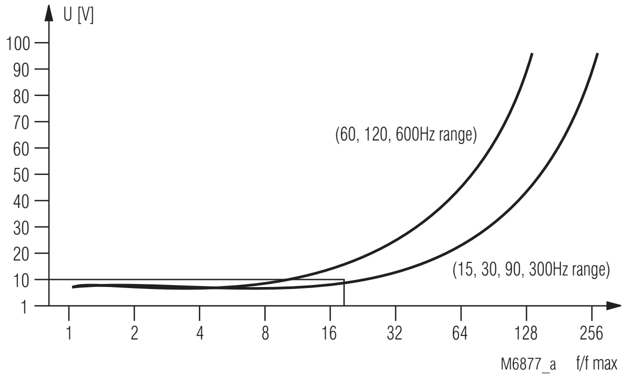
BA 9837 .12 /_ _ _ AC 230 V 50/60 Hz 20/60 Hz

- 20/60 Hz — Measuring frequency
- 50/60 Hz — Nominal frequency
- AC 230 V — Auxiliary voltage
- /_ _ _ — Variant, if required
- .12 — Contacts
- BA 9837 — Type

Accessories

IK 5110:	Series resist or for higher measuring voltage AC 12 ... 800 V eff. Article number: 0015751

Characteristics



Measuring sensitivity

The diagram shows the sensitivity of the input of the frequency relay AA 9837. If the measuring voltage is lower then the curve values the frequency cannot be measured anymore. Please note.
Superimposed interference voltages on the measuring input with a ration.

$$\frac{f}{f_{max}}$$

above the curve values can influence the measuring results.

f - frequency on input

f_{max} - highest value of the actual frequency range

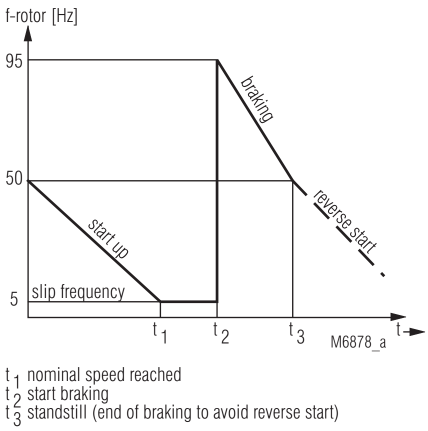
Example:

$U_{meß}$: 10 V; measuring frequency: f = 4 800 Hz

chosen frequency range: 100 - 300 Hz, f_{max} = 300 Hz

$$\frac{f}{f_{max}} = \frac{4\,800\text{ Hz}}{300\text{ Hz}} = 16$$

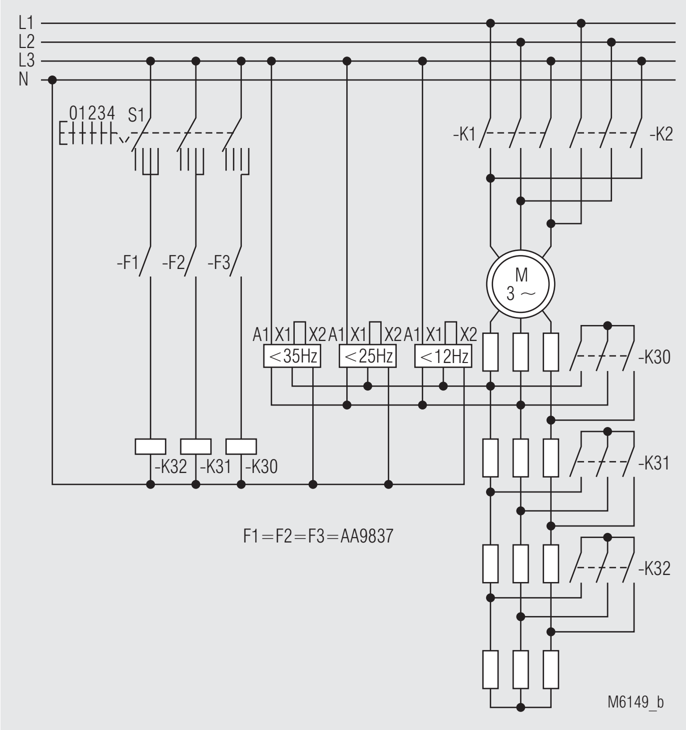
The meauring frequency is detected, as the measuring voltage is above the response curve.



Rotor frequency at countercurrent braking

Braking:
When reversing the phases for braking the rotor frequency changes and drops proportional to the speed to mains frequency. E.g. when the rotor frequency is 5 Hz at nominal speed, it to 95 Hz. When the motor is at stand still the rotor frequency is nominal frequency. At this point the frequency relay has to give the signal to stop braking, before the motor starts up in the opposite direction.

Connection Example



Motor control with starting resistance

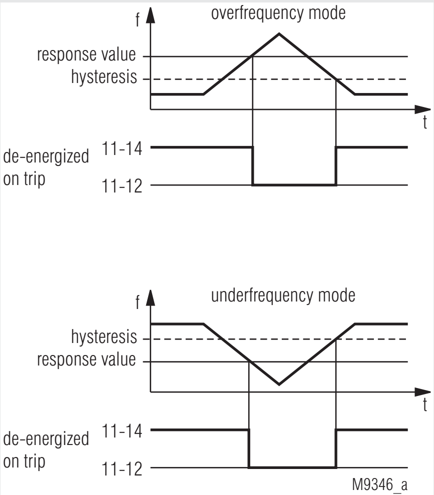
Start:
To achieve an optimum speed depending starting inertia, different starting resistors are switched into the rotor circuit, when certain speed values are reached. Often this procedure is controlled with timers, but with small loads the motor reaches the speed to switch over much faster then with high loads and the motor still runs on the lower stage. When the switching of the resistors is controlled speed depending by frequency relays, the start up cycles can be shortened and the plant can be used more effective.

VARIMETER
Frequency Relay
IL 9837, SL 9837

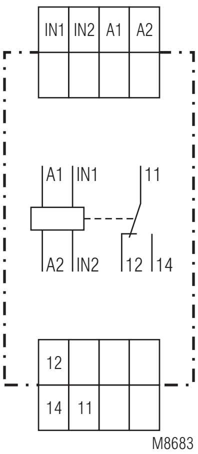
0265347

IL 9837 SL 9837

Function Diagram



Circuit Diagram



IL 9837, SL 9837

- According to IEC/EN 60 255-1
- Overfrequency or underfrequency monitoring of AC voltages
- Adjustable response value $f_{min.}$ or f_{max} 5 ... 200 Hz or 15 ... 600 Hz
- Adjustable hysteresis
- Large voltage range of the measuring input (nominal voltage AC 24 ... 440 V)
- De-energized on trip
- LED indication for auxiliary voltage, measuring voltage and contact position
- 1 changeover contact
- As option for frequency inverters with a range of 1 … 300 Hz
- 2 changeover contacts available on request
- As option adjustable start-up delay available
- Energized on trip function available on request
- Devices available in 2 enclosure versions:
  IL 9837: depth 58 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9837: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- 35 mm width

Approvals and Markings

A025518

* only for IL 9837

Application

- Frequency monitoring of A.C. voltages
- Monitoring of the rotor frequency of slipring motors
- Control / monitoring of drives in crane systems
- Frequency monitoring in frequency inverters (IL 9837.11/500)

Function

The frequency to be monitored is applied to measuring input IN1-IN2. The measuring circuit is electrically separated from the auxiliary voltage input A1-A2, to which the supply voltage of the frequency relay is connected.

The measured frequency is compared to a response value to be set at the unit.

In overfrequency mode, the output relay switches into alarm position when the preset response value is exceeded. When the system frequency once more falls below the response value minus the preset hysteresis, the output relay will switch back into normal position.

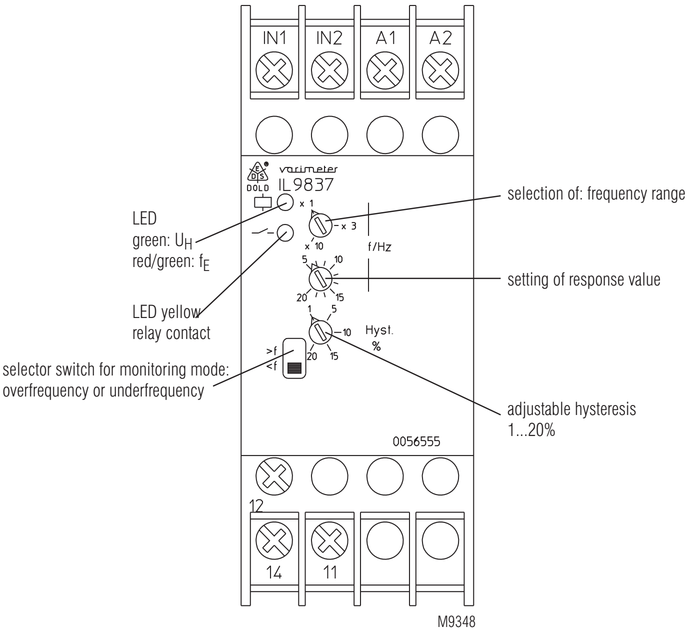
In underfrequency mode, the output relay switches into alarm position when the actual value falls below the preset response value. When the system frequency once more exceeds the response value plus hysteresis, the output relay will switch back into normal position.

If de-energized on trip is selected, the output relay is energized (11-14 closed) in normal status.
If energized on trip is selected, the output relay is energized (11-14 closed) in alarm status.

Indicators

Upper LED:	green light is permanently on, when only the auxiliary voltage has been applied to A1-A2, green-red alternating light, when measuring frequency has also been
applied	to IN1-IN2
Yellow LED:	is on, when the output relay is energized (contacts 11-14 closed)

Setting



Notes

Monitoring mode underfrequency or overfrequency
The mode can be selected by means of the slide switch at the front of the unit. The operating mode de-energized or energized on trip as well as the response value do not change.

Setting of the hysteresis
With input frequencies < 15 Hz (4 Hz with variant IL 9837.11/500), the hysteresis should not be set to minimum values to avoid cycling of the output relay.

In the “underfrequency” monitoring mode (“< f”), with input frequencies close to the end of the respective range, hysteresis can only be set to a maximum of 4 … 10% for proper resetting; this is due to reasons of the switching operation. If applicable, select the next higher frequency range.

Variant IL 9837.11/500 for frequency inverter
This variant can be used with frequency inverter to monitor the frequency of 1 … 300 Hz generated by the frequency inverter. It has a specifically dimensioned measuring input with low pass character to suppress the cycle frequency of the inverter. Simultaneously, the input sensitivity is adjusted to the voltage/frequency characteristic of the inverter.

Technical Data

Measuring Circuit

Measuring input:	IN1-IN2
Nominal voltage U_N:	AC 24 ... 440 V
Voltage range:	0.8 ... 1.1 U_N
Input resistance: approx.	1 MΩ
Frequency range:	5 ... 20 Hz, 15 ... 60 Hz, 50 ... 200 Hz or 15 ... 60 Hz, 45 ... 180 Hz, 150 ... 600 Hz selected with rotary switch
Response value	
infinitely adjustable:	1 : 4 in each frequency range
Hysteresis	
infinitely adjustable:	1 ... 20 % of the set response value

Measuring input:	IL 9837.11/500
Max. input voltage:	AC 500 V
Min. measuring voltage:	approx. AC 10 V with 1 Hz … AC 220 V with 300 Hz, see diagramm M8681
Input resistance:	approx. 700 kΩ
Frequency range:	1 ... 10 Hz, 5 ... 50 Hz, 30 ... 300 Hz selected with rotary switch
Response value	
infinitely adjustable:	1 : 10 in each frequency range
Hysteresis	
infinitely adjustable:	1 ... 20 % of the set response value

Technical Data

Auxiliary Circuit

Nominal voltage U_H:	AC 24, 42, 115, 127, 230, 240, 400 V DC 12, 24, 48 V
Voltage range	
AC:	0.8 ... 1.1 U_H
DC:	0.9 ... 1.25 U_H
Nominal consumption	
AC:	approx. 1.5 VA
DC:	approx. 1 Watt
Frequency range	
AC:	45 ... 400 Hz

Output

Contacts:	1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Contact life:		
to AC 15 at 1 A, AC 230V:	1.5 x 10^5 switch. cycles	IEC/EN 60 947-5-1
Short circuit strenght		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

General Data

Nominal operation:	Continous	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
Rated rated impulse voltage voltage /		
Pollution degree:	4 kV / 2	
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge		
between		
supply lines:	1 kV	IEC/EN 61 000-4-5
HF voltage driven:	10 V	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0 behavior according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	DIN EN 50 005	
Wire connection:	2 x 2.5 mm² massive, or 2 x 1.5 mm² stranded wire ferruled DIN 46 228-1/-2/-3	
Wire fixing:	Screw terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Net weight		
IL 9837:	approx. 137 g	
SL 9837:	approx. 164 g	

Dimensions

Width x height x depth	
IL 9837:	35 x 90 x 59 mm
SL 9837:	35 x 90 x 98 mm

CCC-Data for IL 9837

Thermal current I_{th}: 4 A

Switching capacity

to AC 15:	5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

IL 9837.11 5 ... 200 Hz U_H AC 230 V Hyst. 1 ... 20 %
Article number: 0056555

- De-energized on trip
- Selection of overvoltage or undervoltage
- Selectable frequency range: 5 ... 20 Hz, 15 ... 60 Hz, 50 ... 200 Hz
- Response value:Infinitely adjustable 1:4
- Auxiliary voltage U_H: AC 230 V
- Hysteresis: 1 ... 20 % adjustable
- Output contact: 1 changeover contact
- Width: 35 mm

Varianten

IL 9837.11/500: Input designed for frequency inverters
Selection of overfrequency or underfrequency
Selectable frequency range
1 ... 10 Hz, 5 ... 50 Hz, 30 ... 300 Hz
Response value infinitely adjustable 1:10
Auxiliary voltage U_H AC 230 V
De-energized on trip
Output contact 1 changeover contact

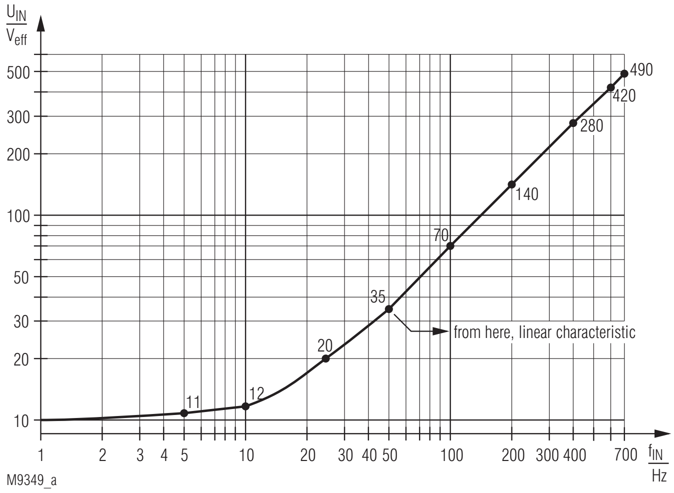
IL 9837.11/_ _4: with adjustable start-up delay
0.1 ... 20 s

Ordering example for variants

IL 9837 .11 /_ _ _ 5 ... 200 Hz U_HAC 230 V 1 ...20 %

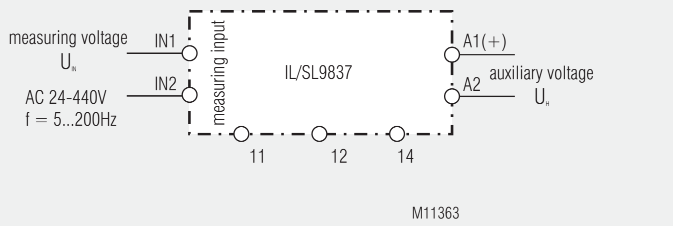
- Hysteresis
- Auxiliary voltage
- Frequency range
- Variant, if required
- Contacts
- Type

Characteristic



Typical input sensitivity of the measuring input with variant IL 9837.11/500

Connection Example

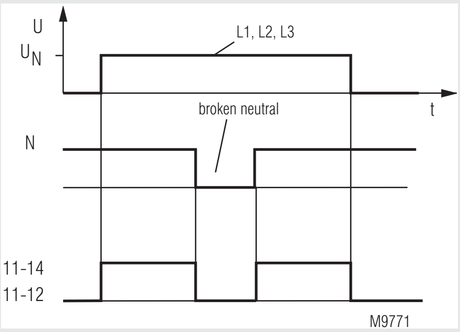


VARIMETER
Neutral Monitor
IL 9069, SL 9069

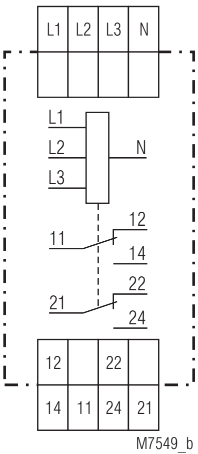
0255165

- According to IEC/EN 60 255-1
- Detection of
  - missing neutral in the system
  - broken neutral on IL/SL 9069
  - neutral exchanged against phase
- Detection of phase failure also with disconnected load
- For 3-phase systems
- De-energized on trip
- LED indicator for operation/state of output contacts
- Single phase connection possible
- Without auxiliary voltage
- 2 cangeover contacts
- Optionally with adjustable asymmetry detection and on delay
- Devices available in 2 enclosure version:
  IL 9069: depth 59 mm with terminals at the bottom for installations systems and industrial distribution systems according to DIN 43 880
  SL 9069: depth 98 mm with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

Function Diagram

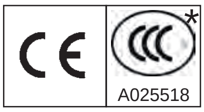


Circuit Diagram



IL 9069.12, SL 9069.12

Approval and Markings



* only for IL 9069

Application

Neutral monitoring in 3-phase systems
In 3-phase systems with neutral often also single phase loads are connected between phase and neutral. If the neutral is missing in a system like this, unsymmetric voltages occur, that could damage single phase consumers, if the voltage rises to high. Also consumers can stop to work if the phase-neutral voltage gets too low. The IL 9069 detects this problem and can switch off the system immediately.

To monitor mobile systems that are connected via plug connectors. On mobile systems that are connected by a very long cable, voltage drop can cause a significant asymmetry also during normal operation. For this case we recommend the variant IL/SL 9069.12/500 with an adjustable asymmetry setting (approx. 5 ...15%) and an additional response delay.

Function

All 3 phase voltages are measured between phase input L1, L2, L3 and the neutral N. If all 3 phases and the neutral are connected correctly and the asymmetry in good state, the green LED is on and the output relay is energized. If the neutral or one phase is missing or the neutral is exchanged with a phase or the asymmetry exceeds the setting value, the output relay de-energises immediately or after the adjusted time delay (with IL/SL 9069.12/500) and the green LED goes off. The time delay on IL/SL 9069.12/500 is only active when the voltage on terminals L3-N is at least 0,7 U_N as the unit is supplied from these terminals.

Indication

LED green:	on when output relay activated (contact 11-14 and 21-24 are closed)

Technical Data

Input

Nominal voltage U_N:	3/N AC 400 / 230 V	
Max. overload:	AC 440 V on all measuring inputs	
Voltage range:	0.7 ... 1.1 U_N	
Permissible asymmetry of the phase		
IL/SL 9069.12:	max. 5 %	
IL/SL 9069.12/500:	adjustable approx. 5 ... 15 %	
Nominal consumption	approx. 6 VA (L3-N)	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Input current at U_N:	L1-N, L2-N: approx. 1.5 mA	
	L3-N: approx. 25 mA	
On delay		
IL/SL 9069.12:	approx. 100 ms	
IL/SL 9069.12/500:	approx. 0.1 ... 20 s, adjustable	

Output

Contact		
IL 9069.12, SL 9069.12:	2 changeover contacts	
Thermal current I_{th}:	4 A	
Switching capacity		
according to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
according to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	≥ 5 x 10^5 switch. cycl.	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switch. cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	-20 ... + 60°C	
Clearance and creepage distances		
rated rated impulse voltage voltage /		
pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9069:	110 g	
SL 9069:	137 g	

Dimensions

Width x height x depth	
IL 9069:	35 x 90 x 59 mm
SL 9069:	35 x 90 x 98 mm

Standard Type

IL 9069.12, 3/N AC 400 / 230 V, 50 / 60 Hz

Article number:	0048730
• Output:	2 changeover contacts
• Nominal voltage U_N:	3/N AC 400 / 230 V
• Width:	35 mm

SL 9069.12, 3/N AC 400 / 230 V, 50 / 60 Hz

Article number:	0054750
• Output:	2 changeover contacts
• Nominal voltage U_N:	3/N AC 400 / 230 V
• Width:	35 mm

Variant

IL/SL 9069.12/500:	with adjustable asymmetry detection and adjustable on delay

Order example for variant

IL 9069 .12 /_ _ _ 3/N AC 400 / 230 V 50 / 60 Hz

Nominal frequency
Nominal voltage
Variant, if required
Contacts
Type

VARIMETER
Fuse Monitor
RL 9075, RN 9075

DOLD

Product Description

The fuse monitors RL 9075 and RN 9075 of the varimeter series monitor up to 3 fuses. The measurement is very simple and without extensive wiring, as no separate auxiliary supply is necessary. The fast detection of a defective fuse protects against expensive damages and the user has the benefit of high operational performance and availability of the plant.

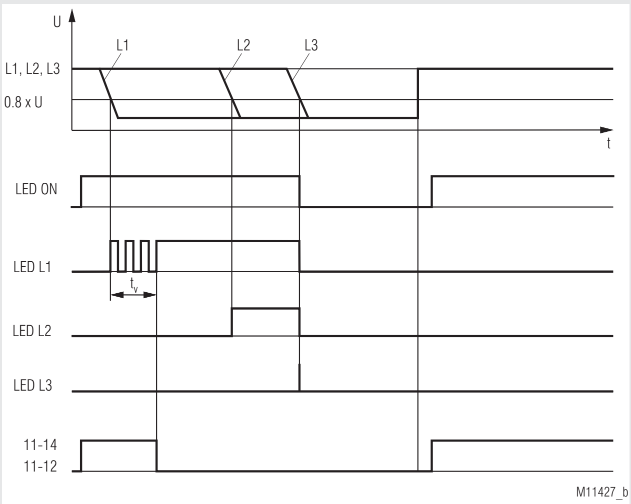
Your Advantages

- Increasing the availability of plants by early detection of blown fuses, that may cause damage if undetected
- Fast detection of blown fuses also with disconnected load availability of your plant on request
- Reliable detection of blown fuses inspite of:
  - asymmetric mains
  - harmonic content

Features

- According to IEC/EN 60 255-1
- To monitor fuses in single and 3-phase AC voltage systems with neutral
- Adjustable operating voltages: 400 V / 230 V and 230 V / 130 V and 110 V / 64V
- Undervoltage detection below 0.8 x U_B
- Fast detection of a blown fuse
- No separate auxiliary necessary
- Output: 1 changeover contact
- De-energized on trip
- Adjustable switching delay
- Width:
  - RL 9075: 35 mm
  - RN 9075: 52.5 mm

Function Diagram



3-phase connetion to monitor 3 fuses

Approvals and Markings

*)
Canada / USA

*) in preparation

Application

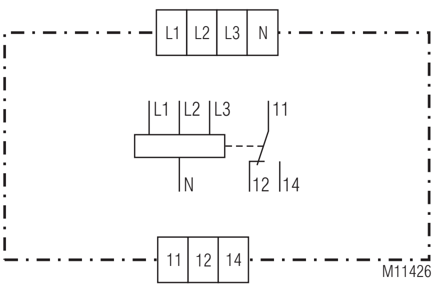
Monitors the state of 1-3 fuses in single- or 3-phase voltage systems with neutral, e.g. for automatic disconnection and lockout in the case of a fuse failure.

Indication

green LED „ON“: on, when supply connected

red LED „L1, L2, L3“: shows that the voltage is dropped under 0.8 x U_B after the fuse which indicates a blown fuse

Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
L1	Phase voltage L1
L2	Phase voltage L2
L3	Phase voltage L3
N	Neutral
11, 12, 14	Changeover contacts (outputrelays)

Function

When monitoring fuses in a 3-phase system all the phases are measured against N. The recognition of a blown fuse is done by monitoring the voltage at the fuse input terminals L1, L2 and L3. A voltage drop on one of these input terminals below 0.8 x U_B is an indication for a blown fuse. In case an undervoltage condition on any of the three terminals has been recognized the LED of the corresponding terminal starts blinking red. After the switching delay time has expired, the LED switches on red continuously. At the same time the relay, which works in open circuit alarm mode, switches its state. After the terminal voltage exceeds the switching level again e.g. by replacing the blown fuse, the corresponding LED immediately turns off and at the same time the relay switches back into idle mode.

When monitoring fuses in a 1-phase system, up to 3 fuses can be connected to the same phase and being monitored.

If less than 3 fuses are monitored at 3- or single-phase monitoring, the unused terminals LX have to be bridged (see connection examples).

Via rotary switch the both operating ranges 400 V / 230 V or 230 V / 130 V at RN 9075 can be selected. At RL 9075 the operating voltage is fixed.

Notes

During initialisation the fuse monitor recognises the mains frequency (50 Hz or 60 Hz).

For reliable detection of fuse failure with large inductive loads we recommend to have symmetric loads.
When using the fuse monitor with motor loads it could happen, due to feedback voltage, that the failed fuse is only detected after the motor is switched off.

Adjustable operating voltages via rotary swich:

Device	Function Lx/N	Voltages 0.8 x Lx/N
RN 9075	230 V	184 V
	130 V	104 V
RL 9075	-	51 V

Technical Data

Input

Operating voltage U_B:
RL 9075: 3/N AC 77 ... 121 V / 44 ... 70 V
1- or 3-phase without / with neutral
RN 9075: 3/N AC 138 ... 440 V / 78 ... 253 V
1- or 3-phase without / with neutral
Voltage rated operating U_e:
RL 9075: 3/N AC 90 ... 110 V / 52 ... 64 V
RN 9075: 3/N AC 162 ... 400 V / 92 ... 230 V
Voltage range:
RL 9075: 0.7 ... 1.1 U_B
RN 9075: 0.6 ... 1.1 U_B
Nominal frequency: 50 / 60 Hz
Frequency range: 45 … 65 Hz
Nominal consumption: approx. 7 VA

Output

Contacts: 1 changeover contact
Contact material: AgNi
Switching voltage: AC 250 V
Thermal current I_{th}: 5 A
Switching capacity
to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V: typ. x 10^5 switching cyles
short circuit strength IEC/EN 60 947-5-1
max. fuse rating: 5 A gL
Mechanical life: > 30 x 10^6 switching cyles

Technical Data

Measuring circuit

Monitoring voltage
RL 9075: Lx/N = 51 V (0.8 x 64 V)
RN 9075: Lx/N = 184 V (0.8 x 230 V) +
Lx/N = 104 V (0.8 x 130 V)
Monitoring range:
RL 9075: 0.7 … 1.1 U_B
RN 9075: 0.6 … 1.1 U_B
Nomber of monitored fuse: 1 .. 3
Switching delay t_v: infinite adjustable
instantaneuos, 2 … 30 s
Repeat accuracy: ± 2 %
Temperature influence: ± 1 %

General Data

Operating mode: continuous operation
Temperature range
Operation: - 20 ... + 55 °C
Storage: - 25 ... + 60 °C
Relative air humidity: 93 % at 40 °C
Altitude: < 2,000 m
Clearance and creepage distances
Rated impuls voltage/
Pollution degree: 6 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF irradiation
80 MHz ... 1 GHz: 12 V / m IEC/EN 61 000-4-3
1 GHz ... 2,7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge
between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
HF wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection:
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Enclosure: Thermoplastic with V0 behaviour
acc. to UL subject 94
Vibration resistance: Amplitude 0,35 mm
Class I IEC/EN 60 255-21
Climate resistance: 20 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: DIN 46 228-1/-2/-3/-4
Fixed screw terminals
Cross section: 0.2 ... 4 mm² (AWG 24 - 12) solid or
0.2 ... 2.5 mm² (AWG 24 - 12)
stranded wire with and without ferrules
Stripping length: 7 mm
Fixing torque: 0.6 Nm EN 60 999-1
Wire fixing: Captive slotted screw / M2.5
Fixed
High-voltage terminals
Cross section: 0.2 ... 6 mm² (AWG 24 - 10) massiv oder
0.2 ... 4 mm² (AWG 24 - 10)
stranded wire without ferrules
0.25 ... 4 mm² (AWG 24 - 10)
stranded wire with ferrules
Stripping length: 8 mm
Fixing torque: 0.7 Nm EN 60 999-1
Wire fixing: Captive slotted screw / M3
Mounting: DIN rail IEC/EN 60 715
Weight:
RL 9075: approx. 105 g
RN 9075: approx. 125 g

Dimensions

Width x height x depth:
RL 9075: 35 x 90 x 71 mm
RN 9075: 52.5 x 90 x 71 mm

UL-Data

ANSI/UL 60947-1, 5th Edition
ANSI/UL 60947-5-1, 3rd Edition

CAN/CSA-C22.2 No. 60947-1-13, 2nd Edition
CAN/CSA-C22.2 No. 60947-5-1-14, 1st Edition

Switching capacity:	Pilot duty B300 5A 240Vac Resistive, G.P. 5A 30Vdc Resistive or G.P. 5A 250Vac G.P.
Wire connection:	60°C / 75°C copper conductors only
RL 9075:	AWG 24 - 12 Sol/Str Torque 0.6 Nm
RN 9075	
for terminals 11, 12, 14:	AWG 24 - 12 Sol/Str Torque 0.6 Nm
for terminals L1, L2, L3, N:	AWG 30 - 10 Sol/Str Torque 0.7 Nm

Technical data that is not stated in the UL-Data, can be found in the technical data section

Standard Types

RL 9075.11 3/N AC 110 V / 64 V 0 ... 30 s

Article number:	0066880
• Output:	1 changeover contact
• Operating voltage:	3/N AC 110 V / 64 V
• Switching delay:	0 ... 30 s
• Width:	35 mm

RN 9075.11 3/N AC 230 V / 130 V + 3/N AC 400 V / 230 V 0 ... 30 s

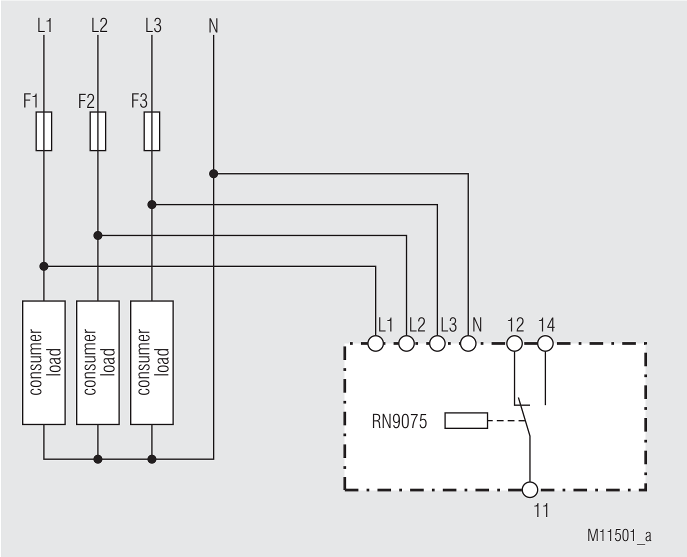
Article number:	0066928
• Output:	1 changeover contact
• Operating voltage:	3/N AC 230 V / 130 V + 3/N AC 400 V / 230 V
• Switching delay:	0 ... 30 s
• Width:	52,5 mm

Ordering Examples

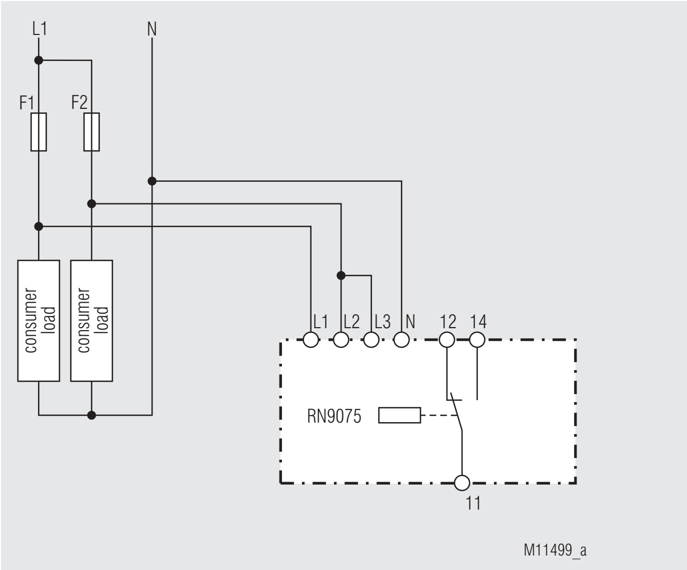
R_ 9075 .11 /00_ 3/N AC 110 V / 64 V 0 ... 30 s

- Switching delay
- Operating voltage
  - RL 9075:
  - 3/N AC 110 V / 64 V
  - RN 9075:
  - 3/N AC 400 V / 230 V +
  - 3/N AC 230 V / 130 V
- Operation mode/Outputs
  - 0: De-Energized on trip
  - 1: Energized on trip
- Contacts
- Type
  - L: 35 mm Width
  - N: 52.5 mm Width

Connection Examples



3-phase connection to monitor 3 fuses



1-phase connection to monitor 2 fuses

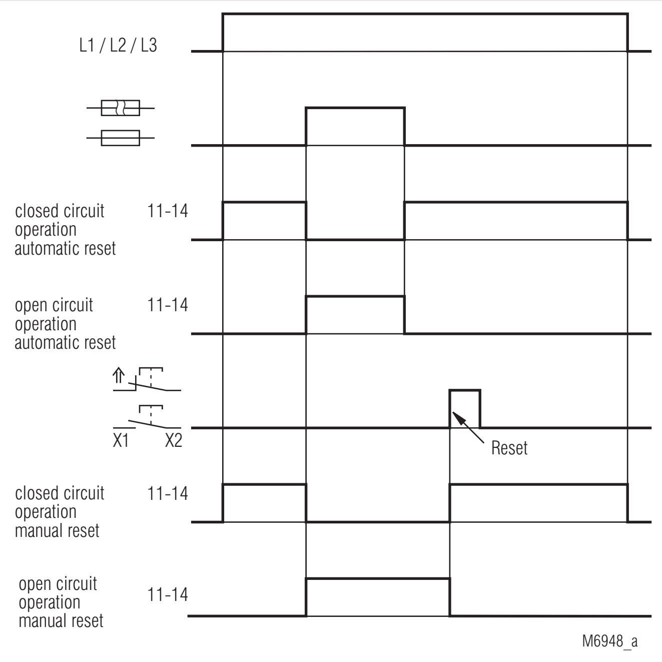
VARIMETER
Fuse Monitor
IL 9075, IP 9075, SL 9075, SP 9075

DOLD

0221571

- According to IEC/EN 60 255-1
- Recognizes fuse failures in three-phase mains up to 3 AC 690 V
- Can be used for all types and sizes of fuses
- Independent of phase sequence
- Signals even if loads are switched off
- No malfunction on
  - asymmetrical mains
  - mains with harmonic waves
  - motors producing feedback
- Shorter response time than with motor circuit-breakers
- Green LED for intact fuses
- Red LED for fuse failure
- As option: energized / de-energized on trip in the case of IP 9075 programmable via X4-X5 or X3-X4
- As option: with manual reset function and remote reset, programmable via X1-X2
- As option: 1 NO contact or 2 changeover contacts
- Devices available in 2 enclosure versions:
  I-model: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  S-model: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- IL 9075, SL 9075: width 35 mm
  IP 9075, SP 9075: width 70 mm

Function Diagram



Approvals and Markings

A025518

1) only IL 9075

Applications

Fuse monitoring in the three-phase mains, e.g. for automatic switching-off and switch-on blockage of three-phase motors in the event of one or more phase fuses failing.

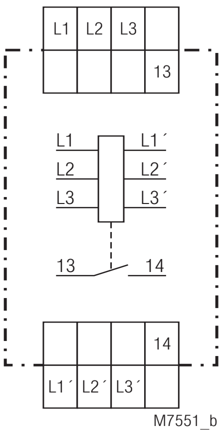
Indicators

green LED:	for healthy fuse
red LED:	for blown fuse

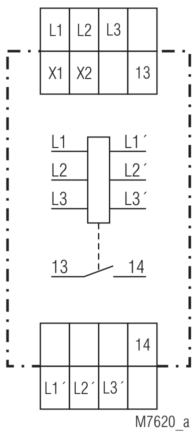
Notes

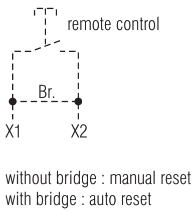
The internal resistance of the fuse monitor's measuring path is in the MOhm range, meaning that the regulations as regards touch voltage are fulfilled if a fuse is not present or if it is faulty (IEC 974-1, internal resistance > 2000 Ohm/V).

Circuit Diagrams

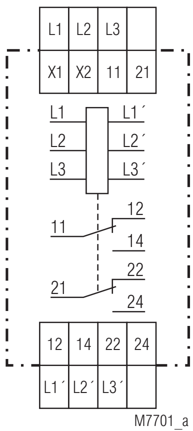


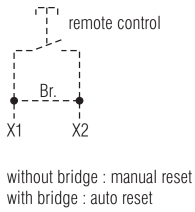
IL 9075.01,
SL 9075.01



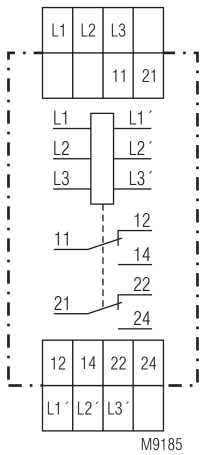


IL 9075.01/01_,
SL 9075.01/01_



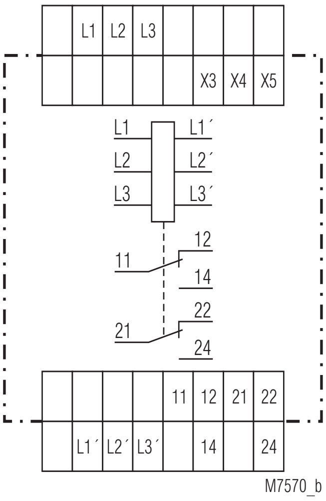


IL 9075.12/01_,
SL 9075.12/01_

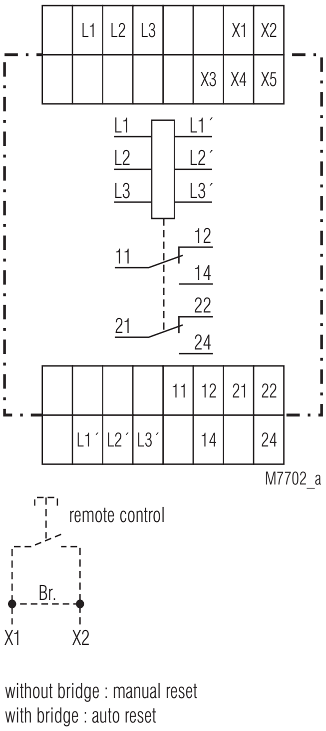


IL 9075.12/001,
SL 9075.12/001

Circuit Diagrams



IP 9075.12, SP 9075.12



IP 9075.12/010, SP 9075.12/010

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Voltage before the fuses
L1´, L2´, L3´	Voltage after the fuses
X1, X2	Programming manual reset / reset
X3, X4, X5	Programming input energized / de-energized on trip
_ _ 9075.01: 11, 13	NO contact Rel. 1
_ _ 9075.12: 11, 12, 14	C/O contact Rel. 1
_ _ 9075.12: 21, 22, 24	C/O contact Rel. 2

Technical Data

Input

Nominal voltage U_N:		
IL/SL 9075.01/_ _ _:	3 AC 110 ... 127 V	
	3 AC 220 ... 240 V	
	3 AC 380 ... 415 V	
	3 AC 400 ... 440 V	
IL/SL 9075.12/_ _ _:	3 AC 110 V	
	3 AC 230 V	
	3 AC 400 V	
IP 9075, SP 9075:	3 AC 480 ... 550 V, 600 ... 690 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption:		
IL 9075, SL 9075:	2.0 VA (on L2 / L3)	
IP 9075, SP 9075:	3.0 VA (on L1 / L2)	
Nominal frequency:	50 ... 400 Hz	
Internal resistance of the measuring paths:	> 2000 Ω/V	
Permissible feedback:	max. 90 %	

Output

Contacts		
IL/SL 9075.01/ _ _ _ :	1 NO contact	
IL/SL 9075.12/ _ _ _ :	2 changeover contacts	
IP/SP 9075.12/ _ _ _ :	2 changeover contacts	
Response/release time:		
de-energized on trip		
IL/SL 9075. _ _/001:	< 50 ms	
IL/SL 9075. _ _/011:	< 50 ms	
IP/SP 9075:	< 50 ms	
energized on trip		
IL/SL 9075. _ _ :	< 500 ms	
IL/SL 9075. _ _ /010:	< 500 ms	
IP/SP 9075:	< 500 ms	
Output nominal voltage:	max. AC 250 V	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
IL/SL 9075:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
IP/SP 9075:		
Schließer:	3 A / AC 230 V	IEC/EN 60 947-5-1
Öffner:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V		
IL/SL 9075:	1.5 x 10^5 switching cycles	
IP/SP 9075:	2.5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 10^8 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 70 °C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated rated impulse voltage voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	3 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Min. cross section:	0,6 mm	
Insulation of wires or sleeve length:	10 mm	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail (also available for screw mounting)	IEC/EN 60 715

Weight:

IL 9075:	130 g
SL 9075:	157 g
IP 9075:	255 g
SP 9075:	304 g

Dimensions

Width x height x depth

IL 9075:	35 x 90 x 59 mm
SL 9075:	35 x 90 x 98 mm
IP 9075:	70 x 90 x 59 mm
SP 9075:	70 x 90 x 98 mm

Standard Types

IL 9075.01/001 AC 380 ... 415 V 50 ... 400 Hz
Article number: 0041517
SL 9075.01/001 AC 380 ... 415 V 50 ... 400 Hz
Article number: 0054755

- De-energized on trip
- Automatic reset
- 1 NO contact
- Nominal voltage U_N: AC 380 ... 415 V
- Width: 35 mm

Variants

For rated voltages up to 3 AC 400 resp. 440 V:

IL 9075. _ _	:	energized on trip, automatic reset
IL 9075. _ _ /001	:	de-energized on trip, automatic reset
IL 9075. _ _ /010	:	energized on trip, manual reset
IL 9075. _ _ /011	:	de-energized on trip, manual reset

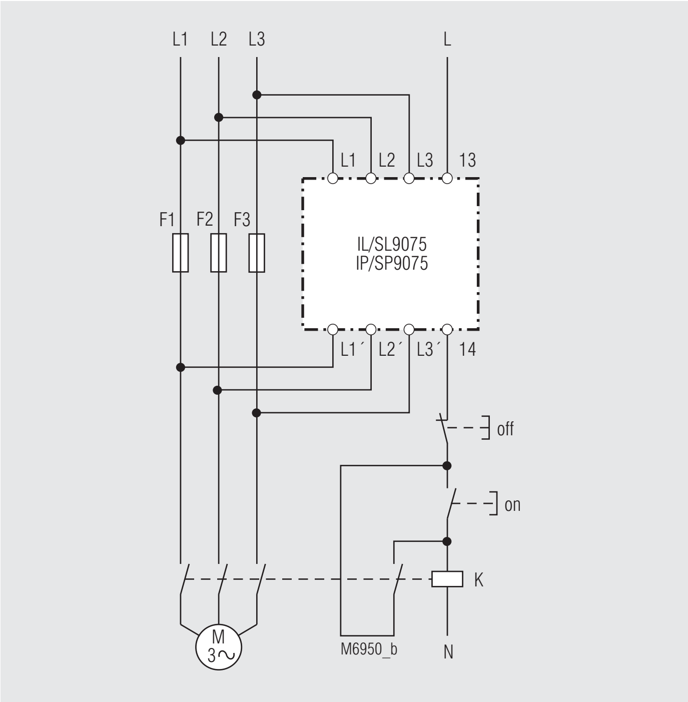
For rated voltages up to 3 AC 690 V,
open/de-energized on trip, settable:

IP 9075.12	:	automatic reset
IP 9075.12/010	:	manual reset or automatic reset settable

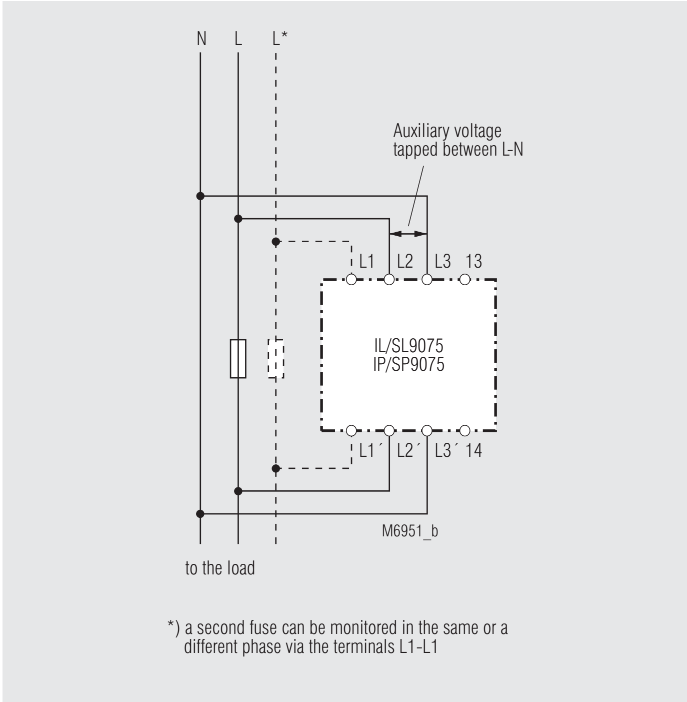
Ordering example for variants

IL 9075 .01 /_ _ _ AC 380 ... 415 V 50 ... 400 Hz

Nominal frequency
Nominal voltage
Variant, if required
Contact
Type



Fuse monitoring in the 2-phase mains, e.g. for motor protection with IL 9075/001 or with IP 9075, de-energized on trip, jumper X3-X4



Fuse monitoring in the alternating current mains

VARIMETER
Fuse monitor
UG 9075

Your advantages
- increasing the availability of plants by early detection of blown fuses, that may cause damage if undetected
- fast detection of blown fuses also with disconnected load availability of your plant on request
- reliable detection of blown fuses inspite of:
  - asymmetric mains
  - harmonic content

Features
- According to IEC/EN 60 255-1
- To monitor fuses in single and 3-phase AC voltage systems
- Undervoltage detection below 0.7 x U_N
- No separate auxiliary necessary
- 2 changeover contacts
- 2 nominal voltages adjustable:
  3/N AC 240 V / 140 V or 3/N AC400 V / 230 V or
  fixed nominal voltage: 3/N AC 110 V / 64 V
- Adjustable operate delay
- Energized on trip
- Automatic adjustment to 50 Hz and 60 Hz mains frequency
- Width 22.5 mm

Approvals and Markings

Application
Monitors the state of 1-3 fuses in single- or 3-phase voltage systems. e.g. for automatic disconnection and lockout of a 3 phase motor in the case of a fuse failure.

Function
During initialisation the fuse monitor recognises the mains frequency (50 Hz or 60 Hz). When monitoring fuses in a 3-phase system all the phases are measured against N. The recognition of a blown fuse is done by monitoring the voltage at the fuse input terminals F1, F2 and F3. A voltage drop on one of these input terminals below 0.7 x U_N is an indication for a blown fuse. In case an undervoltage condition on any of the three terminals has been recognized the LED of the corresponding terminal starts blinking red. After the adjusted response time has expired, the LED switches on red continuously. At the same time the relay, which works in open circuit alarm mode, switches its state. After the terminal voltage exceeds the switching level again e.g. by replacing the blown fuse, the corresponding LED immediately turns off and at the same time the relay switches back into idle mode.

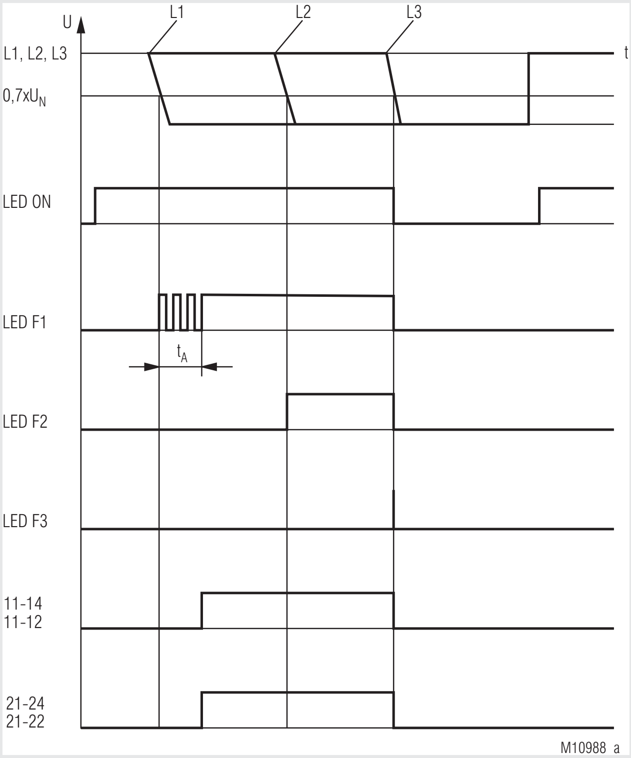
When monitoring fuses in a 1-phase system, up to 3 fuses can be connected to the same phase and being monitored.

At Variant for 3/N AC 240 V / 140 V and 3/N AC 400 V / 230 V are both voltage ranges via potentiometer settable.

Notes
For reliable detection of fuse failure with large inductive loads we recommend to have symmetric loads.

When using the fuse monitor with motor loads it could happen, due to feedback voltage, that the failed fuse is only detected after the motor is switched off.

Function Diagram

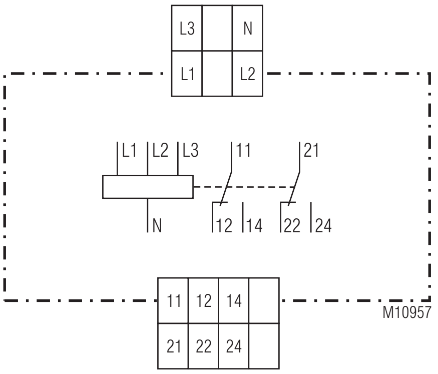


3-phase connetion to monitor 3 fuses

LED F1	LED F2	LED F3	Relay output
1	1	1	off
0	1	1	on
1	0	1	on
1	1	0	on
0	0	1	on
0	1	0	on
1	0	0	on
0	0	0	off
Logic table for 3 fuses 1: fuse OK, 0: fuse blown			

LED F1	LED F2	LED F3	Relay output
1	1	1	off
0	1	1	on
1	0	0	on
0	0	0	off
Logic table for monitoring of 2 fuses in a single-phase a.c. system 1: fuse OK, 0: fuse blown			

Circuit Diagrams



Connection Terminals

Terminal designation	Signal designation
L1, L2, L3, N	Connection for fuses
11, 12, 14, 21, 22, 24	Blown fuse-indicatior relay (2 changeover contacts)

Indicators

green LED "ON" — on when supply connected

red LED "F1, F2, F3" — shows that the voltage is dropped under 0.7 U_N after the fuse which indicates a blown fuse

Technical Data

Input

Nominal voltage U_N: 3/N AC 240 V / 140 V
3/N AC 400 V / 230 V
3/N AC 110 V / 64 V
Voltage range: 0.7 … 1.1 U_N
Nominal frequency: 50 / 60 Hz
Nominal consumption: approx. 2 W

Measuring circuit

Monitoring voltage U_N: 3/N AC 240 V / 140 V
3/N AC 400 V / 230 V
3/N AC 110 V / 64 V
Monitoring range: 0.7 … 1.1 U_N
Response value: 0.7 x U_N
Hysteresis: 10 %
Nomber of monitored fuse: 1 ... 3
On delay: infinite adjustable
instantaneuos (< 200 ms), 2 … 25 s
Release delay: instantaneuos
Accuracy: ± 3 %
Repeat accuracy: ± 1 %

Output

Contacts: 2 changeover contacts
Switching capacity
to AC 15
NO contact: 3 A / AC 120 V IEC/EN 60 947-5-1
NC contact: 1.5 A / AC 240 V IEC/EN 60 947-5-1
to DC 13
NO contact: 0.22 A / DC 120 V IEC/EN 60 947-5-1
NC contact: 0.1 A / DC 250 V IEC/EN 60 947-5-1
Electrical life
to AC 1 at 8 A, AC 250 V: > 10^5 switching cyles IEC/EN 60 947-5-1
Shortcircuit protection
max. fuse: 3 A gL IEC/EN 60 947-5-1
Mechanical life: > 3 x 10^7 switching cyles

Technical Data

General Data

Operating mode: continuous operation
Temperature range
Operation: 0 ... + 55 °C
Storage: - 25 ... + 60 °C
Relative air humidity: 93 % at 40 °C
Altitude: < 2.000 m
Rated impulse voltage/
Pollution degree: 4 kV/ 2 IEC 60 664-1
EMC
Electrostatic discharge (ESD): 8 kV (Luftentladung) IEC/EN 61 000-4-2
HF irradiation
80 MHz ... 2,7 GHz: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire bound: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Protection degree:
Enclosure: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Enclosure: Thermoplastic with V0 behaviour acc. to UL Subj. 94
Vibration resistance: Amplitude 0.35 mm,
Frequency 10 .. 55 Hz IEC/EN 60 068-2-6
Climate resistance: 0 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: DIN 46 228-1/-2/-3/-4
Plugin with
screw terminals (PS)
max. cross section
for connection: 1 x 0,25 ... 2,5 mm² solid or
stranded ferruled (isolated) or
2 x 0,25 ... 1,0 mm² solid or
stranded ferruled (isolated)
Insulation of wires
or sleeve length: 7 mm
Wire fixing: captive slotted screw
Fixing torque: 0,5 ... 0,6 Nm
Mounting: DIN rail
Weight: approx. 190 g

Dimensions

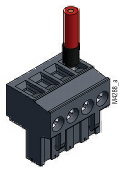
Width x height x depth: 22.5 x 109 x 120.3 mm

Standard Types

UG 9075.12 PS   3/N AC 240 / 140 V + 3/N AC 400 / 230 V
Article number: 0065531
- 2 nominal voltages adjustable:
  3/N AC 240 / 140 V + 3/N AC 400 / 230 V
- Output: 2 changeover contacts
- Width: 22,5 mm

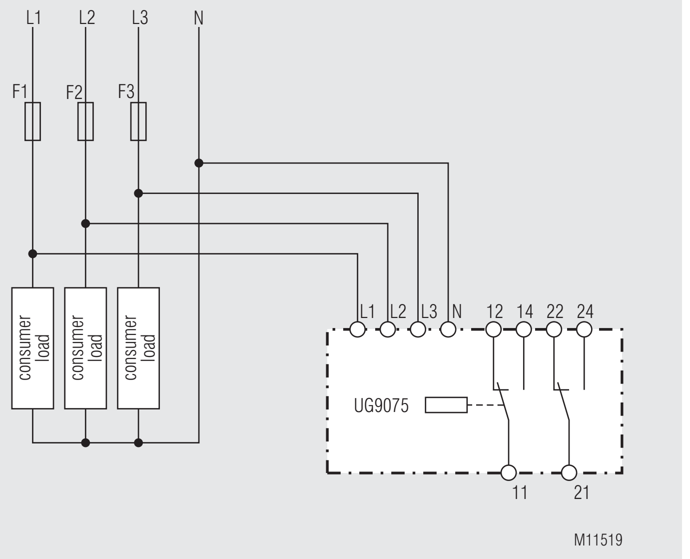
UG 9075.12PS   3/N AC 110 / 64 V
Article number: 0065532
- fixed nominal voltage: 3/N AC 110 / 64 V
- Output: 2 changeover contacts
- Width: 22,5 mm

Options with Pluggable Terminal Blocks

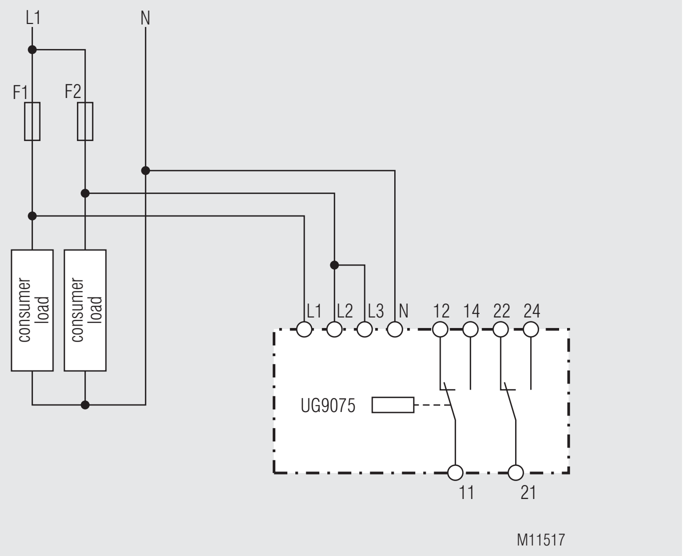


Screw terminal
(PS/plugin screw)

Application Examples



3-phase connection to monitor 3 fuses



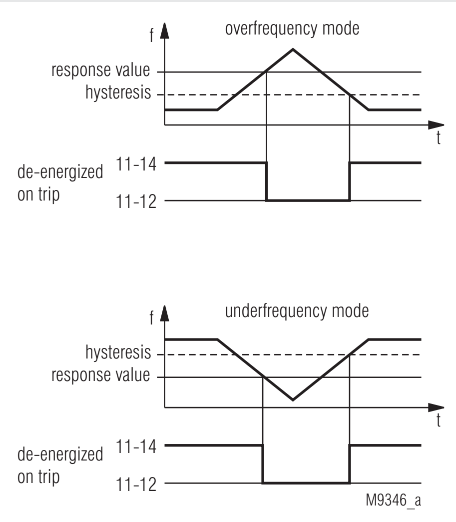
1-phase connection to monitor 2 fuses

VARIMETER
Frequency Relay
IK 9143, SK 9143

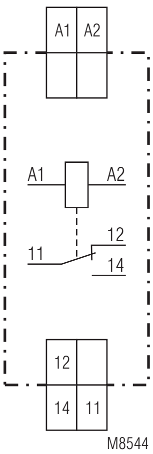
IK 9143 SK 9143

- According to IEC/EN 60 255, DIN VDE 0435-303
- Monitoring of overfrequency and underfrequency (selectable) in A.C. power systems
- Without auxiliary voltage
- Selection of frequency range for 50 or 60 Hz systems
- Adjustable response value
- Adjustable hysteresis
- De-energized on trip (output relay not activated in case of error)
- LED indicators for measuring voltage and contact position
- 1 changeover contact
- As option energized on trip (output relay activated in case of error)
- **Devices available in 2 enclosure versions:**
  IK 9143: depth 58 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9143: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- 17.5 mm width

Function Diagram



Circuit Diagram



IK 9143, SK 9143

Approvals and Markings

CE

Application

Frequency monitoring function in in-plant generation units and local power supply systems

Function

The system to be monitored is connected to the terminals A1-A2. Its internal supply voltage is also taken from these terminals. The input frequency is compared to response value to be set at the unit.

In overfrequency mode, the output relay switches into alarm position when the preset response value is exceeded. When the system frequency once more falls below the response value minus the preset hysteresis, the output relay will switch back into normal position.

In underfrequency mode, the output relay switches into alarm position when the actual value falls below the preset response value. When the system frequency once more exceeds the response value plus hysteresis, the output relay will switch back into normal position.

If de-energized on trip is selected, the output relay is energized (11-14 closed) in normal status.
If energized on trip is selected, the output relay is energized (11-14 closed) in alarm status.

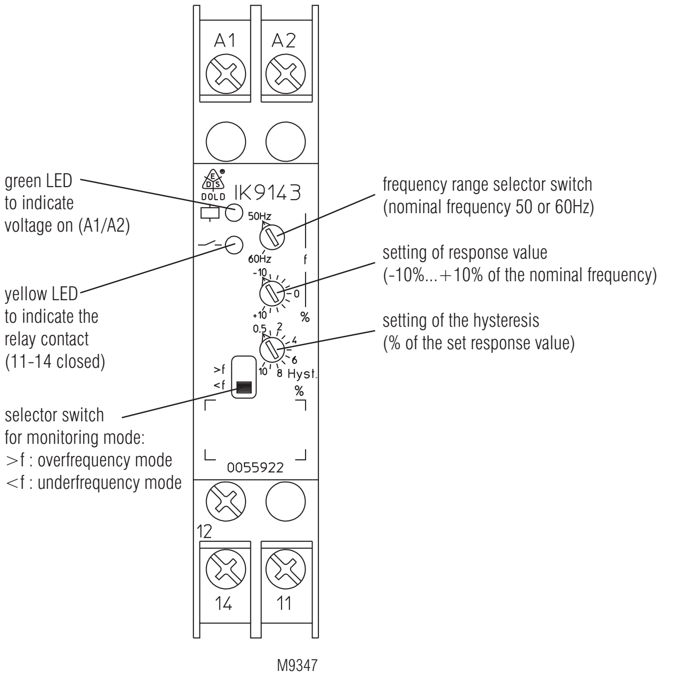
Indicators

Green LED:	On, when measuring voltage is connected to A1 - A2
Yellow LEDs:	On, when the output relay is energized (contacts 11-14 closed)

Notes

Monitoring mode underfrequency or overfrequency
The mode can be selected by means of the slide switch at the front of the unit. The operating mode de-energized or energized on trip as well as the response value do not change.

Setting



Technical Data

Input

Nominal voltage U_N:AC 110, 230, 400 V
Voltage range:0.8 ... 1.1 U_N
Nominal consumption:
AC 110 Vapprox. 3 VA
AC 230 V:approx. 5 VA
AC 400 V:approx. 8 VA
Frequency range:50/60 Hz, selectable with rotary switch**Response value**
infinitely adjustable:- 10 ... + 10% of the selected frequency range
Hysteresis
infinitely adjustable:0.5 ... 10% of the set response value

Output

Contacts:1 changeover contact
Thermal current I_{th}:4 A
Switching capacity
to AC 15
NO contact:3 A / AC 230 VIEC/EN 60 947-5-1
NC contact:1 A / AC 230 VIEC/EN 60 947-5-1
to DC 13
NO contact:1 A / DC 24 V IEC/EN 60 947-5-1
NC contact:1 A / DC 24 V IEC/EN 60 947-5-1
Contact life:
to AC 15 with 1 A, AC 230V: > 1.5 x 10^5 operating cycles
IEC/EN 60 947-5-1
Short circuit strenght
max. fuse rating:4 A gLIEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 operating cycles

General Data

Nominal operation:	Continous	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
Rated impulse voltage / Pollution degree:	4 kV / 2	IEC 60 664-1

Technical Data

EMC		
Electrostatic discharge (ESD):	8 kV (air discharge)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge between supply lines:	1 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplast with V0 behavior according to UL Subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² massive, or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3	
Wire fixing:	Screw terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Net weight		
IK 9143:	approx. 65 g	
SK 9143:	approx. 83 g	

Dimensions

Width x height x depth

IK 9143:	17.5 x 90 x 58 mm
SK 9143:	17.5 x 90 x 98 mm

Standard Type

IK 9143.11   50 / 60 Hz   ± 10 %   AC 230 V   Hyst. 0.5 ...10 %
Article number: 0055922

- De-energized on trip
- Selection of overvoltage or undervoltage
- Selectable frequency range: 50 or 60 Hz
- Response value: ± 10 % adjustable
- Nominal voltage U_N: AC 230 V
- Hysteresis: 0.5 ... ± 10 % adjustable
- Width: 17.5 mm

Variants:

IK 9143.11/001,
SK 9143.11/001: energized on trip

Ordering example for variants

IK 9143 .11 /_ _ _ 50 / 60 Hz ± 10 % AC 230 V 0.5 ...10 %

Hysteresis
Nominal voltage
Response value
Frequency range
Variant, if required
Contacts
Type

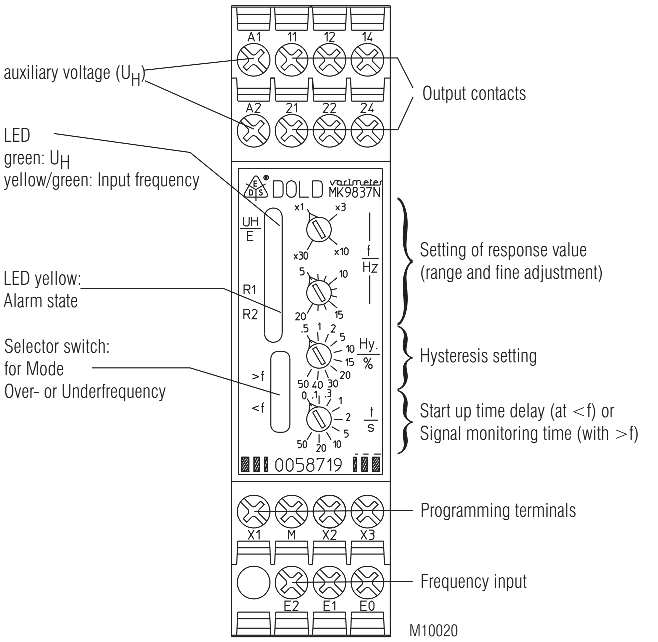
VARIMETER
Frequency Relay
MK 9837N, MH 9837

DOLD

0260272

MK 9837N MH 9837

Setting



Your Advantages
- Universal usage
- Easy handling

Features
- According to IEC/EN 60 255-1
- Detection of over- or underfrequency of alternating voltage (adjustable function)
- Fast reaction time by measuring duration of cycle of input frequency
- Universal measuring input for AC-voltages of 15 ... 280 V as well as 30 ... 550 V
- As option with measuring input for inverters
- 4 ranges adjustable response value 1,5 ... 200 Hz or 5 ... 600 Hz
- Adjustable hysteresis
- Adjustable start up time delay 0 ... 50 s at function underfrequency
- Adjustable monitoring time for missing input signal at function overfrequency
- Response delay programmable via terminals 0 ... 100 s
- Alarm storing or auto-reset programmable via terminals
- Galvanic separation between measuring input, auxiliary voltage and output contacts
- MH 9837 available with wide input range for auxiliary supply (AC/DC 24 ... 60 V or AC/DC 110 ... 230 V)
- 2 changeover contacts, closed circuit operation
- Open circuit operation on request
- LED indication for auxiliary voltage, measuring voltage and alarm status
- MH 9837.12/008: with galvanic separated analogue output (current/ voltage) and 11 step LED chain for the actual frequency
- Device available with 2 response values and seperately controlled outputrelays for under- and overfrequency see MK 9837N/500
- 2 possible compact designs:
  MK 9837N: Width 22,5 mm
  MH 9837: Width 45 mm

Approvals and Markings

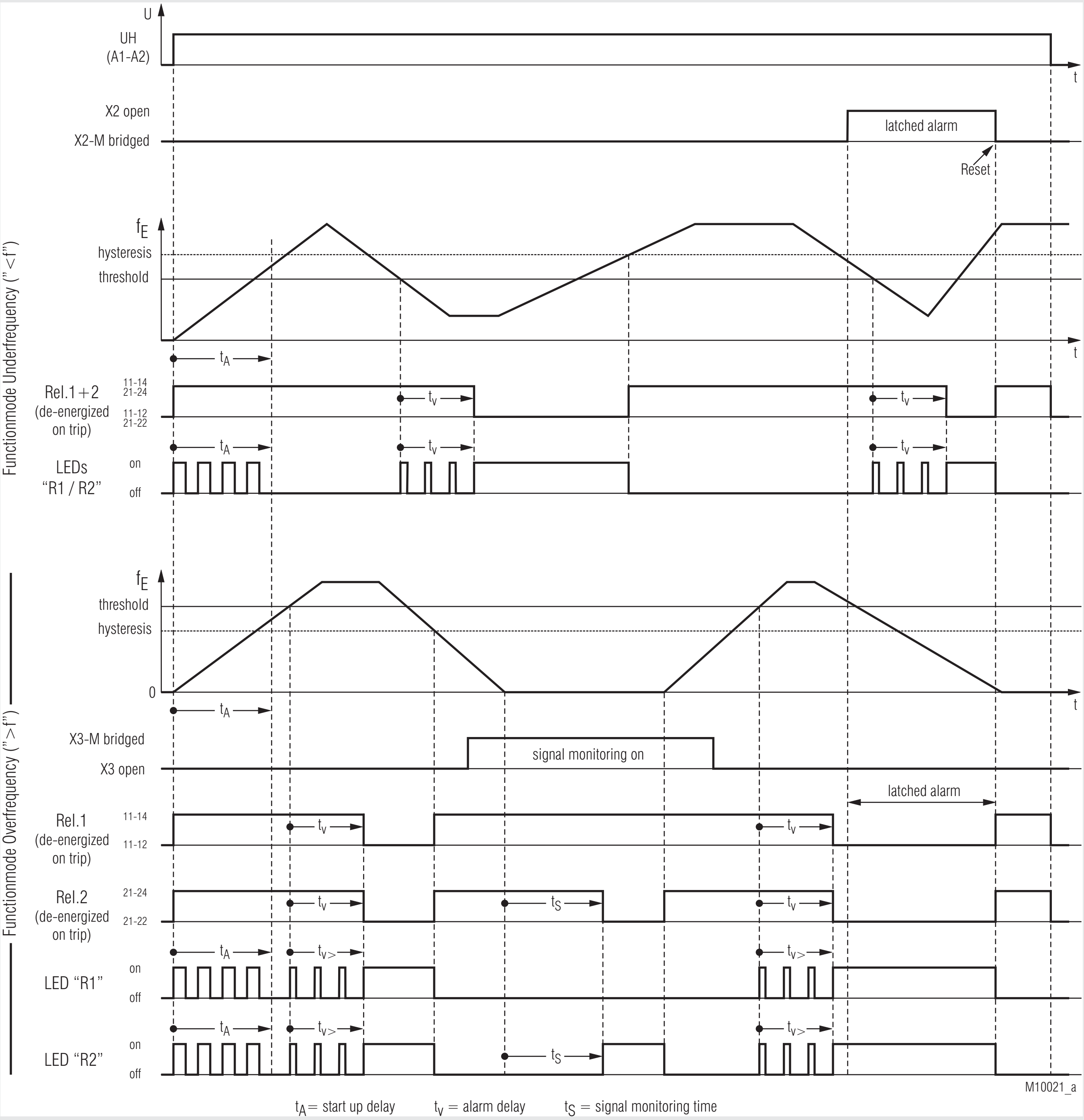
CE | CCC *) A025518

*) only MK 9837N

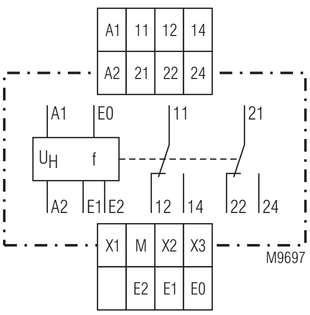
Applications

- Monitoring of frequency in AC systems
- Monitoring of rotor frequency on slip ring motors
- Control and monitoring of motors in sewage water treatment plants
- Monitoring of output voltage on inverters (variant /050)
- Monitoring of supply voltage frequency on railway rolling stock

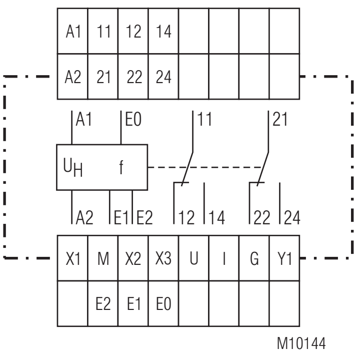
Function Diagram



Circuit Diagrams



MK 9837N



MH 9837/008

Connection Terminals

Terminal designation	Signal designation
A1+, A1	+ / L
A2	- / N
E0, E1, E2	Frequency input
X1, X2, X3	Programming terminals
M	Reference for programming terminals
U	Analogue output voltage
I	Analogue output current
G	Reference for analogue output
Y1	Range selection for analogue output
11, 12, 14, 21, 22, 24	"monitoring output frequency failure (2 changeover contacts)"

Functions

The auxiliary supply is connected to terminals A1-A2.
Terminals E0-E1-E2 form the measuring input. For low voltages the measuring voltage is connected to E1-E0 and for higher voltages to E2-E0 (see section technical data).
The input frequency is compared to the setting value (response value = fine tunig x range).
As the device measures the cycle duration the fastest frequency measurement is possible (reaction time = cycle time + 10 ms).
In overfrequency mode (switch on front in pos. “>f”) the output relay switches to alarm state if the input frequency rises above the response value for a longer time then selected on the terminals. If the measuring frequency drops again under the hysteresis value, the output relay switches back to good state without delay.
In underfrequency mode (switch on front in pos. “<f”) the output relay switches to alarm state, if the input frequency drops below the response value for a longer time then selected on the terminals. If the measuring frequency rises again above the hysteresis value, the output relay switches back to good state without delay.

If manual reset is chosen, the output relay stays in tripped position, even if the frequency is back to normal. The reset is made by bridging terminals X2-M or by disconnecting the auxiliary supply.

In alarm state the yellow LEDs „R1“ / „R2“ are continuously on, during time delay they flash with short pulse.

In de-energized on trip mode the output relay is energized in good state (contacts 11-14 etc. closed).
In energized on trip mode the output relay is energized in alarm state (contacts 11-14 etc. closed).

If start up delay is selected a timer is started after connection of auxiliary supply that disables the measuring circuit for the adjusted time. This start up delay avoids an alarm e.g. when starting a generator or motor.

When measuring overfrequency, monitoring of the signal on E0-E1-E2 can be selected. If the signal is missing longer then the selected monitoring time, relay 2 (contacts 21-22-24) and LED “R2” indicate alarm.

Indicators

Upper LED „UH/E“:
- green, when only auxiliary voltage connected to A1 - A2
- yellow/green, when measuring frequency is detected on E0-E1-E2

Lower LED „R1“ (yellow):
- On, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active

Lower LED „R2“ (yellow):
- On, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active
- additional flashes at signal monitoring alarm

LEDs "R1" and "R2" flash together during start up delay

Notes

Frequency measuring input

The standard measuring input is divided up in to voltage ranges (E1-E0 AC 15… 280 V and E2-E0 AC 30 … 550 V). If the measuring voltage is always higher then AC 30 V, the higher range should be used. To measure the output frequency on inverters the variant /_5_ has to be used. A special dimensioned measuring input with low pass characteristic avoids the measuring of the pulse frequency. In addition the input sensitivity is adapted to the voltage-/frequency-characteristic of inverters (see diagram in technical data).
Visual indication of measuring voltage: If the voltage on the measuring input is to low for correct function on inputs E0-E1-E2 the upper 2-colour LED “UH/E” shows green continuous light. If underfrequency is selected the unit indicates underfrequency alarm, if overfrequency is selected together with measuring signal monitoring the unit indicates measuring signal alarm. If the voltage on the measuring input is high enough the LED “UH/E” flashes yellow/green.

Notes

Start up delay / monitoring of measuring signal.
The start up time delay (tA) can be adjusted with the lowest potentiometer on the front side of the unit and is activated when connecting the auxiliary supply.
In underfrequency mode (“<f”) the start up delay can be extended/restarted at any time with a control contact between terminals X3-M. As long as X3-M is bridged the start up delay is continuously on and the frequency is not measured. When the link on X3-M is opened the start up delay time restarts.
In overfrequency mode (“>f”) with a bridge on X3-M, the lowest potentiometer sets the measuring signal monitoring time (tS) (The adjusted time values tA/tS are identically).
When signal monitoring in mode “>f” is selected by bridging X3-M the measuring input is monitored as follows: If during the adjusted monitoring time interval no measuring signal is detected, measuring signal alarm is indicated. As soon as the measuring signal returns the alarm status is reset (auto reset selected) and the monitoring interval tS starts again.
The alarm status is indicated on relay 2 (contacts 21-22-24) and LED “R2” and can be easily differentiated from under/over frequency alarm where both relays (contacts 11-12-14and 21-22-24) and LEDs “R1”and “R2”) are active.
The detection of missing measuring signal can increase the safety in critical applications on overfrequency. It detects if the measuring signal is connected to the input of the device and works correctly

Programming terminals (M-X1-X2-X3):

Attention! The terminals M-X1-X2-X3 have no galvanic separation to the measuring circuit, and must be operated potential free.

M: Common connection (Ground) of the programming terminals
X1: A response delay of 0…100 s after connection of auxiliary supply is achieved by connecting a X1 to M with a potentiometer or fixed resistor (see technical data). The delay can be stopped by bridging X1 to M at any time.
If no start up delay is required the terminals X1-M must be linked.
X2: Manual reset with NO contact push button on X2-M, auto reset with terminals X2-M bridged.
X3: When X3-M is bridged in mode “underfrequency” the start up delay is continuously active or the time is restarted. In mode overfrequency the monitoring of the measuring signal is switched on by bridging X3-M.

Adjustment aid for start up delay and alarm delay

During the elapse of start up delay and alarm delay the yellow LED „R1“ and „R2“ is flashing with a frequency of 2 Hz. To set a specific time value in seconds the number of flash pulses can be used to check the setting: Number of flash pulses divided by 2 = time delay in seconds.

Variant MH 9837.12/008: 45 mm width
Identically to MK 9837N.12, but with 11 step LED chain indicator and galvanic separated analogue output to display the actual measured frequency.
On terminals U/G of the analogue output 0-10 V are provided, on terminals I/G 0-20 mA are available. By bridging terminals Y1 and G the output can be switched over to 2-10 V and 4-20 mA. The max. value of the analogue output is indicating 2 times of the max. value of the selected range this allows also to indicate overfrequency values. The scaling is linear to the input frequency (lowest analogue value is 0 Hz). The LED chain indicator shows on 10 LEDs the actual frequency (≤ 10% ... 100% of the setting range). If the frequency exceeds the maximum value of the range the idicator is switched over to 2 x max value and the top LED (red) is on.

Technical Data

Frequency Measuring Input (E0-E1-E2)

Standard-frequency measuring
Voltage range
E0-E1: AC 15 ... 280 V,
E0-E2: AC 30 ... 550 V
Input resistance
E0-E1: approx. 300 kΩ
E0-E2: approx. 850 kΩ

Frequency Measuring Input for Inverters (variant /_5_)

Max. input voltage: AC 550 V
Min. measuring voltage: see characteristic M9349
Input resistance: approx. 900 kΩ

Common Data for Both Measuring Inputs

Galvanic separation: Frequency measuring input to auxiliary voltage and output contacts
Frequency ranges:

1,5 ... 6 Hz	5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz or
5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz	150 ... 600 Hz 4 ranges selectable

Response time
(response value): continously variable; 1:4 in each response value
Tolerances of the adjusted tripping values at variation of auxiliary supply and temperature: better than ± 1 %
Hysterese: continously variable: 0,5 ... 50 % of adjustable response value
Reaction time of Frequency monitoring: (Alarm delay set to 0) Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms
Response delay: adjustable 0 ... 100 s with resitor/potentiometer across terminals X1-M:

R / kΩ:	0	15	22	33	47	68	100	150	220	470	∞
t_v / s:	0	0.3	0.7	1.3	2.3	5	9	15	25	50	100

Time between connection of auxiliary supply and ready to mesure: approx. 0,4 s (with start up delay is 0)
Start up time delay / Signal monitoring time: 20 ms ... 50 s continously variable on logarithmic scale

Auxiliary Circuit (A1-A2)

Auxiliary voltage U_H
(galvanic separation): AC 115, 230, 400 V
DC 12, 24, 48 V
AC/DC 24 ... 60, 110 ... 230 V (only for MH-version possible)
Voltage range
AC: 0,8 ... 1,1 U_H
DC: 0,9 ... 1,2 U_H
AC/DC: 0,75 ... 1,2 U_H
Frequency range
AC: 45 ... 440 Hz
Nominal consumption:
AC: approx. 4 VA
DC: approx. 2 W

Output (11-12-14, 21-22-24)

Contacts: 2 changeover contacts
Thermal current I_{th}: 4 A
Switching capacity
according to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
according to DC 13
NO contact: 1 A / DC 24 V IEC/EN 60 947-5-1
NC contact: 1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
acc. to AC 15 at 1 A, AC 230 V: $1{,}5 \times 10^5$ switching cycles IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 switching cycles

Technical Data

Analogue Output with MH 9837.12/008

galvanic separation AC 3750V
to auxiliary supply, measuring circuit and relay outputs
terminal U(+) / G(-): 0 ... 10 V, max. 10 mA
terminal I (+) / G(-): 0 ... 20 mA, max. burden 500 Ohm
change to 2 ... 10 V or 4 ... 20 mA by bridging terminal Y1 and G.
scaling is linear with frequency (lowest value at f = 0, highest value at 2 x max setting value)

General Data

Nominal operating mode: continuous operation
Temperature range
Operation: - 20 ... + 60°C (higher temperature with limitations on request)
Storage: - 25 ... + 60°C
Altitude: < 2,000 m
Clearance and creepage distance
rated impulse voltage / pollution degree:
output to measuring circuit: 4 kV / 2 IEC 60 664-1
output to auxiliary circuit: 4 kV / 2 IEC 60 664-1
output to output: 4 kV / 2 IEC 60 664-1
auxiliary circuit to measuring input: 4 kV / 2 IEC 60 664-1
Programming terminals
M-X1-X2-X3: without galv. separation to measuring circuit
EMV
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation
80 MHz ... 1 GHz: 20 V/m IEC/EN 61 000-4-3
1 GHz ... 2.5 GHz: 10 V/m IEC/EN 61 000-4-3
2.4 GHz ... 2.7 GHz: 1 V/m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltage
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection:
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0,35 mm
Frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 4 mm^2 solid or
2 x 1,5 mm^2 solid or
1 x 2,5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4 or
2 x 1,5 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/
Wire fixing: Plus-minus terminal screws
M3,5 box terminals with wire protection
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715
Weight:
MK 9837N: approx. 210 g
MH 9837: approx. 350 g

Dimensions

Width x heigh x depth:
MK 9837N: 22,5 x 90 x 97 mm
MH 9837: 45 x 90 x 97 mm

Classification to DIN EN 50155

Vibration and shock resistance: Category 1, Class B IEC/EN 61 373
Ambient temperature: T1 compliant
T2, T3 and TX with operational limitations
Protective coating of the PCB: No

CCC-Data

Auxiliary voltage U_N:
MK 9837N: AC 115, 230 V
DC 12, 24, 48 V

Switching capacity
to AC 15
NO contact: 1,5 A / AC 230 V IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Types

MK 9837N.12 5 ... 600 Hz U_H AC 230 V
Article number: 0058719

- Switchable monitoring modus: over- or underfrequency
- Closed circuit operation
- Mode overfrequency with selectable signal monitoring
- 4 settable frequency ranges are possible:
  5 ... 20 Hz, 15 ... 60 Hz, 50 ... 200 Hz, 150 ... 600 Hz
- Settalbe hysteresis of 0,5 ... 50 %
- Start up time delay / signal monitoring time:
  settable to 0 ... 50 s
- Response delay: settalbe with external resitor to 0 ... 100 s
- Alarm storing or auto-reset selectable
- Frequency measuring input: AC 15 ... 280 V / AC 30 ... 550 V
- Auxiliary voltage U_H: AC 230 V
- Output: 2 changeover contacts
- Width: 22,5 mm

Variants

MK 9837N.12/050:	as MK 9837N.12, but with measuring input for intverters
MH 9837.12:	as MK 9837N.12, but for variants with wide auxiliary voltage range Width: 45 mm
MH 9837.12/008:	similar to MK 9837N.12, but with galvanic separated analogue output (current/voltage) and 11 step LED chain. Width: 45 mm

Ordering example for variants

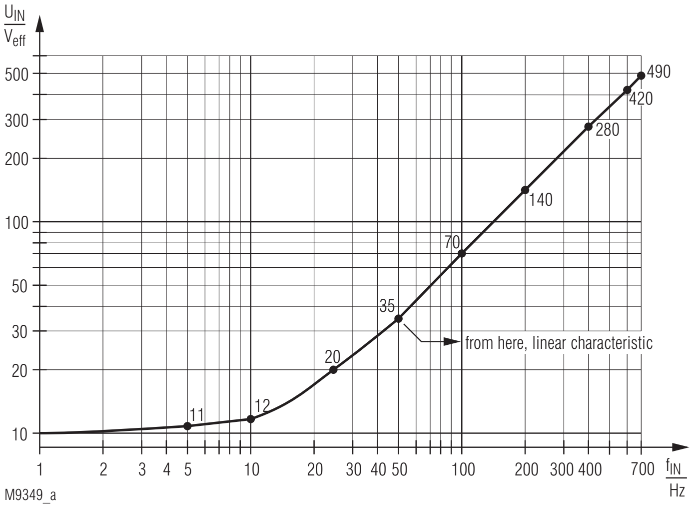
MK 9837N .12 /050 1,5 ... 200 Hz U_H AC 230 V

- Auxiliary voltage
- Response value
- Variant, if required
- Contacts
- Width: 22,5 mm

MH 9837 .12 1,5 ... 200 Hz U_H AC/DC 110 ... 230 V

- Auxiliary voltage
- Response value
- Contacts
- Width: 45 mm

Characteristic



Typical sensitivity of the measuring input at variant MK 9837N.12/_5_

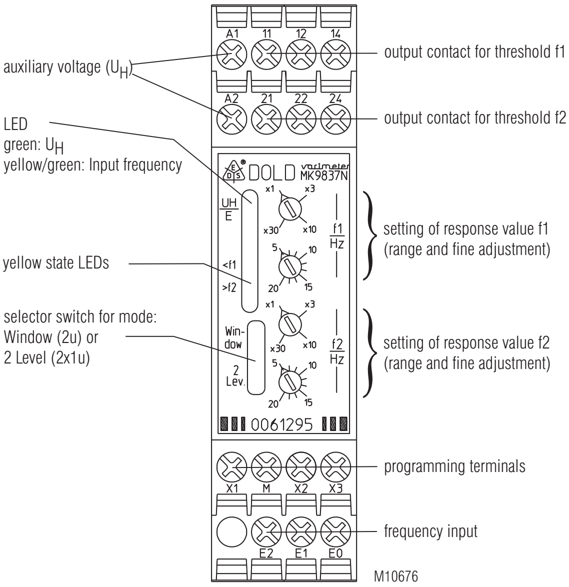
VARIMETER
Frequency Relay
MK 9837N/5_0, MH 9837/5_0

DOLD

0266342

MK 9837N/500 MH 9837/500

Setting



Your Advantages
- Separate output signals for under and over frequency
- Simple wiring
- Easy handling

Features
- According to IEC / EN 60 255, VDE 0435 Teil 303
- Monitoring of AC voltage for under and overfrequency, can be used also for pre-warning
- Separate relay outputs for over- or underfrequency (1 or 2 changeover contacts each)
- Alternative usage for monitoring of a frequency window
- Separate adjustment of response value for over- or underfrequency at 4 ranges each, 1.5 ... 200 Hz or 5 ... 600 Hz
- Second response value for prewarning possible
- Fast reaction time by measuring duration of cycle of input frequency
- Universal measuring input for AC-voltages of 15 ... 280 V as well as 30 ... 550 V
- As option with measuring input for inverters
- Programmable hysteresis of response value: 2 ... 10 %
- Start up time delay programmable via terminals from 0 ... 50 s e.g. continuously
- Manual or auto-reset programmable via terminals
- Galvanic separation between measuring input, auxiliary voltage and output contacts
- MH 9837/508: with galvanic separated analogue output (current/ voltage) and 11 step LED chain for the actual frequency
- MH 9837/5_0: with wide input range for auxiliary voltage available (AC/DC 24 ... 60 V or AC/DC 110 ... 230 V)
- Closed circuit operation (de-energized on trip)
- LED indication for auxiliary voltage, measuring voltage and alarm status
- Device available with 2 contacts
  MK 9837N/5_0: 2 x 1 changeover contact
  MH 9837/5_0: 2 x 2 changeover contacts or wide auxiliary voltage range
- 2 possible compact designs:
  MK 9837N/5_0: Width 22,5 mm
  MH 9837/5_0: Width 45 mm

Approvals and Markings

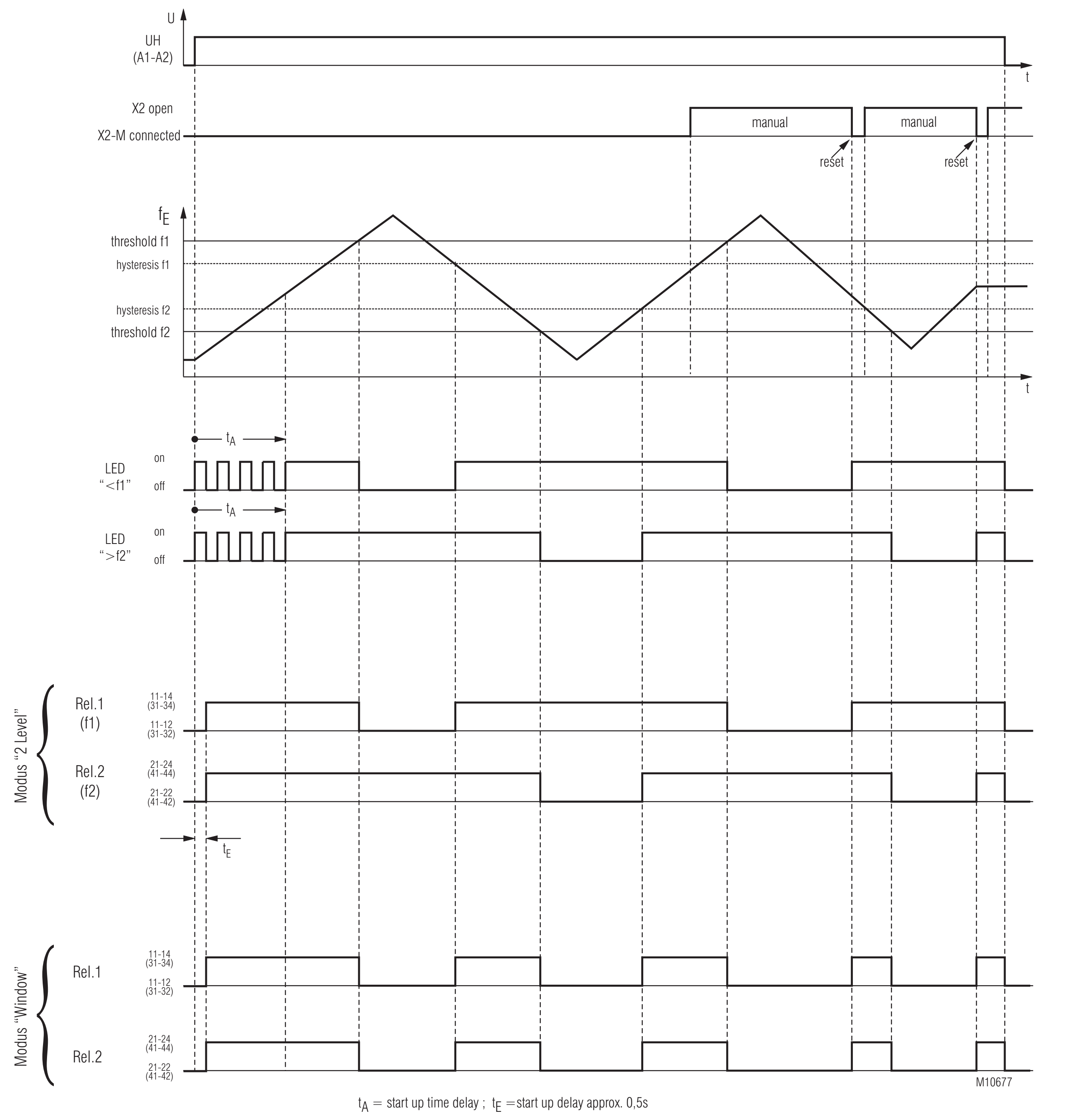
CE	AE68 *)	A025518 *)

*) only MK 9837N/5_0

Application

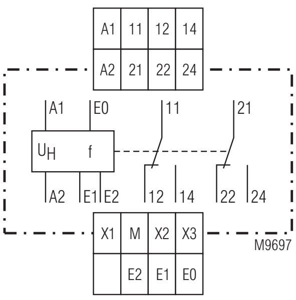
- Monitoring of frequency in AC systems
- Monitoring of rotor frequency on slip ring motors
- Control and monitoring of motors in sewage water treatment plants
- Monitoring of output frequency on inverters (variant /550)

Function Diagram

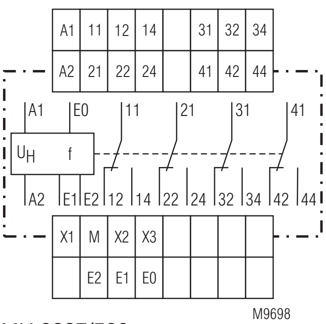


t_A = start up time delay ; t_E =start up delay approx. 0,5s

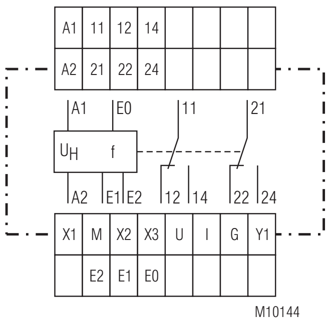
Circuit Diagrams



MK 9837N/500



MH 9837/500



MH 9837/508

Connection Terminals

Terminal designation	Signal designation
A1+, A1	+ / L
A2	- / N
E0, E1, E2	Frequency input
X1, X2, X3	Programming terminals
M	Reference for programming terminals
U	Analogue output voltage
I	Analogue output current
G	Reference for analogue output
Y1	Range selection for analogue output
11, 12, 14, 21, 22, 24, 31, 32, 34, 41, 42, 44	"monitoring output frequency failure (2 or 4 changeover contacts)"

Functions

The auxiliary supply is connected to terminals A1-A2.
Terminals E0-E1-E2 form the measuring input. For low voltages the measuring voltage is connected to E1-E0 and for higher voltages to E2-E0 (see section technical data).
The input frequency is compared to the setting value for over- and underfrequency (response value f1 e.g. f2 = fine tunig x range).
As the device measures the cycle duration the fastest frequency measurement is possible (reaction time = cycle time + 10 ms).

If the input frequency on the measuring input E0-E1-E2 is under the response value f1 less hysteresis (both upper potentiometers) and over the response value f2 (both lower potentiometers) plus hysteresis then the output relays are energized and the yellow LEDs “<f1” and “>f2” are on.

If the frequency rises above the value of f1, the relay 1 de-energizes (contacts 11-12 close) in “2 level mode”, in “window mode” also relay 2 de-energizes (contacts 21-22 close). The yellow LED “<f1” goes off. Only when the input frequency drops under the level f1 minus hysteresis, the output relay (both relays in window mode) energize again and the yellow LED”<f1” is on.

If the frequency drops below the value of f2, the relay 2 de-energizes (contacts 21-22 close) in “2 level mode”, in “window mode” also relay 1 de-energizes (contacts 11-12 close). The yellow LED “<f2” goes off. Only when the input frequency rises above the level f2 plus hysteresis, the output relay (both relays in window mode) energize again and the yellow LED”<f2” is on.

If manual reset is active (terminal x2 not connected) and the frequency returns to good state the relay (relays) remain in alarm position (de-energized) and the corresponding LED is off. To reset the alarm terminals X2-M must be bridged, or the auxiliary supply has to be switched off and on again.

IIf a start-up delay is adjusted, this delay starts with the connection of the auxiliary supply. During this time the frequency is not detection is off, the yellow LEDs “<f1” and “>f2” flash and the output relays are in good state (energized). The start-up delay allows to avoid alarms during the starting period of a generator or motor.

Using the sliding switch on the front of the unit the user can chose between the two function modes”2-level mode” and “window mode”.
„2 level-mode“: 2x1 c/o contacts; the output relays 1 and 2 switch separately at the corresponding response value f1 and f2.
„window-mode“: 2 c/o contacts; the output relays switch together at the response values for f1 and f2 (where f1>f2); i.e. the relays switch off together the frequency rises over f1 or drops under f2.

Indicators

Upper LED „UH/E“:
- green, when only auxiliary voltage connected to A1 - A2
- yellow/green, when measuring frequency is detected on E0-E1-E2

Lower LED „<f1“ (yellow): - On, input frequency is lower than response value f1 (= relay 1 energized in “2-level mode”)

Lower LED „>f2“ (yellow): - On, when input frequency is higher than response level f2 (= relay 2 energized in “2-level mode”)
LEDs "<f1" and ">f2" flashes during start up delay

Notes

Setting of response values f1 and f2 / function energized on trip for output relays
Normally the response value f1 is used for overfrequency and f2 for underfrequency the hysteresis works accordingly to these settings. Both relays operate de-energized on trip. In “2-level-mode” the frequency detection and the control of the corresponding relays at the response values f1 and f2 work completely independent. So it is possible to adjust f2 higher than f1 if auto reset is selected. If f2 is used for overfrequency, the unit works energized on trip, as the relay 2 (21-22-24) always energizes when the frequency rises above response value + hysteresis. In the same way the response value f1 - hysteresis can be used for underfrequency so that relay 1 (11-12-14) is energized on trip.

When using manual reset in “window mode” the response value f1 (minus hysteresis) must always be higher than f2 (plus hysteresis) to avoid that the output relays do not switch anymore and the yellow LEDs “<f1” and “>f2” remain dark.

Frequency measuring input
The standard measuring input is divided up in to voltage ranges (E1-E0 AC 15… 280 V and E2-E0 AC 30 … 550 V). If the measuring voltage is always higher then AC 30 V, the higher range should be used.

To measure the output frequency on inverters the variant /550 has to be used. A special dimensioned measuring input with low pass characteristic avoids the measuring of the pulse frequency. In addition the input sensitivity is adapted to the voltage-/frequency-characteristic of inverters (see diagram in technical data).

Visual indication of measuring voltage:
If the voltage on the frequency measuring input is high enough for monitoring the upper dual color LED “UH/E” is ON yellow/green. If the voltage on the input is to low, the LED “UH/E” shows only green color.
Attention: If the measuring voltage is to low the unit reacts as on underfrequency!

Programming terminals (M-X1-X2-X3):

Attention! The terminals M-X1-X2-X3 have no galvanic separation to the measuring circuit (E0-E1-E2), and must be operated potential free.

M: Common connection (Ground) of the programming terminals

X1: start up delay at range of 0...50 s is achieved by connecting a X1 to M with a potentiometer (0.25 W) or fixed resistor (see technical data). If no start up delay is required the terminals X1-M must be linked.

X2: Manual reset with NO contact push button on X2-M, auto reset with terminals X2-M bridged.

X3: Hysteresis setting at range of 2...10 % is achieved by connecting the terminal X3 to M with a potentiometer (0.25 W) or fixed resistor (see technical data).
For a hysteresis of 2 % the terminal X3 remains open; for a hysteresis of 10 % s the terminals X3-M must be linked.

Start up delay
A start up delay (t_A = 0 ... 50 s) adjusted by connecting a resistor 0 …500kOhm to the terminals X1 and M see technical data. This start up delay is started when connecting the auxiliary supply. During this time monitoring is disabled and both output relays are energized. If the connection between X1 and M is open circuit (resistance > 500 kOhm), the startup delay is continuously on. With this possibility the frequency monitoring can be disabled by an external contact until e.g. a system reaches its normal operation status. When the circuit X1 – M closes the time delay set by a resistor in this circuit runs down before the monitoring starts.
If no start up delay is required, the terminals X1-M must be linked.
There must be a connection between X1-M when the frequency should be monitored.
While the start up delay is active, the yellow LEDs “<f1” and “>f2” flash with 2 Hz. To adjust a specific time the number of flashing cycles can be counted. Number of cycles divided by 2 = start up time in seconds.

Notes

Manual / automatic reset
To enable manual reset the connection X2-M remains open. Storing of the alarm influences the output relays and the corresponding LEDs.
Reset is made by closing the connection between X2 and M or by disconnecting the auxiliary supply.

Setting of hysteresis
Connecting terminal X3 via a resistor to M adjusts the hysteresis. Both response values (f1 and f2) have the same hysteresis in percentage of the adjusted response values. So the absolute value of the hysteresis is higher on the higher response value then on the lower response value.

Variant MH 9837.38/508: (45 mm width)
Identically to MK 9837N.12, but with 11 step LED chain indicator and galvanic separated analogue output to display the actual measured frequency.
On terminals U/G of the analogue output 0-10 V are provided, on terminals I/G 0 ... 20 mA are available. By bridging terminals Y1 and G the output can be switched over to 2 ... 10 V and 4 ... 20 mA. The max. value of the analogue output is indicating 2 times of the max. value of the selected range this allows also to indicate overfrequency values. The scaling is linear to the input frequency (lowest analogue value is 0 Hz). The LED chain indicator shows on 10 LEDs the actual frequency (≤ 10% ... 100% of the setting range). If the frequency exceeds the maximum value of the range the idicator is switched over to 2 x max value and the top LED (red) is on.

Technical Data

Frequency Measuring Input (E0-E1-E2)

Standard-frequency measuring
Voltage range
E0-E1: AC 15 ... 280 V,
E0-E2: AC 30 ... 550 V
Input resistance
E0-E1: approx. 300 kΩ
E0-E2: approx. 850 kΩ

Frequency measuring input for inverters (variant /550)

Max. input voltage: AC 550 V
Min. measuring voltage: approx.. AC 10 V (at1 Hz) ... AC 150 V (at 200 Hz); (see characteristic M8681)
Input resistance: approx. 900 kΩ

Common Data for Both Measuring Inputs

Galvanic separation: Frequency measuring input to auxiliary voltage and output contacts

Frequency ranges: (separately selectable for f1 and f2)

1.5 ... 6 Hz	5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz or
5 ... 20 Hz	15 ... 60 Hz	50 ... 200 Hz	150 ... 600 Hz 4 ranges selectable each

Response time f1, f2
(response value): separately adjustable at absolute scale
Tolerances of the adjusted tripping values at variation of auxiliary supply and temperature: approx. ± 1 %
Hysteresis: adjustable from 2 ... 10 % with resitor/potentiometer across terminals X3-M

Resistance:	0	15 kΩ	39 kΩ	120 kΩ	∞
Hysteresis:	10 %	8 %	6 %	4 %	2 %

Reaction time of Frequency monitoring: Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms
Start up delay: adjustable from 0 ... 50 s with resitor/potentiometer across terminals X1-M:

R / kΩ:	0	15	22	33	47	68	100	150	220	470	∞
t_v / s:	0	0,3	0,7	1,3	2,3	5	9	15	25	50	∞

Time between connection of auxiliary supply and ready to mesure: approx. 0.5 s (with start up delay is 0)

Technical Data

Auxiliary Circuit (A1-A2)

Auxiliary voltage U_H
(galvanic separation): AC 115, 230, 400 V
DC 12, 24, 48 V
AC/DC 24 ... 60, 110 ... 230 V (only for MH-version possible)
Voltage range
AC: 0.8 ... 1.1 U_H
DC: 0.9 ... 1.2 U_H
AC/DC: 0.75 ... 1.2 U_H
Frequency range
AC: 45 ... 440 Hz
Nominal consumption:
AC: approx. 4 VA
DC: approx. 2 W

Output (11-12-14, 21-22-24 + 31-32-34, 41-42-44 at MH 9837.39/5_0)

Contacts:
MK 9837N.38/5_0: 2 x 1 changeover contact (1 each for over- and underfrequency alarm)
MH 9837.39/5_0: 2 x 2 changeover contacts (2 each for over- and underfrequency alarm)
Thermal current I_{th}: 4 A
Switching capacity
to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
to DC 13
NO contact: 1 A / DC 24 V IEC/EN 60 947-5-1
NC contact: 1 A / DC 24 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V: $1{,}5 \times 10^5$ switching cycles IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30×10^6 switching cycles

Analogue Output with MH 9837.38/508

galvanic separation AC 3750V
to auxiliary supply, measuring circuit and relay outputs
terminal U(+) / G(-): 0 ... 10 V, max. 10 mA
terminal I (+) / G(-): 0 ... 20 mA, max. burden 500 Ohm
change to 2 ... 10 V or 4 ... 20 mA by bridging terminal Y1 and G.
scaling is linear with frequency (lowest value at f = 0, highest value at 2 x max setting value)

General Data

Nominal operating mode: continuous operation
Temperature range: - 20 ... + 60°C
Clearance and creepage distance
rated impulse voltage / pollution degree:
output to measuring circuit: 4 kV / 2 IEC 60 664-1
output to auxiliary circuit: 4 kV / 2 IEC 60 664-1
output to output: 4 kV / 2 IEC 60 664-1
auxiliary circuit to measuring input: 4 kV / 2 IEC 60 664-1
Programming terminals M-X1-X2-X3: without galv. separation to measuring circuit
EMV
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltage between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011

Technical Data

Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequency 10 ... 55 Hz	 IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 4 mm² solid or 2 x 1.5 mm² solid or 1 x 2.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4 or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/	
Wire fixing:	Plus-minus terminal screws M3.5 box terminals with wire protection	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
MK 9837N/5_0:	approx. 210 g	
MH 9837/5_0:	approx. 295 g	
MH 9837/508:	approx. 350 g	

Dimensions

Width x heigh x depth:	
MK 9837N/5_0:	22.5 x 90 x 97 mm
MH 9837/5_ _:	45 x 90 x 97 mm

CCC-Data

Auxiliary voltage U_N:		
MK9837N/5_ _:	AC 115, 230 V DC 12, 24, 48 V	
Switching capacity		
to AC 15		
NO contact:	1,5 A / AC 230 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

MK 9837N.38/500 2 x 5 ... 600 Hz U_H AC 230 V
Article number: 0061295

- 2 adjustable response values at 4 ranges each:
  5 ... 20 Hz, 15 ... 60 Hz, 50 ... 200 Hz, 150 ... 600 Hz
- Switchable monitoring mode: „2 Level" or „Window"
- Hysteresis: programmable via terminal: 2 ... 10 %
- start up time delay: settalbe with external resitor 0 ... 50 s
- Alarm storing or auto-reset selectable
- Frequency input AC 15...280 V / AC 30...550 V
- Closed circuit operation
- Auxiliary voltage U_H: AC 230 V
- Output: 2 changeover contacts
- Width: 22,5 mm

Variants

MK 9837N.38/550:	as MK 9837N.38/500, but with but with measuring input for intverters
MH 9837.38/5_0:	as MK 9837N.38/5_0, but for variants with wide auxiliary voltage range Width: 45 mm
MH 9837.38/508:	as MK 9837N.38/500, but with galvanic separated analogue output (current/voltage) and 11 step LED chain. Width: 45 mm
MH 9837.39/5_0:	as MK 9837N.38/5_0, jedoch mit 2 x 2 Wechslern Width: 45 mm

Ordering example for variants

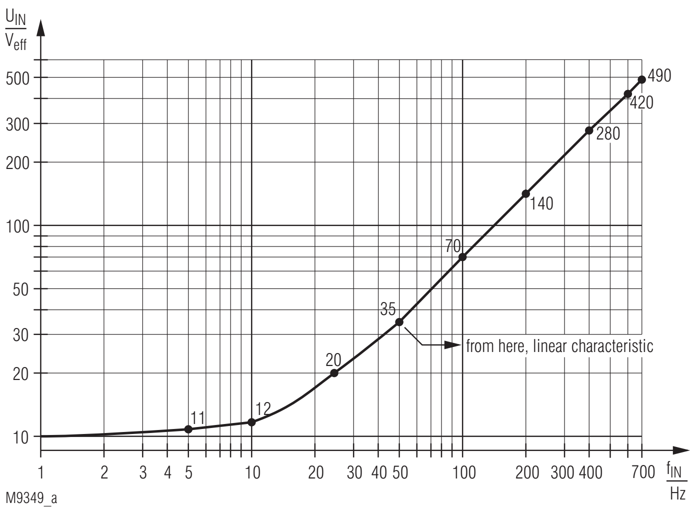
MK 9837N .38 /5_0 2 x 5 ... 600 Hz U_H AC 230 V

- Auxiliary voltage
- Response value
- Variant, if required
- Contacts
- Width: 22.5 mm

MH 9837 .38 /5_0 2 x5 ... 600 Hz U_H AC/DC 110 ... 230 V

- Auxiliary voltage
- Response value
- Variant, if required
- Contacts
- Width: 45 mm

Characteristics



Typical sensitivity of the measuring input at variant MK 9837N.12/_5_

VARIMETER
Mains Frequency Monitor
MK 9143N, MH 9143

0257047

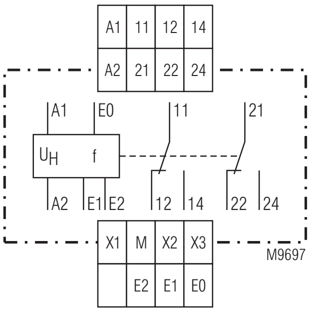
MK 9143N MH 9143

- According to IEC / EN 60 255-1
- Monitoring of 50 - and 60 Hz-current supply on over- and underfrequency
- Monitoring of local generator sets and voltage supplies
- For precise frequency measuring with fast response time
- High disturbance immunity
- Separately adjustable trip points and separate outputs for over- and underfrequency (1 or 2 c/o each)
- **MK 9143N / MH 9143**:
  - Trip points adjustable precisely and reproducible on 10 step rotational switch in the range of ± 0,1 Hz to ± 5 Hz related to 50 or 60 Hz
  - Nominal frequency 50 or 60 Hz selectable
  - Fixed hysteresis optimised for trip point
  - Time delay for over and underfrequency each adjustable from 0 to 20 s
  - As option one common output for under and overfrequency “Window”-mode (MK 9143N/400 / MH 9143/400)
- **MH 9143.38/008**: with galvanic separated analogue output (current/ voltage) and 11 step LED chain for the actual frequency
- **MK 9143N/600 / MH 9143/600**:
  - Variable alarm value in the range of 45 to 65 Hz
  - Hysteresis adjustable for under- and overfrequency separately adjustable 0 …20%
  - Common output for under and overfrequency “Window”-mode can be selected
- Start up delay 0…30 s selectable
- Manual or auto reset selectable
- Output relay energized or de-energized on trip selectable for overfrequency
- Output relay de-energized on trip for underfrequency
- Universal frequency measuring input for AC 40 … 550V
- Several options for auxiliary supply
- As option without aux. supply for voltage range AC 18 … 70 V or 70 … 275V
- LED indicators for auxiliary supply, input frequency, over and under frequency alarm
- 2 possible contact arrangements
  MK 9143N and MK 9143N/600: 2 x 1 C/O contacts, width 22,5 mm
  MH 9143 and MH 9143/600: 2 x 2 C/O contacts, width 45 mm

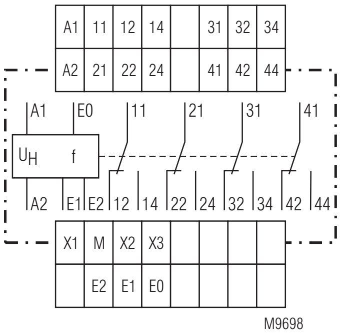
Approvals and Markings

CE

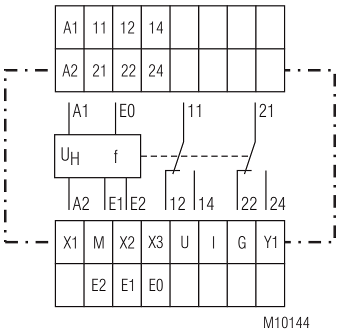
Circuit Diagrams



MK 9143N.38



MH 9143.39



MH 9143.38/008

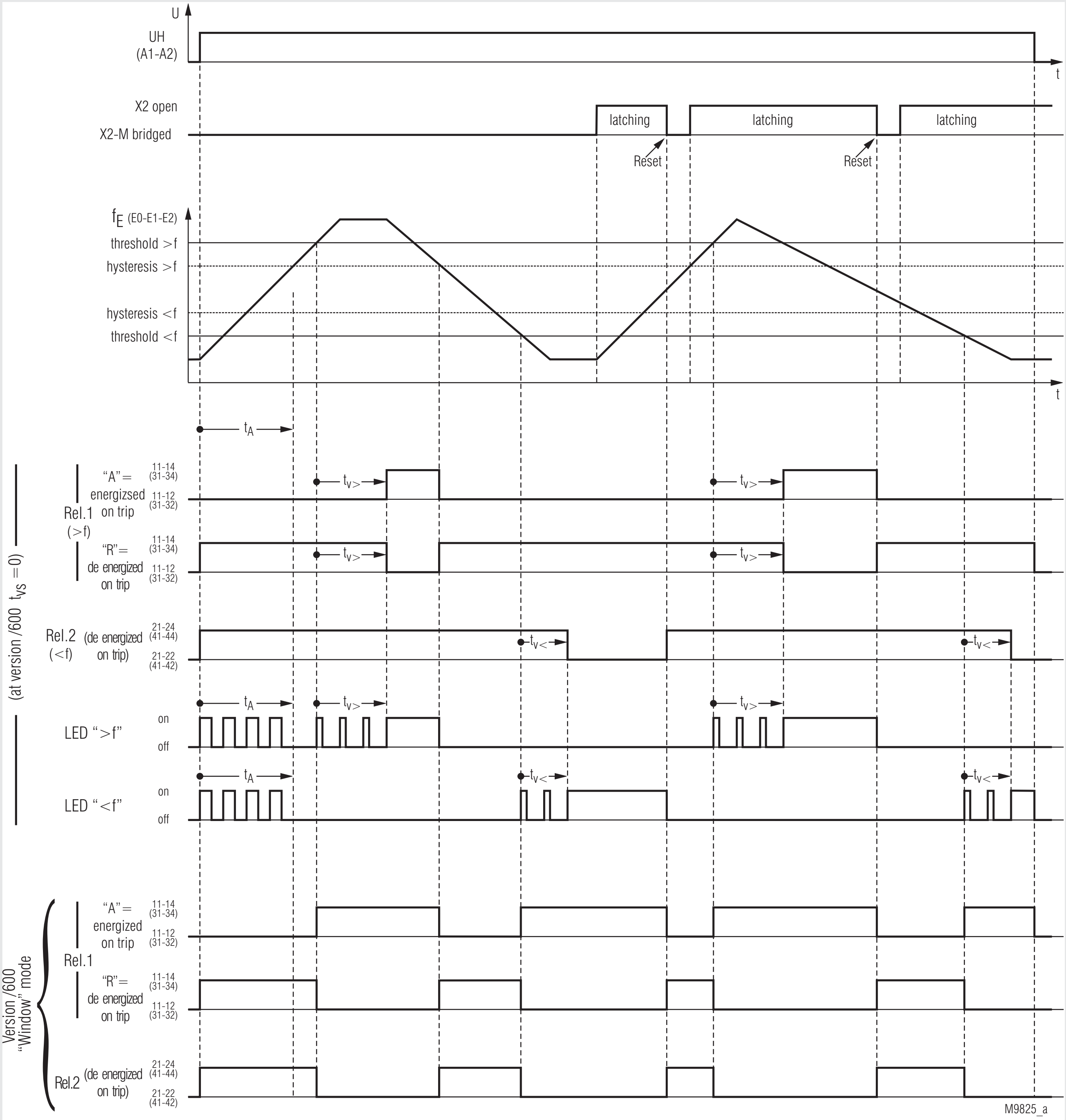
Connection Terminals

Terminal designation	Signal designation
A1+, A1	+ / L
A2	- / N
E0, E1, E2	Frequency input
X1, X2, X3	Programming terminals
M	Reference for programming terminals
U	Analogue output voltage
I	Analogue output current
G	Reference for analogue output
Y1	Range selection for analogue output
11, 12, 14, 21, 22, 24	"monitoring output frequency failure (2 changeover contacts)"

Application

Monitoring of local generator sets and voltage supplies

Function Diagram



t_A = start up delay ; $t_{v>}$ / $t_{v<}$ = response delay at under- and overfrequency

Function

The auxiliary supply is connected to terminals A1-A2.
(If the measuring voltage is within the tolerances pf the auxiliary supply the terminals A1-A2 can also be supplied from the Measuring voltage.)
The measuring input is on terminals E0-E1-E2 with low voltages on E1-E0 and high voltages on E2-E0 (see technical data). The input frequency is compared to the values set on the device.
If the input frequency falls below or rises above the tripping value, the corresponding output relay goes in alarm state (with time delay if adjusted) and the LED >f or <f lights up. When the frequency returns to good state the relays the hysteresis is active before the relays return to good state and the corresponding LED goes off.
If manual reset is selected the relay and the LED remain in alarm state when the frequency returns to good state.
Manual reset is made by bridging terminals X2-M or by disconnecting the auxiliary supply.

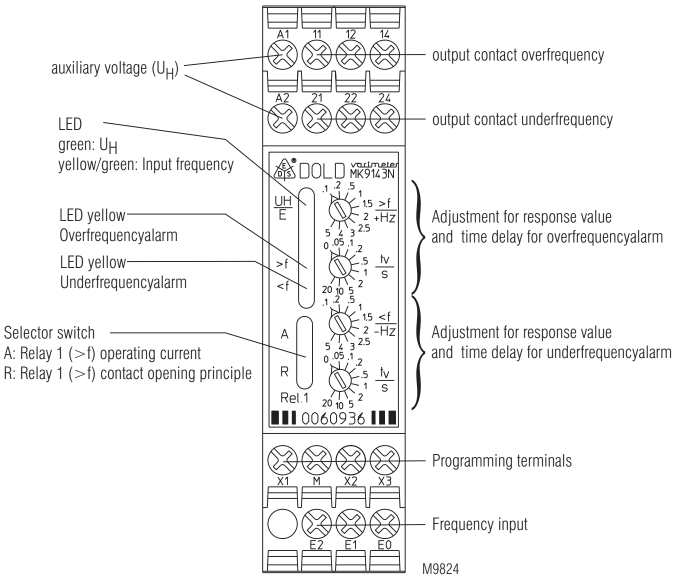
In de-energized on trip mode the output relay is energized in good state (contacts 11-14 etc. closed).
In energized on trip mode the output relay is energized in alarm state (contacts 11-14 etc. closed).

If start up delay is selected a timer is started after connection of auxiliary supply that disables the measuring circuit for the adjusted time. Both LEDs <f and >f flash together and the relays are in non tripped state (Good state). Using the start up delay an alarm can be avoided during start up of a generator.

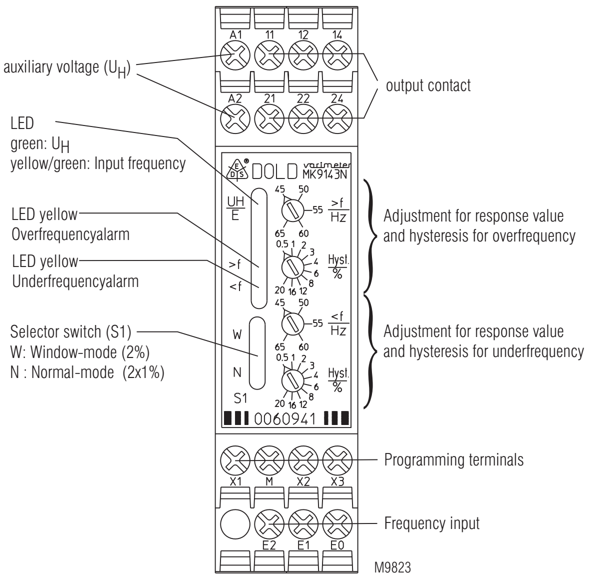
Indicators

Upper LED „UH/E“:	-	green, when only auxiliary voltage connected to A1 - A2
	-	yellow/green, when measuring frequency is detected on input
Lower LED „>f“ (yellow):	-	On, when overfrequency is detected, flashes (with short pulse) when time delay is active
Lower LED „<f“ (yellow):	-	On, when underfrequency is detected, flashes (with short pulse) when time delay is active
LEDs „>f“ and „<f“:		flash together during start up delay.

Settings



MK 9143N



MK 9143N/600

Notes

Frequency measuring input
The standard frequency measuring input for Ac voltages AC 40…550V is divided in 2 ranges (40…150 V on E1-E0 and 150-550 V on E2-E0) to achieve a higher immunity against Harmonics and disturbance. If the measuring voltage is around 150 V the smaller range should be used, as it can be overloaded continuously up to 250 V. In the case of lower measuring voltages an input for AC 10-280 V E1-E0 and 20 to 550 V E2-E0 is available with slightly lower disturbance immunity. If the measuring signal is missing or if it is to low on E0-E1-E2 the upper 2 colour LED UH/E lights green. The underfrequency output is tripped in this case as well. When the input voltage is high enough on the measuring input this LED light yellow-green.

Output contacts
Relay 1 (11-12-14, and 31-32-34 on MH 9143.39) is tripped on overfrequency. Relay 2 (21-22-24, and 41-42-44 on MH 9143.39) is tripped on underfrequency.
On the variant /600the slide switch on the front can be switched to position W (window mode) in that position both relays switch on under- and overfrequency.
Relay 1 can be switched over from energized to de-energized on trip, relay 2 only operates de-energized on trip.
The model /400 operates always window mode. Both relays switch on over- and underfrequency. On this variant both relays can be switched over together between energized and de-energized on trip

Programming terminals (M – X1 – X2 – X3):

Attention! The terminals M-X1-X2-X3 have no galvanic separation to the measuring circuit, and must be operated potential free.

M: Common connection (Ground) of the programming terminals
X1: A start up delay of 0…30 s after connection of auxiliary supply is achieved by connecting a X1 to M with a potentiometer or fixed resistor (see technical data). The start up delay can be stopped by bridging X1 to M at any time.
If no start up delay is required the terminals X1-M must be linked.

X2: Manual reset with NO contact push button on X2-M, auto reset with terminals X2-M bridged.
X3: selection of nominal frequency 50 or 60 Hz with MK 9143N and MH 9143;
selection of relay mode energized or de-energized on trip for relay 1 with MK 9143N/600 and MH 9143/600

Model MK 9143N and MH 9143:
This variant offers a very accurate frequency setting that is required e.g. for small generator sets which feed the public mains:
- the adjustment of the tripping values for over and underfrequency is accurate and reproducible in 10 steps from + / - 0,1 Hz to + / - 5 Hz
- the hysteresis is always 1/8 of the adjusted tripping value, I, e, at setting + or -0,1 Hz it is 0,012 Hz and at setting + or -4 Hz it is approx. 0,5 Hz
- the tripping delay is separately adjustable for over and under-frequency with a range of 20 s.
- switching between energized and de-energized on trip of relay 1 by slide switch Rel.1 on the front
- programming of mains frequency 50 or 60 Hz with terminal X3:
  X3 open: Frequency 50 Hz
  X3 linked to M: Frequency 60 Hz

Notes

Variant MH 9143.38/008: 45 mm width
Identically to MK 9143N, but with 11 step LED chain indicator and galvanic separated analogue output to display the difference between measured frequency and the mains frequency (50 or 60 Hz).
On terminals U/G of the analogue output 0-10 V are provided, on terminals I/G 0-20 mA are available. By bridging terminals Y1 and G the output can be switched over to 2-10 V and 4-20 mA. The middle value of the analogue output indicates nominal frequency, the display and analogue output shows ± 10% difference to the nominal frequency.

Model MK 9143N/400 and MH 9143/400
Identical with MK 9143N and MH 9143 but both output relays switch together (Window mode) and both can be switched over together via slide switch from energized to de-energized on trip.

Model MK 9143N/600 and MH 9143/600
To be used on local generator sets and other equipment where larger frequency tolerances are necessary:
- Adjustment of the tripping values for over and underfrequency individual between 45 and 65 Hz
- Separate adjustable hysteresis for over and underfrequency in a range of 0,5 … 20% of the tripping value
- Output function can be changed with slide switch (S1)on the front:
  Position „N“: Normal mode: relay 1 for overfrequency, relay 2 for underfrequency
  Position „W“: Window mode: relay 1+2 switch together at over and underfrequency
- Switching between energized and de-energized on trip of relay 1 by terminal X3:
  X3 open: de-energized on trip for relay 1
  X3 linked to M: energized on trip for relay 1

Adjustment aid for start up delay and alarm delay
During the elapse of start up delay and alarm delay on MK 9143N and MH 9143) the yellow LED <f or >f is flashing with a frequency of 2 Hz. To set a specific time value in seconds the number of flash pulses can be used to check the setting: Number of flash pulses divided by 2 = time delay in seconds.

Technical Data

Measuring Input (E0-E1-E2)

Voltage range
E0-E1: AC 40 ... 150 V,
E0-E2: AC 150 ... 550 V
Input resistance
E0-E1: approx. 170 kΩ
E0-E2: approx. 640 kΩ
Galvanic separation: Frequency measuring input to auxiliary voltage and output contacts
Response time of
Frequency monitoring: typ. 60 ms
(when alarm delay is 0)
Time between connection of auxiliary supply and ready to mesure: approx. 0,4 s (with start up delay is 0)
Start up time delay: adjustable from 0 ... 30 s with resitor/potentiometer between terminals X1 and M:

R / kΩ:	0	4,7	12	22	39	56	100	180	390	∞
t_{Anl} / s:	0	0,5	1	2	4	6	10	15	20	100

Adjustment of the response values (frequency threshold for alarm)
MK 9143N, MH 9143: 10 individual step as deviation from nominal frequency.

Overfrequency:	+0,1	+0,2	+0,5	+1	+1,5	+2	+2,5	+3	+4	+5	Hz
Underfrequency:	-0,1	-0,2	-0,5	-1	-1,5	-2	-2,5	-3	-4	-5	Hz

Setpiont frequency: 50 or 60 Hz, selectable via connection of terminal X3
Accuracy of the frequency threshold: better than 200 ppm (0,02 %)

Technical Data

Auxiliary voltage- and temperature influence: less than 200 ppm (< 0,02 %)
Hysterese: 1/8 of adjusted deviation value of nominal frequency
Time delay: separately adjustable for over- and under frequency alarm: 0 ... 20 s adjustable on logarithmic scale.
Adjustment of response value (frequency threshold for alarm)
MK 9143N/600, MH 9143/600: continously variable, separately for over- and underfrequency alarm: each 45 ... 65 Hz
Setting accurancy: approx. 1 Hz
Hysteresis: continously variable, separately for over- and underfrequency alarm: each 0,5 ... 20 % of the setting alarm threshold
Tolerances of the adjusted tripping values at variation of auxiliary supply and temperature: ± 0,2 Hz

Auxiliary Circuit

Auxiliary voltage U_H
(galvanic separation): AC 115, 230, 400 V
DC 12, 24, 48 V
AC/DC 24 ... 60, 110 ... 230 V (only for MH-version possible)
Voltage range:
AC: 0,8 ... 1,1 U_H
DC: 0,9 ... 1,2 U_H
AC/DC: 0,75 ... 1,2 U_H
Frequency range
AC: 45 ... 440 Hz
Nominal consumption:
AC: approx. 4 VA
DC: approx. 2 W

Output 11-12-14, 21-22-24; + 31-32-34, 41-42-44 at MH 9143.39

Contacts
MK 9143N.38, MK 9143.38/600: 2 x 1 C/O contacts, each 1 for over- and underfrequency alarm
MH 9143.39, MH 9143.39/600: 2 x 2 C/O contacts, each 2 for over- and underfrequency alarm
Thermal current I_{th}: 4 A
Switching capacity
according to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
according to DC 13
NO contact: 1 A / DC 24 V IEC/EN 60 947-5-1
NC contact: 1 A / DC 24 V IEC/EN 60 947-5-1
Elektrical life
acc. to AC 15 at 1 A, AC 230 V: $1{,}5 \times 10^5$ switching cycles IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: 30×10^6 switching cycles

Analogue Output with MH 9143.38/008

galvanic separation AC 3750V
to auxiliary supply, measuring circuit and relay outputs.
terminal U(+) / G(-): 0 ... 5 ... 10 V, max. 10 mA
terminal I (+) / G(-): 0 ... 10 ... 20 mA, max. burden 500 Ohm
change to 2 ... 10 V or 4 ... 20 mA by bridging terminal Y1 and G
Analogue output: ± 10% difference to the nominal frequency

Technical Data

General Data

Nominal operating mode: continuous operation
Temperature range:
Operation: - 20 ... + 60°C
Storage: - 25 ... + 60°C
Altitude: < 2.000 m
Clearance and creepage distance
rated impulse voltage / pollution degree:
output to measuring circuit: 4 kV / 2 IEC 60 664-1
output to auxiliary circuit: 4 kV / 2 IEC 60 664-1
output to output to: 4 kV / 2 IEC 60 664-1
auxiliary circuit to measuring input: 4 kV / 2 IEC 60 664-1
Programming terminals
M-X1-X2-X3: without galv. separation to measuring circuit
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF irradiation
80 MHz ... 1 GHz: 10 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz: 3 V / m IEC/EN 61 000-4-3
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
HF-wire guided: 30 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection:
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0,35 mm
Frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection
Cross section: 1 x 4 mm² solid or
2 x 1,5 mm² solid or
1 x 2,5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4 or
2 x 1,5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/
Stripping length: 8 mm
Wire fixing: Plus-minus terminal screws
M4 box terminals with wire protection
Fixing torque: 0.8 Nm
Mounting: DIN rail IEC/EN 60 715
Weight:
MK 9143N, MK 9143/600: approx. 210 g
MH 9143, MH 9143/600: approx. 295 g
MH 9143.38/008: approx. 350 g

Dimensions

Width x heigh x depth:
MK 9143N, MK 9143/600: 22,5 x 90 x 97 mm
MH 9143, MH 9143/600: 45 x 90 x 97 mm

Standard Type

MK 9143N.38 + / - 5 Hz U_H AC 230 V
Article number: 0060936

- Each 1 C/O contact for over- and underfrequency
- Auxiliary voltage U_H: AC 230 V
- Frequency measuring input: AC 40 ... 150 / 150 ... 550 V
- Trip points adjustable precisely and reproducible on 10 step rotational switch in the range of ± 0.1 Hz to ± 5 Hz related to 50 or 60 Hz
- Switching setpoint frequency: 50 / 60 Hz
- Time delay for over and underfrequency each adjustable from 0 ... 20 s
- Start up delay: 0 … 30 s selectable
- Manual or auto reset selectable
- Width: 22.5 mm

Variants

MK 9143N.38/400:	Same as MK 9143N.38, but with output relay in "Window"-Mode
MK 9143N.38/600:	- over- and underfrequency threshold each continously variable of 45 ... 65 Hz - without time delay - Hysteresis at over- and underfrequency each continously variable of 0.5 ... 20 % - Funktion mode of the outputrelay switchable on "Window"
MK 9143N.38/801:	Same as /600, but with fixed time delay for over- and underfrequency of 100 ms
MH 9143.38/008:	Same as MK 9143N.38, but with galvanic separated analogue output (current/voltage) and 11 step LED chain. Width: 45 mm
MH 9143.39:	Same as MK 9143N.38, but with each 2 C/O contacts for over- and underfrequency width: 45 mm
MH 9143.39/400:	Same as MK 9143N.38/400, but with each 2 C/O contacts for over- and underfrequency Width: 45 mm
MH 9143.39/600:	Same as MK 9143N.38/600, but with 2 C/O contacts for over- and underfrequency Width: 45 mm

Ordering example for variants

MK 9143N .38 /_00 U_H AC 230 V

- U_H AC 230 V: Auxiliary voltage
- /_00: 4: + / - 5 Hz; 6: 45 ... 65 Hz
- .38: Contacts
- MK 9143N: Type

MH 9143 .39 /_00 U_H AC 230 V

- U_H AC 230 V: Auxiliary voltage
- /_00: 4: + / - 5 Hz; 6: 45 ... 65 Hz
- .39: Contacts
- MH 9143: Type

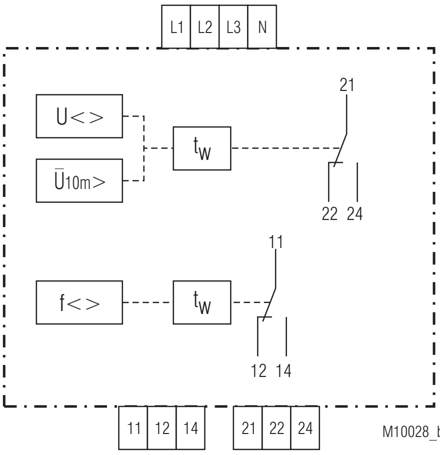
VARIMETER NA
Voltage and Frequency Monitor
RP 9800

DOLD

0262345

- According to DIN EN 60255-1, DIN EN 60947-1
- Voltage and frequency monitoring for generator sets >30 kVA on public grid, according to VDEW directive
- RP 9800: 3-phase voltage measurement to neutral
- Disconnection on rise and drop of voltage
- Disconnection on rise and drop of frequency
- Disconnection when 10 minute mean value differs to nominal voltage (overvoltage)
- Frequency and voltage are indicated by separate output relays
- Permits connection or re-connection after adjustable time delay t_w
- Protection against manipulation by sealable transparent cover over setting switches
- Precise adjustment and indication of setting values according to the directive
- High measuring accuracy
- Width 70 mm

Circuit Diagram



M10028_b

Approvals and Markings

AE68

Application

Monitoring of voltage and frequency for generator set >30 kVA connected to the public grid according to VDEW directive
As alternative to disconnector switches in plants with <30 kVA , when a manual isolator switch is used.

Function

The RP 9800 monitors the voltage of the 3 phases against neutral indicating over and undervoltage. The phase with the highest voltage (overvoltage) and the phase with the lowest voltage (undervoltage) will cause the relay to switch. The unit is calibrated to the mean RMS value.

The frequency is measured single phase in phase L1. (Reference N).

The voltage and frequency monitoring operate 2 separate output relays. When exceeding the setting values the output relays switch into de-energized state.

If the measured values are within or return to the adjusted ranges the activation or reset takes place after an adjustable time delay t_w.

Note

When using the variant RP 9800.12 N-terminal for 3-pase 4 wire connection, the neutral has to be connected.

Indication

green LED ON	On, when auxiliary supply connected.
red LED f<>	On, when frequency out of range.
red LED U<>	On, when voltage out of range, Flashes, when 10 min mean value is higher then setting.
yellow LED f<>	On, when relay f<> is energized, flashes during time delay t_w-relay f<>.
yellow LED U<>	On, when relay Rel. U<> s energized, flashes during time delay t_w - Rel. U<>.

Adjustment Facilities

Adjustment with 8-or 10 step rotary switches:

Poti f>(Hz):	- overfrequency (variant /500: 2 potentiometers)
Poti f<(Hz):	- underfrequency
Poti U>(%):	- overvoltage
Poti U<(%):	- undervoltage (variant /500: not available)
Poti $\overline{U}$ 10 min:	- overvoltage, 10 min mean value
Poti t_w(s):	- time delay for activation or reset

Standard factory settings according to VDE 0126
(not for time delay for activation):

Response value for:	- overfrequency f> = 50,2 Hz
Response value for:	- underfrequency f< = 47,5 Hz
Response value for:	- overvoltage U> = 115 %
Response value for:	- undervoltage U< = 80 %
Response value for:	- overvoltage, 10 min mean value $\overline{U}$10m> = 110 %
Time delay for:	- activation t_w = 40 s

Technical Data

Overfrequency:

RP 9800:	50.2 ... 52 Hz setting via 8 step rotary switch 50.2; 50.3; 50.4; 50.6; 50.8; 51.0; 51.5; 52 Hz	
RP 9800/500:	50.2 … 51.5 Hz Adjustment on 2 Pots each with 8 steps in steps of 0.1 Hz Pot. 2 min. + Pot. 1 50.2 … 50.8 Hz and Pot. 1 max. + Pot. 2 50.9 … 51.5 Hz	
Underfrequency:	47 ... 49.8 Hz setting via 8 step rotary switch 47; 47.5; 47.8; 48.2; 48.6; 49.0; 49.4; 49.8 Hz	
Overvoltage:	197 ... 218 V (L - N) (182 V) 248 ... 276 V (L - N) (230 V) setting via 8 step rotary switch 108%, 110%, 112%, 114%, 115%, 116%, 118%, 120% of U_N	
Undervoltage		
RP 9800:	131 ... 164 V (L - N) (182 V) 166 ... 207 V (L - N) (230 V) setting via 8 step rotary switch 72%, 74%, 76%, 78%, 80%, 82%, 86%, 90% of U_N	
RP 9800/500:	80% of U_N fixed	
Overvoltage, 10 minute mean value:	189 ... 211 V (L - N) (182 V) 239 ... 267 V (L - N) (230 V) setting via 8 step rotary switchr 104%, 106%, 108%, 110%, 112%, 114% 115% 116% von U_N	
Time delay for activation or reset:	setting via 10 step rotary switch 5, 10, 20, 30, 40, 50, 60, 70, 80, 90 s	
Repeat accuracy:	Voltage measuring $\leq \pm 1$ % Frequency measuring $\leq \pm 0.02$ %	
Hysteresis:	Voltage measuring ≤ 2.5 % Frequency measuring 0.05 Hz	
Response time (disconnection):	< 100 ms (typ. 75 ms)	
Output		
Thermal current I_{th}:	5 A	
Switching capacity according to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life to AC 15 at 1 A, AC 230 V		
NO contacts:	3 x 10^5 switching cycles	IEC/EN 60 947-5-1
Max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 50 x 10^6 switching cycles	

Technical Data

General Data

De-energized on trip:	are switched off when failure indicated or voltage is switched off 2 relays with C/O contact each 1. Rel. for f<>, 2. Rel. for U<>	
Voltage range:	3 x AC 85 V ... 280 V (U_H of all 3-phases to neutral)	
Terminals:	box terminal with cross recess screw	
Cross section:	solid / stranded 0,5 - 4 mm²	
Flexible with multicore cable ends:	0.5 - 2.5 mm²	
Multiple wire connection:	0.5 - 1.5 mm² (2 wires of same diameter)	
Temperature range:	-20 ...60 °C	
Clearance and creepage distance		
rated impulse voltage / pollution degree:	6 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Termials:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with VO behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10...55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Cross section:	solid/stranded 0.5 ... 4 mm²	
Stranded ferruled:	0,5 ... 2,5 mm²	
Multiple wire connection:	0,5 ... 1,5 mm² (2 wires with same cross section)	
Wire fixing:	box terminal with cross recess screw	
Mounting:	DIN rail	
Weight:	175 g	

Dimensiones

Width x height x depth: 70 x 90 x 71 mm

Standard Types

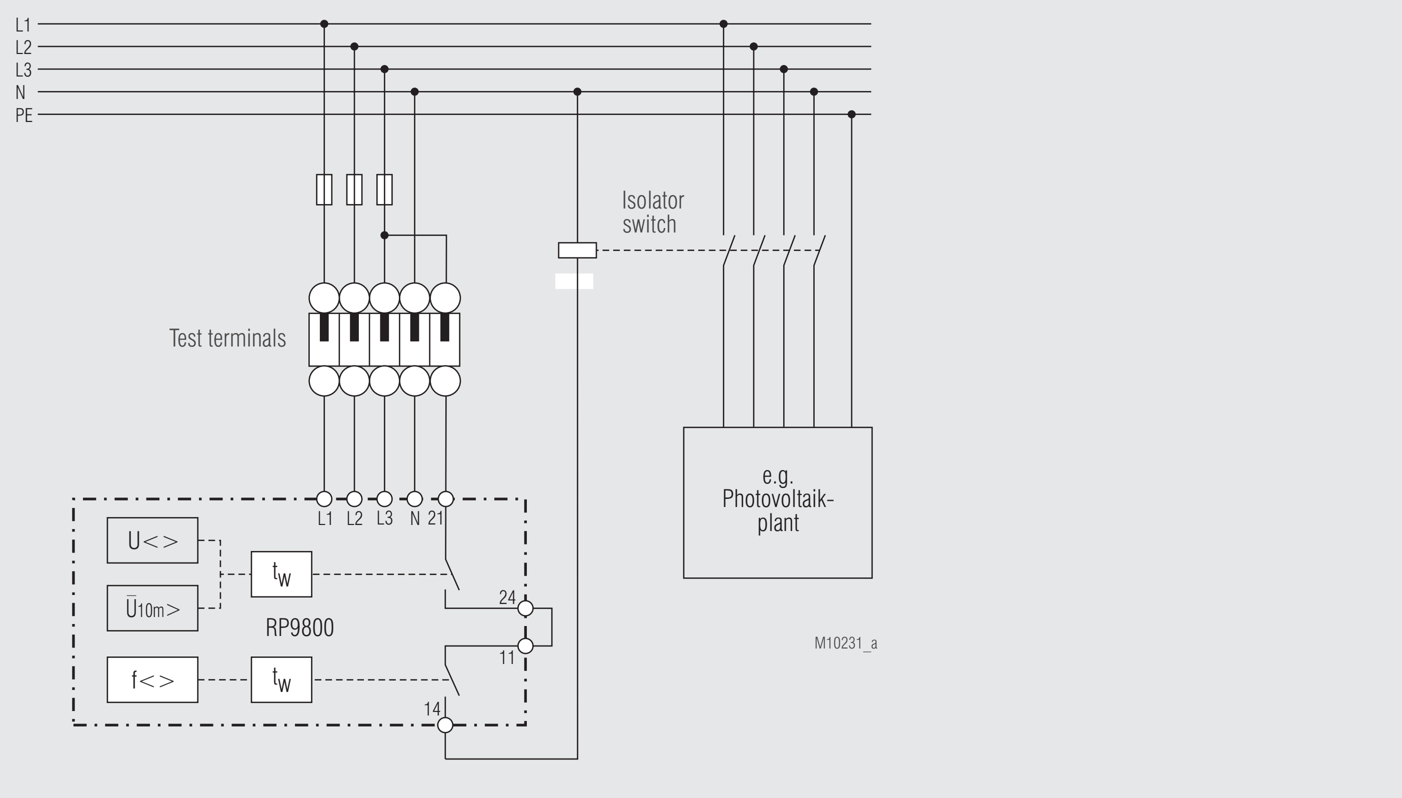
RP 9800.12 3/N AC 400/230V
Article number: 0062263

RP 9800.12 3/N AC 315/182 V
Article number: 0063103

RP 9800.12/200 3/N AC 690/400 V
Auxiliary voltage U_H: AC/DC 24 ... 80 V
Article number: 0063268

RP 9800.12/500 3/N AC 400/230V
Article number: 0064515

Application Example



VARIMETER NA
Voltage- and Frequency Monitor acc. to VDE-AR-N 4105
RP 9810

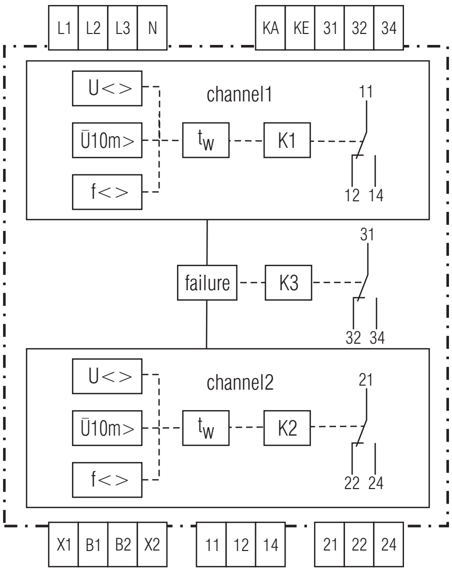
DOLD

0237306

Your Advantages
- Easy adjustment via rotational switch
- Precise adjustment and indication of setting values
- Indication, diagnostics and fault presentation via display
- Protection against manipulation by sealable transparent cover over setting switches
- Mains and system protection for your generator set

Features
- Certificate of conformity (test certificate) of the BG ETEM acc. to VDE-AR-N 4105
- Following DIN V VDE V 0126-1-1
- According to DIN EN 60 255-1
- Can be used according to EEG 2012 and SysStabV
- Voltage and frequency monitoring for generator sets >30 kVA on public grid, as option also for ≤ 30kVA
- Fail-safe because of 2-channel structure
- Certificate of conformity (test certificate) of the BG ETEM
- Monitoring of the section switches with measuring of response time
- System test via test button
- Isolated grid detection
- Manual reset
- With additional enabling input, e.g. for ripple control receiver
- Connection or re-connection after adjustable delay time t_w
- Factory setting according to VDE-AR-N 4105
- Random controlled disconnection in the range of 50.2 Hz and 51.5 Hz for non-regulated power generation systems
- Protection against manipulation by sealable transparent cover over setting switches
- Additional fault signalling relay output
- High measuring accuracy
- Installion type enclosure 4TE (width x height x depth: 70 x 90 x 71 mm)

Circuit Diagram



M10854_a

Approvals and Markings

CE | BG ETEM

Applications
- Photovoltaic, wind power
- Combined heat and power stations, water power
- Monitoring of voltage and frequency for generator set connected to the public grid according to VDE-AR-N 4105 directive

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3 / N	Auxiliary voltage and measuring inputs
11, 12, 14	Control of section switch 1
21, 22, 24	Control of section switch 2
31, 32, 34	Contacts fault signalling relay
X1, B1 / X2, B2	Enabling inputs
KA, KE	Feedback circuit of section switch

Functions

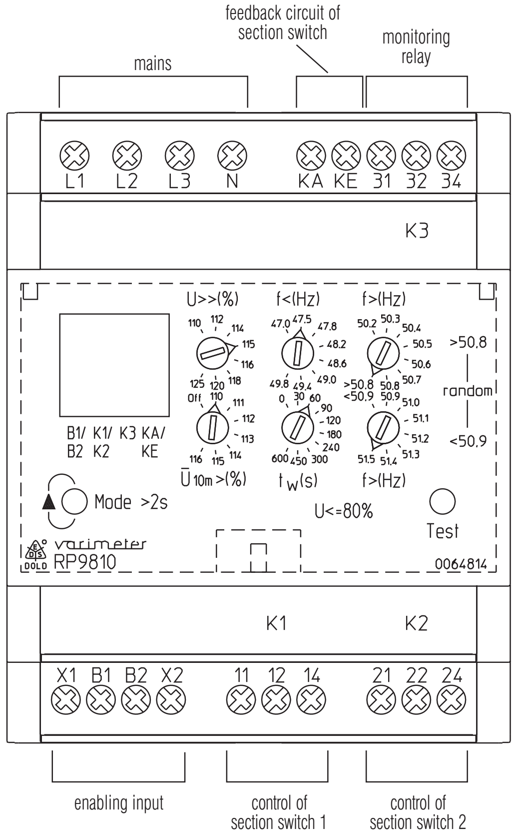
The voltage and frequency module RP 9810 monitors in domestic generator sets the mains of the energy supplier. It is built up in a redundant way and each of the 2 channels act on a separate output relay. The adjustment is made via rotational switches. The factory default setting is according to the description in VDE-AR-N 4105. The limit value for undervoltage is fixed at 80% of Un. After setup the settings may be sealed with a transparent front cover.

Measured values above or below the limits will lead to a disconnection of the generator system from the mains. The reconnection of the generator system to the mains is only enabled, when the frequency and the voltage are within the limits for the adjusted time tw without interruption. After a disconnection because of a short interruption, the reconnection is made when the frequency and the voltage are within the limits for 5 s without interruption. When the supply voltage has failed the conditions for the short interruption are not valid.

The voltage frequency monitor measures the voltage in all 3 phases between phase and neutral. In addition the phase-to–phase voltages are calculated and monitored. The frequency is measured single phase in both models in L1.

The indication of the operating status, the measured values and the fault memory is done on an LCD display. The value to be displayed is selected by pressing a pushbutton.

Indication



M10855

The colour of the backlight indicates the operating status of the device

Off: No supply voltage connected
Green: Normal operation.
Red: Failure status.
Yellow: Warning (failure message not acknowledged or test button pressed).

2 display modes can be selected, the actual value display and the failure memory display.
Pressing the button "Mode" (>2s) toggles between both display modes.

Actual value display
Displays the actual frequency and the voltage. Short activation of the button "mode" displays the next value.

Enabling via input B1/B2 active

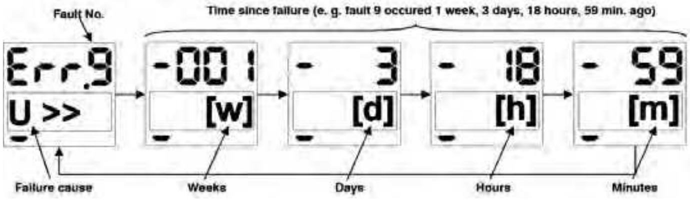
Feedback circuit KA-KE open (symmetric flashing indicates time elapse of the reconnection time)

Relays K1 and K2 energized

Monitoring relay K3 energized

Indication

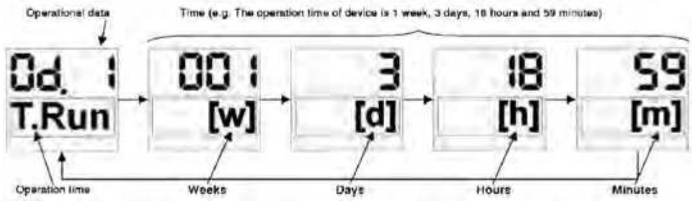
Display of failure memory
In failure display mode the failure entries with failure cause and relative time to event are shown. Short activation of the button "mode" displays the next failure message. If no entries are stored, the display shows "NoErr".



Display of operating data (variant /_02)
This variant displays additionally to the actual value and failure memory, the operating time or the disconnection time. Pressing the button "Mode" for more then 2 s toggels the display between actual value, failure memory and operating data.

Within this display mode the following operating data (Operational data can be selected by short actuation of the "Mode" button:

Od.1: „T.Run": ∑ Operating time (powersupply connected)
Od.2: „t.Err": ∑ Alarm-/ Failure duration
Od.3: „t.Xof": ∑ Duration of external disconnection (via input B1/B2)



All operational data is deleted by pressing "Mode" and "Test" for more than 2 seconds in operational data display mode. The reset is confirmed on the display "ResOd" (Reset operational data).

Error Indication

The failure status of the unit is indicated by a red backlight. If a failure is detected the unit automatically changes to failure memory display. The last 9 failures are stored, where failure 1 is the newest and failure 9 the oldest. The failures are displayed as follows

„U<“: undervoltage
„U10m>“: overvoltage, 10 min mean value
„U>>“: overvoltage
„f1<“: underfrequency
„f1>“: overfrequency
„KS“: failure section switch (broken wire in feedback circuit KA/KE or section switch contacts welded)
„KS??“: Warning section switch K1 and K2 energized but feedback circuit KA/KE indicates open section switch
„Setup“: Setting of the 2 overfrequency potentiometers (f>) is not plausible
„Sys.X“: System error
„Int.X“: Internal error

When leaving the failure state, the backlight changes from red to yellow in the first step. Only when the failures are acknowledged, either by deleting the failure memory or by changing into display mode actual value, the backlight changes to green. The entries of the failure memory stay valid when resetting a failure message (pressing the pushbutton “Mode” for >2s).

The failure memory is deleted by pressing the buttons “Mode” and “Test” simultaneously for more than 2 seconds in display mode failure or by disconnecting the supply L1/L2/L3/N for a longer period.

Fault Signalling Relay

A third output relay K3 indicates the disconnection of the generator system in the case of a failure (contact 31-32).

Isolated Grid Detection

The RP9810 includes a passive procedure to detect an isolated network according to chapter 6.5.3 and annex D2 of VDE-AR-N 4105. The 3-phase voltage monitoring allows this isolated network detection.

System Test

With the pushbutton „Test“ the contacts of the section switch can be tested for correct function. Pressing the test button disconnects the generator system from the mains. When testing the release time of the section switch is monitored via the feedback circuit. The measured time is shown on the LCD display. To determine the full disconnection time the measuring and evaluation time is added to the release time of the section switch. According to VDE-AR-N 4105 200 ms must not be exceeded.

Monitoring of Section Switches

Via the 2 contacts 11-14 and 21-24 the 2 section switches are controlled. The monitoring of the section switches is made by the feedback circuit (terminals KA-KE) to which the NC contacts of the section switches are connected (see connection diagrams).

The voltage and frequency monitor only connects the generator system to the mains when in disconnected state the feedback circuit KA-KE is closed, i.e. the section switches are de-energised (NC contacts are closed). As long as the section switch is not energized the feedback circuit KA-KE must be closed if not the failure “KS” is displayed.

Random Switch Off at Overfrequency

In VDE-AR-N 4105 a frequency range between 50.2 Hz and 51.5 Hz was defined. In this range a step less reduction of the generated power can be made if the generator is controllable.

Non controllable generator systems can alternatively disconnect themselves in the frequency range of 50.2 Hz and 51.5 Hz from the mains. In this case a symmetric distribution within this range of the disconnection frequency for each plant has to be observed. The RP9810 has a random setting facility within this range, by turning both related switches into position “random”. With this setting also the connection and reconnection time is automatically selected within a range of 1 ...10 minutes.

Adjustment Facilities

Adjustment with 8-or 10 step rotary switches:
Poti 1+2 f>(Hz): - overfrequency
Poti f<(Hz): - underfrequency
Poti U>>(%): - overvoltage
Poti $\overline{U}$10m>(%): - overvoltage, 10 min mean value
Poti t_w(s): - time delay for activation or reset
fixed: - undervoltage

Standard factory settings according to VDE-AR-N 4105
(not for time delay for activation):
Response value for: - overfrequency f> = 51.5 Hz
Response value for: - underfrequency f< = 47.5 Hz
Response value for: - overvoltage U>> = 115 %
Response value for: - undervoltage U< = 80 %
Response value for: - overvoltage, 10 min mean value $\overline{U10}$m> = 110 %
Time delay for: - time delay for activation or reset t_w = 60 s

Technical Data

Overfrequency:	50.2 … 51.5 Hz Adjustment on 2 Potis each with 8 steps in steps of 0.1 Hz Poti 2 min. + Poti 1 50.2 … 50.8 Hz or Poti 1 max. + Poti 2 50.9 … 51.5 Hz
Random disconnection:	50.2 ... 51.5 Hz setting f> "random"
Underfrequency:	47.0 ... 49.8 Hz setting via 8 step rotary switch 47.0; 47.5; 47.8; 48.2; 48.6; 49.0; 49.4; 49.8 Hz
Overvoltage	
at version ≤ 30 kVA:	253 ... 288 V (L - N)
at version > 30 kVA:	253 ... 288 V (L - N) + 438 ... 498 V (L - L)
both versions are	
setting via 8 step rotary switch:	110%, 112%, 114%, 115%, 116%, 118%, 120%, 125 % von U_N
Undervoltage	
at version ≤ 30 kVA:	184V (L - N)
at version > 30 kVA:	184V (L - N) + 319 V (L - L)
both versions:	80% von U_N fixed
Overvoltage,	
10 minute mean value:	
at version ≤ 30 kVA:	253 ... 267 V (L - N)
at version > 30 kVA:	253 ... 267 V (L - N) + 438... 462 V (L- L)
both versions are	
setting via 8 step rotary switch:	Off, 110%, 111%, 112%, 113%, 114%, 115%, 116% von U_N
Time delay for activation	
or reset:	0 ... 600s setting via 10 step rotary switch 0, 30, 60, 90, 120, 180, 240, 300, 450, 600 s
Random	
Random reconnection:	60 ... 600 s setting f> "random"
Reconnecting conditions	
voltage:	5% hysteresis
frequency:	47.5 Hz ... 50.05 Hz
Repeat accuracy:	Voltage measuring ≤ ± 1 % ± 1 digit Frequency measuring ≤ ± 0.02 % ± 1 digit
Response time (disconnection):	< 100 ms

Output

Relay K1 and K2:	1 changeover contact each	
relay K3:	1 changeover contact	

The 3 Output relays are de-energized on trip, after disconnection or failure

Thermal current I_{th}:	5 A	
Switching capacity		
according to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V		
NO contact:	3 x 10^5 switch. cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 50 x 10^6 switching cycles	

Technical Data

General Data

Voltage range:	3 x AC 85 V ... 288 V (U_H of all 3-phases to neutral)	
Enabling inputs B1/B2:	AC 24V, 40 ... 400Hz	
Temperature range:		
Operation:	- 20 ... 60 °C (At an ambient temperature below 0°C the LCD display may have restricted function.	
Storage:	- 25 ... 70 °C	
Altitude:	< 2.000 m	
Clearance and creepage distance		
rated impulse voltage/ pollution degree:		
Measuring circuit / 11, 12, 14 / 21, 22, 24:	6 kV / 2	IEC 60 664-1
Measuring circuit / B1, B2 / 31, 32, 34:	4 kV / 2	IEC 60 664-1
the Measuring circuit are:	L1, L2, L3, N, KA, KE, X1, X2	
EMC		
Electro static discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 2,7 GHz:	10 V/m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm Frequenz 10...55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
Cross section:	solid/stranded 0.5 ... 4 mm^2	
Stranded ferruled:	0.5 ... 4 mm^2	
Stripping length:	6.5 mm	
Wire fixing:	Plus-minus terminal screws M3.5 box terminals	
Fixing torque:	0.5 Nm	
Mounting:	DIN-rail	
Weight:	215 g	
Recommend fuse protection measuring inputs:	gG / gL 6A	

Dimensions

Width x height x depth: 70 x 90 x 71 mm

Standard Type

RP 9810.13 3/N AC 400/230V > 30 kVA
Article number: 0064814

RP 9810.13/100 3/N AC 400/230V ≤ 30 kVA
Article number: 0064860

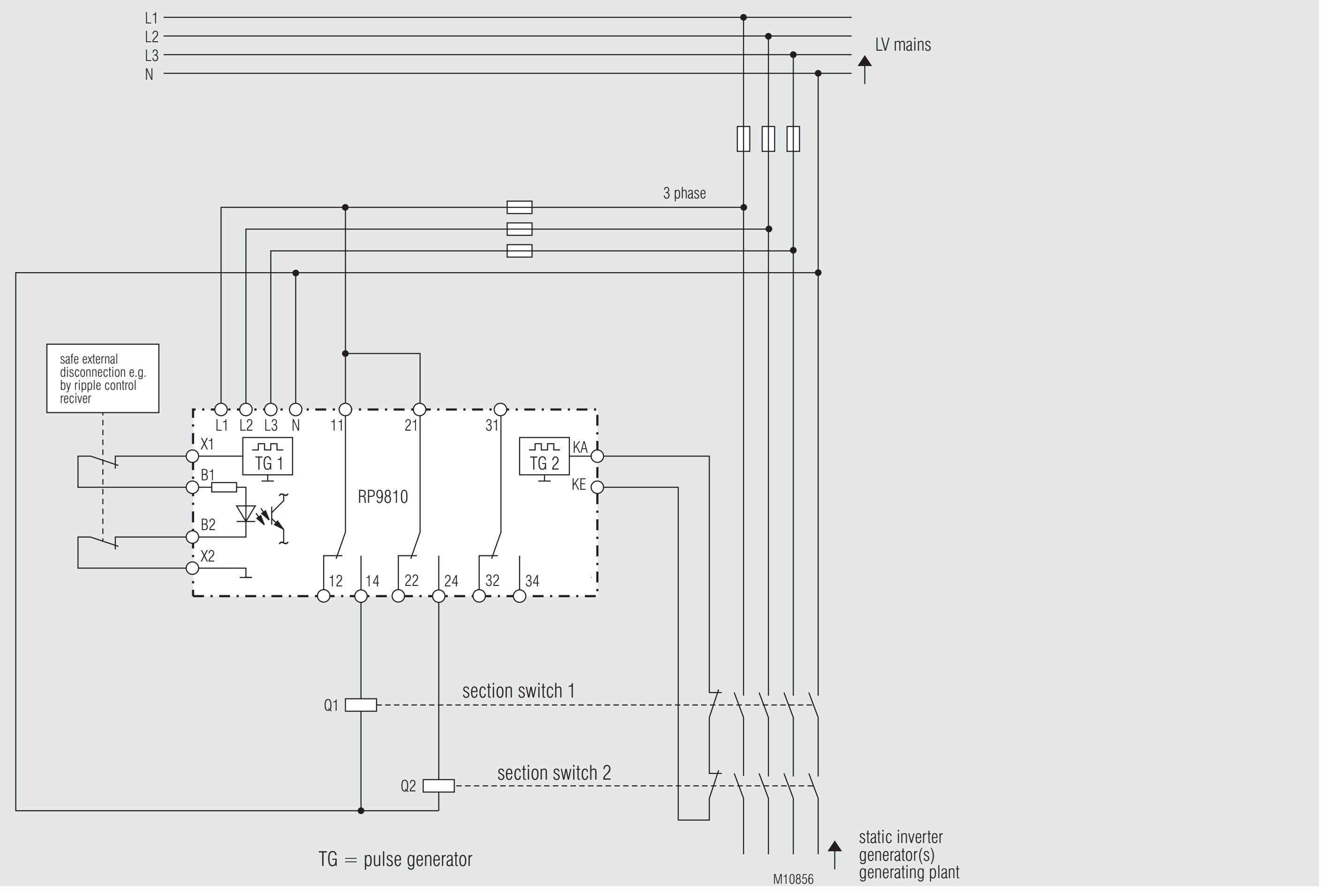
Variant

RP 9810.13/_ 02: with additional display of operating data

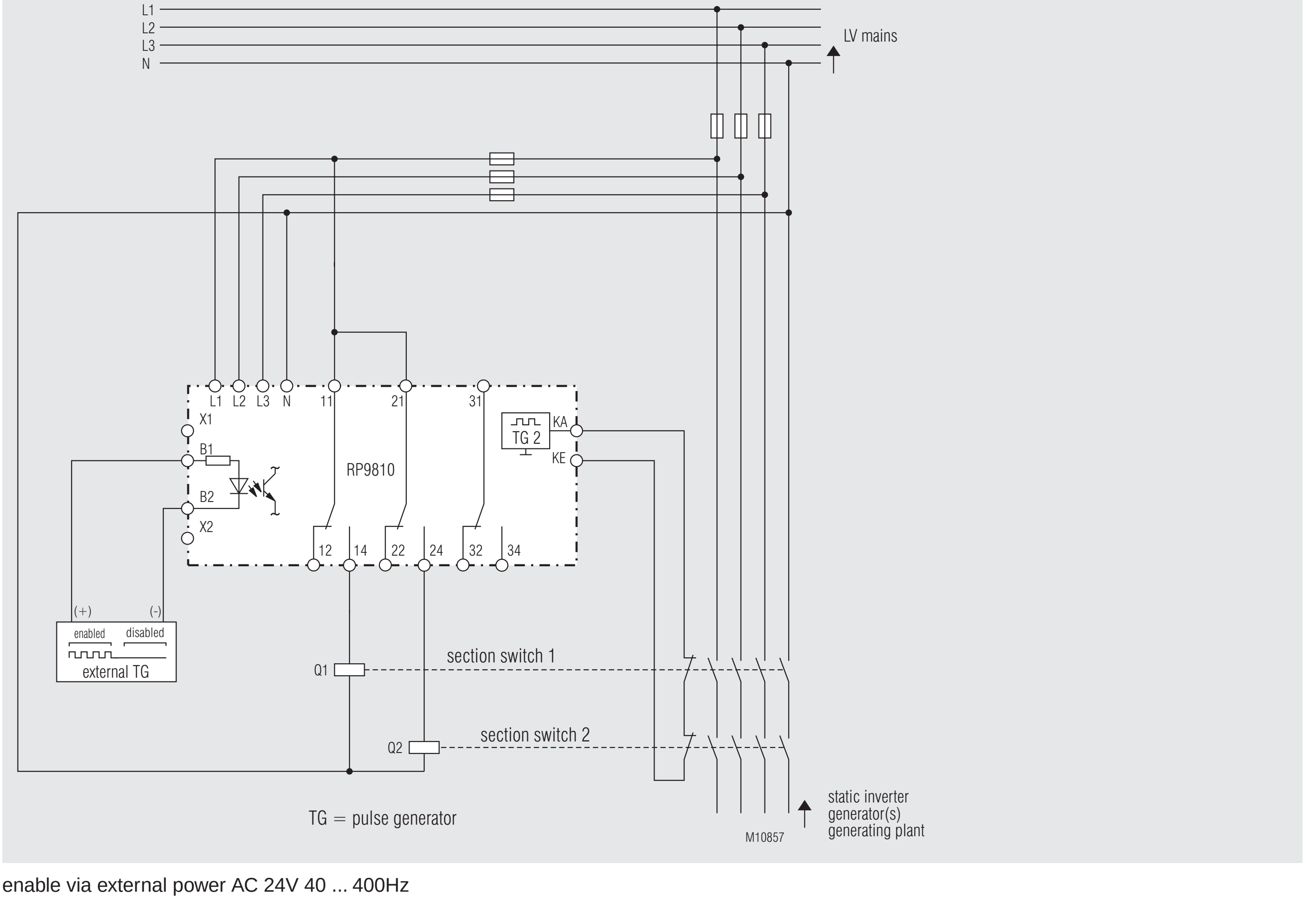
Ordering example for variant

RP 9810 .13 /_ 02 3N AC 400 / 230 V ≤ 30 kVA

- ≤ 30 kVA: Generator system power
- 3N AC 400 / 230 V: Nominal voltage
- 02: with additional display of operating data
- /_: Version 0: > 30 kVA 1: ≤ 30 kVA
- .13: Contact
- RP 9810: Type



enable via external contact



enable via external power AC 24V 40 ... 400Hz

Monitoring Technique

VARIMETER NA
Voltage and Frequency Monitor
RP 9811

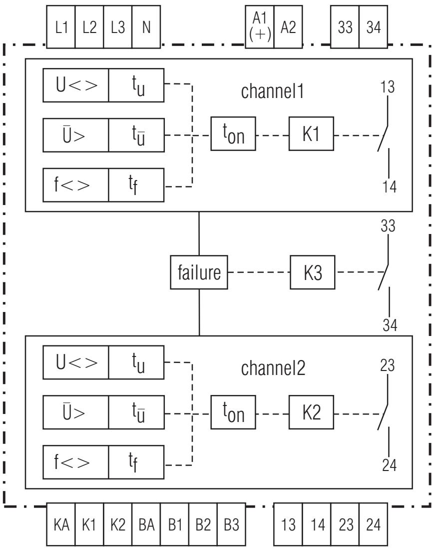
0268343

Your Advantages
- Mains and system protection for your generator set
- Can be used in several countries
  - DIN VDE 0126-1-1 (generator sets on public grid)
  - VDE-AR-N 4105 (generator sets on public grid)
  - BDEW-directive (generator sets on medium voltage grid)
  - CEI 0-21 (generator sets in Italy)
  - ÖVE/ÖNORM E8001-4-712 (generator sets in Austria)
  - G59/3 (generator sets in UK)
- Easy adjustment via rotational switch and menu display
- Indication, diagnostics and fault presentation via display and LEDs
- Password protected
- Protection against manipulation by sealable transparent cover over setting switches
- CRC-value for parameter testing
- Adjustment of the voltage for nominal voltage will change the limit values accordingly
- Mains synchronization on generator operation

Features
- Certificate of conformity (test certificate) of the BG ETEM
- Acc. to VDE-AR-N 4105, DIN VDE 0126-1-1, BDEW-directive, CEI-0-21
- Acc. to DIN EN 60 255-1
- Can be used according to EEG 2012 and SysStabV
- Voltage and frequency monitoring for generator sets
- Fail-safe 2-channel structure
- Monitoring of the section switches by measuring the response time
- System test via test button
- Enabling inputs allow integration into various ripple control and plant concepts
- Isolated grid detection
- Manual reset
- Memorising of disconnection time
- Connection or re-connection after adjustable delay time t_{On}
- Factory setting according to:
- VDE-AR-N 4105, DIN VDE 0126-1-1, BDEW-directive, CEI 0-21, ÖVE/ÖNORM, G59/3 LV
- Random controlled disconnection in the range of 50.2 Hz and 51.5 Hz for non-regulated power generation systems
- Random operated connection time (t_{on}) setting range 60...600 s
- Additional fault signalling relay output
- High measuring accuracy
- Installion type enclosure 4TE (width x height x depth: 70 x 90 x 71 mm)

Product Description
The voltage and frequency monitor RP 9811 represents a safe solution to monitor and optimize mains supply when feeding power to a public grid that conforms with various national standards. User-friendly: The unit can be adjusted quickly and simply with only two rotary switches. Use the first rotary switch to select one of the already preset standards according to your national requirements. Use the second rotary switch to set the type of system, quickly and simply, on the unit. You can adjust each parameter individually with menu-guidance in case of different requirements. All measuring variables required are constantly determined by the unit. If incorrect voltage or frequency values occur, the RP 9811 disconnects the distributed power generation system securely from the mains.

Circuit Diagram



M10900_e

Approvals and Markings

CE | BG ETEM

Connection Terminals

Terminal designation	Signal designation
A1(+), A2	Auxiliary voltage AC or DC
L1, L2, L3, N	Connections for measuring ciruit
KA, K1, K2	Feedback circuit of external section switch KA / K1: section switch 1 KA / K2: section switch 2
BA; B1, B2, B3	Enabling of monitoring function: BA / B1 + BA / B2 bridged) + BA / B3 open With setting standard CEI 0-21: BA / B2 - function selection
K1 (13, 14)	Connection section switch 1 - NO contact
K2 (23, 24)	Connection section switch 2 - NO contact
K3 (33, 34)	Fault indicating relay - NO contact (open NO: indicates fault)

Applications
Monitoring of voltage and frequency for generator sets e.g.:
- Photovoltaic
- Wind power
- Water power
- Combined heat and power stations

Functions

The voltage and frequency module RP 9811 monitors the domestic generator set and the mains of the energy supplier. It is built up in a redundant way and each of the 2 channels act on a separate output relay. The adjustment is made via menu and rotational switches. The factory default setting is set by rotational switch and can be setted via menu. After setup the settings can be sealed with a transparent front cover or alternatively protected by password.

Measured values above or below the limits will lead to a disconnection of the generator system from the mains. The reconnection of the generator system to the mains is only enabled, when the frequency and the voltage are within the limits for the adjusted time t_{On} without interruption.

The voltage frequency monitor RP 9811 measures the voltage in all 3 phases between phase and neutral. Depending on the rotary switch setting the phase-to-phase voltages are calculated and monitored. The frequency is measured single phase in both models on L1.

The operating state, measured values, error memory and the parameters are viewed via LCD display. The measured value, operating data or scan of the error memory is selected via the "Mode" button, the parameters are selected via the "RUN/SET" button.
Status LEDs are available also.

Parameter No. 25 short interruption (t_{On}Short) = on:
After the disconnection due to a short interruption < 3 s, reconnection automatically occurs if the mains frequency and voltage have been continuously within the tolerance range for 5 s. A short term interruption does not register as a hard failure of the operating voltage.

Changing the mains rated voltage – limit values adjust automatically
If the mains voltage must be adjusted because of the requirements of the power supply utility or if the operation of the voltage and frequency monitor takes place on a medium-voltage grid, parameter 1 (rated voltage U_N) must be adjusted accordingly. With a medium-voltage grid, this is due to the transformation ratio of the voltage measuring transducer used through which the device is connected to the grid.
The voltage-related monitoring parameters are set as percentage deviation of the mains rated voltage. When the mains rated voltage changes, the absolute limits adjust automatically to the changed mains rated voltage.

Functions

Function RoCoF (df/dt)

RoCoF „Rate of Change of Frequency“ (rate of Change of Frequency)

Parameter:

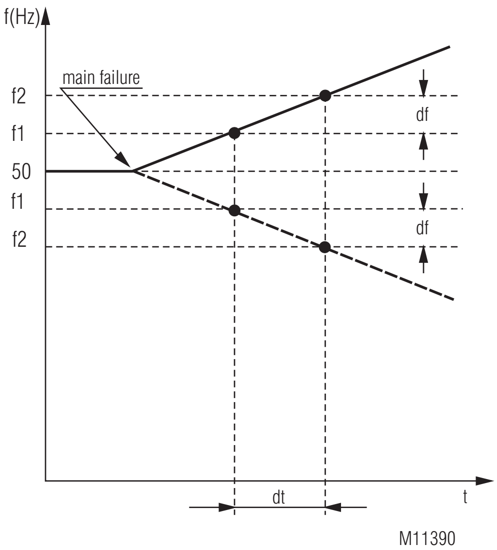
Parameter table

	Display	Value	
1)	RoCoF	0,10 ... 5 Hz /s / off	df / dt
2)	T_df/dt	0,05 ... 10 s / off	off delay
3)	Perio	4 ... 50	Number of cycles for measurement
Default- setting: 4 cycles			

Description
The voltage and frequency monitor RP 9811 is able to measure the rate of change of frequency df/dt (frequency gradient). If the frequency gradient rises for an adjustable time over an adjustable value the RP 9811 switches off after an adjustable time.

The frequency gradient can be positive or negative, i.e. rising frequency as well as dropping frequency can be detected.

Response
If for the duration of the selected number of cycles the frequency gradient is exceeded, the adjusted time delay „T_df/dt“ is started, the display shows the failure message “RoCoF” and the fault signaling relay switches.
If the failure gradient goes under the response value minus hysteresis of 5% within the selected number of cycles or the direction of change of frequency changes the monitoring cycle starts again from the beginning.
Only when the time delay „T_df/dt“ is finished the RP 9811 switches off. If „T_df/dt“ = off the RP9811 switches off immediately.



Function Vector shift

Parameter:

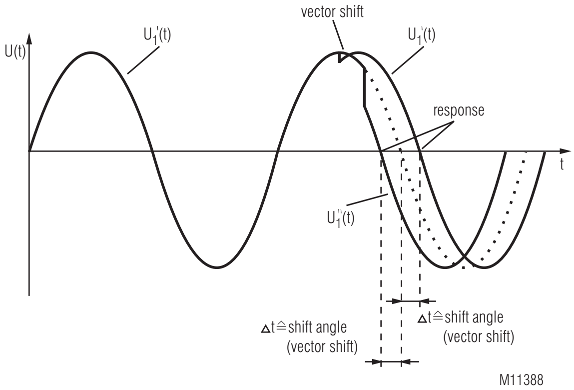
Parameter table

1)	VecSh	2 ... 20° / off	(Vector shift)
2)	Phase	1 / 3	(single- oder 3-phase)

Description
The add-on fast disconnection on vector shift detects phase jumps in all 3 phases simultaneously. Independent of this the unit can be set to react on single phase vector shift (sensitive measurement).
The selection is done with parameter “Phase” number of phases 1 or 3 phases. When selecting 3 phases the vector shift response takes only place when the adjusted vector shift angle is exceeded in all 3 phases.

The shift angle can be adjusted between 2 and 20%. The value could be positive or negative. The actual frequency is continuously measured in all 3 phases. The measurement is based on time measurements of full frequency cycles and is calculated as mean value of 8 cycles before a vector shift. To detect a vector shift the sum of two cycles is relevant.
After each cycle a new sum is calculated. A angle shift that has the length of 2 cycles is reliably detected.

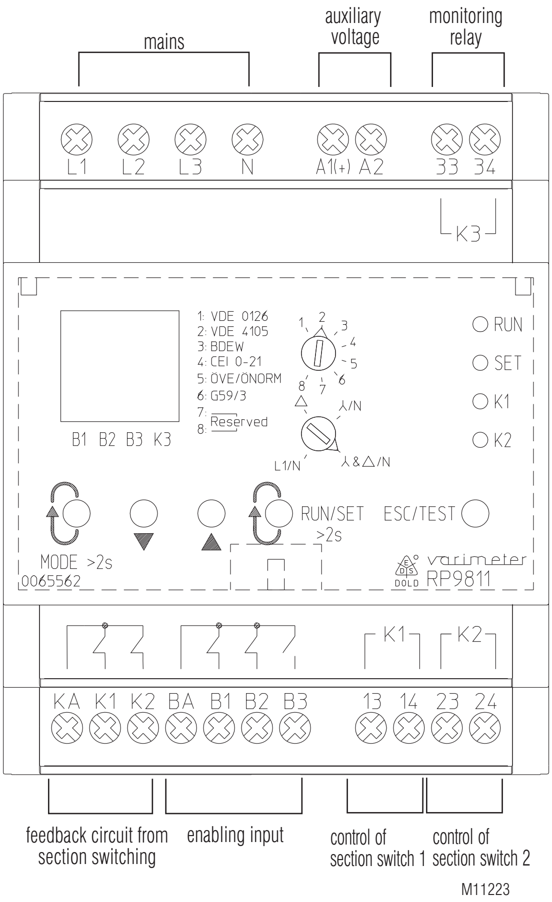
Response
When detecting a vector shift the RP 9811 disconnects within <50 ms.



Reset
If a disconnection was caused by the functions „vector shift“ or „RoCoF“ the reset is started after a delay of 5 seconds. The adjustable reset time “tON” elapses. To start the reset the mains must be without fault and the monitoring function is enabled (inputs BA/B1, B2, B3).

Application
The functions „RoCoF“ and vector shift are mainly used in generator operation. See also Application example „Generator operation with mains synchronization„ in the data sheet.

Indicators



The colour of the backlight indicates the operating status of the device

Off: No supply voltage connected
Green: Normal operation.
Red: Failure status.
Yellow: Warning (failure message not acknowledged or test button pressed).

Four display modes can be selected: the measured value display, operating data display, error memory display and the display of the set parameters. Switching between the display modes is done by pressing the "Mode" button long (> 2 s). Switching to the display of the parameters set is done by pressing the RUN/SET button long (> 2s). When in the display mode of the parameters set, switch to the input mode for parameters to change the settings. This is done by pressing the ▼ ▲ button

Actual value display

Displays the actual frequency and the voltage. Short activation of the button "mode" displays the next value

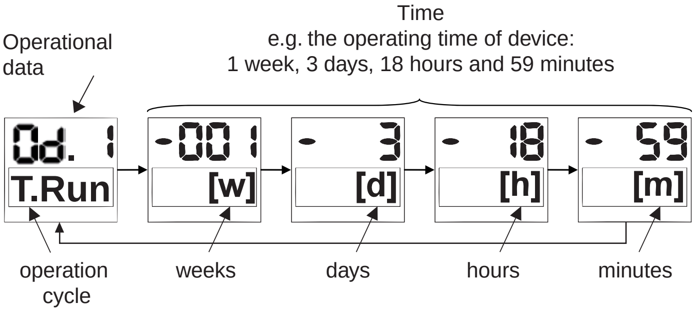
Indicators

Display of the operating data

If the operating voltage is present, various operating data, e.g. the operating duration of the device or the disconnect time, is recorded and added.

Within this display mode the following operating data can be selected by short actuation of the "Mode" button:

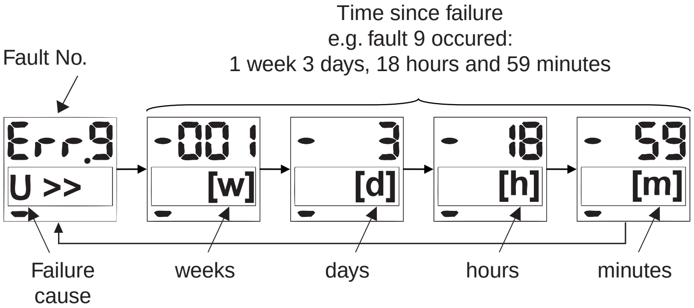
Od.1: „T.Run":	∑ Operating time (powersupply connected)
Od.2: „t.Err":	∑ Alarm-/ Failure duration
Od.3: „t.Xof":	∑ Duration of external disconnection (via input B1/B2/B3)

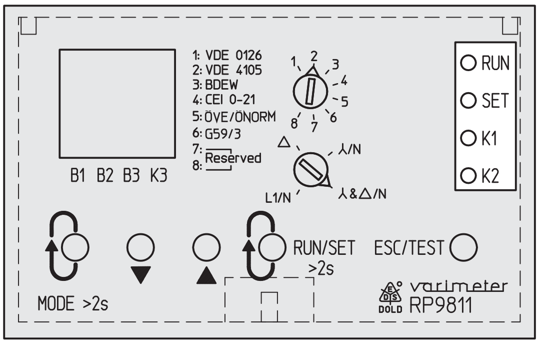


All operational data is deleted by pressing "Mode" and "Test" for more than 2 seconds in operational data display mode. The reset is confirmed on the display "ResOd" (Reset operational data).

Display of failure memory

In failure display mode the failure entries with failure cause and relative time to event are shown. Short activation of the button "mode" displays the next failure message. If no entries are stored, the display shows "NoErr".

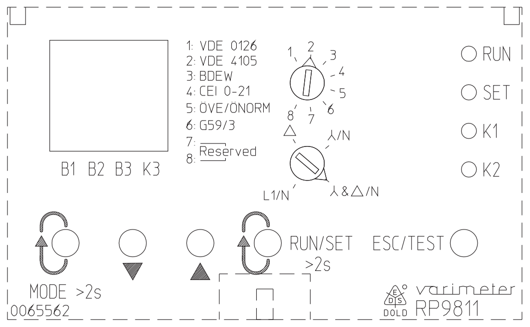




Indication LED

RUN:	Unit in RUN-Mode
SET:	Unit in Input-Mode
RUN+SET simultaneity on:	Adjusted parameters are displayed
K1 on:	Section switch K1 energized
K1 flashing:	Connecting delay is running
K2 on:	Section switch K2 energized
K2 flashing:	Connecting delay is running

Adjustment Facilities



Operating element

MODE	Press the button > 2 s: Device switches to the display mode (measured value, operating data, error memory)
RUN/SET > 2 s:	Device switches to the parameter mode or also back to the display mode. In the parameter mode: Scroll through the parameters stored by briefly pressing the button. They are shown on the display. Press the button in the input mode > 2 s: Save parameters, switch to the RUN mode.
▲ Up	If the device is in the parameter mode, pressing these buttons switches to the input (SET) mode of the parameters.
▼ Down	The values are changed in the input mode.
ESC/TEST	Switch to the display mode without saving changed values. The device switches to the display (RUN) mode without saving the changed values. In the RUN and parameter mode: Test function is triggered; the disconnect time of the section switches is measured here and shown on the display in (ms).

Adjustment by rotational switch

Rotary switch Standard selection:
Device works according to
1: DIN V VDE V 0126-1-1
2: VDE-AR-N 4105 (rotary switch network connection: ⅄&△/ N !)
3: BDEW-directive
4: CEI 0-21
5: ÖVE/ÖNORM
6: G59/3
7 ... 8: Reserved

Rotary switch network connection:
△: Delta voltage
⅄/N: Star voltage
⅄ &△/N: Delta- and star-voltage
L1/N: Voltage L1-N

Example:
Standard factory settings according to VDE-AR-N 4105
(not for time delay for activation):
Response value for: - overfrequency f> = 51,5 Hz
Response value for: - underfrequency f< = 47,5 Hz
Response value for: - overvoltage V>> = 115 % of U_N
Response value for: - undervoltage V< = 80 % of U_N
Response value for: - overvoltage, 10 min mean value $\overline{\text{V10m}}$> = 110 %
Time delay for: - reactivation t_{On} = 60 s

Adjustment Facilities

Remark to standard G59/3 (rotary switch for standard selection position 6)
The parameters for G59/3 LV (Low Voltage Grid) are preset.

If the RP9811 should operate according to G59/3 HV (High Voltage Grid) the following settings have to be changed:

e.g. for 110 V L-L: (rotary switch for standard selection position 6)
- rotary switch network connection: Delta voltage
- Parameter Nr. 1: Nominal voltage (Phase to Phase) change from 400V to 110V.
- Parameter Nr. 2: U> change from 114% to 110% (acc. to standard)
- Parameter Nr. 6: U>> change from 119% to 113% (acc. to standard)
- Parameter Nr. 20: U> On change from 114% to 110%

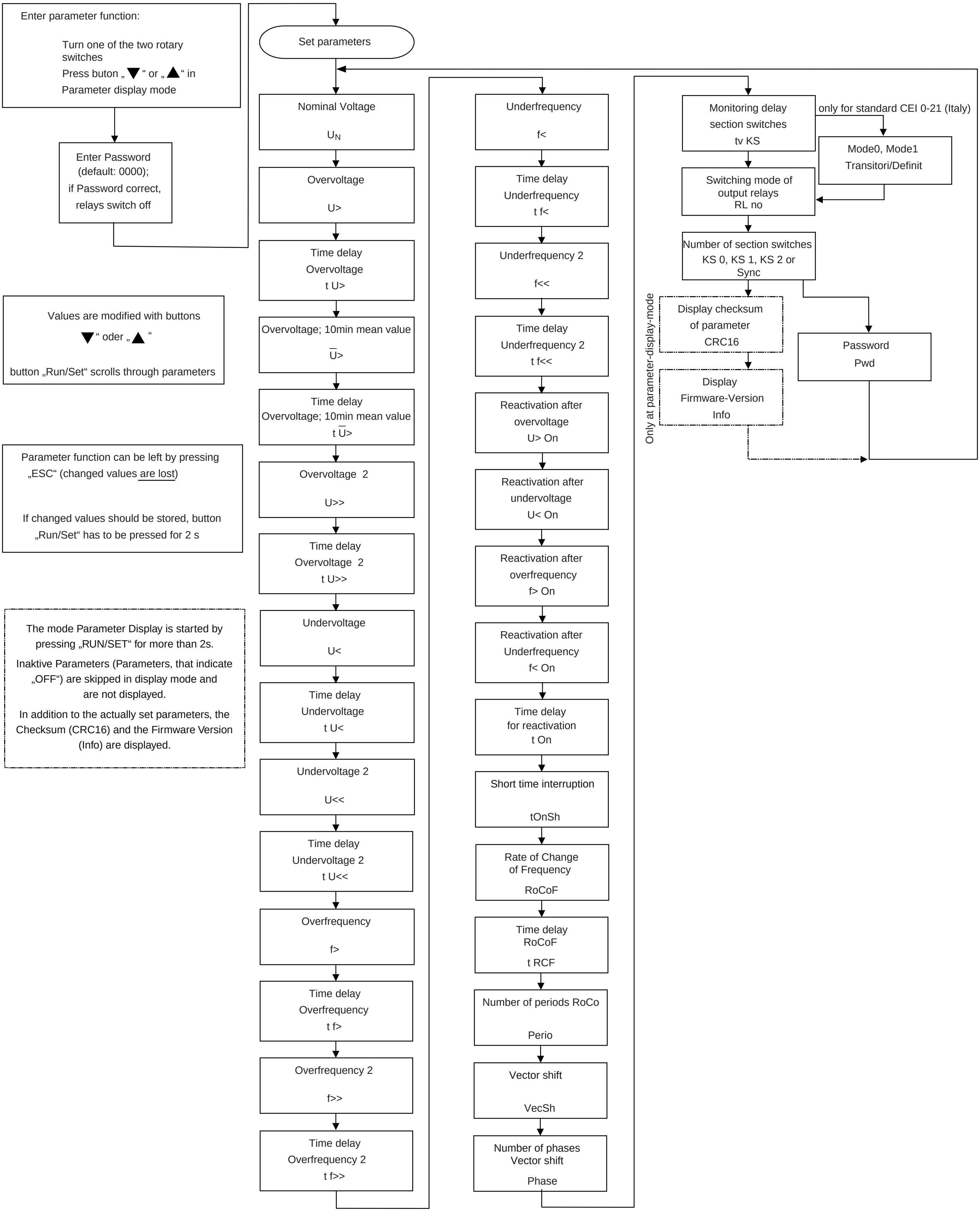
No.	Parameter	VDE 0126		VDE-AR-N 4105		BDEW- medium voltage		Italy CEI0-21		ÖVE/ÖNORM E 8001-4-712		Großbritannien G59/3 Low Voltage Grid	
		Default	Setting range	Default	Setting range	Default	Setting range	Default	Setting range	Default	Setting range	Default	Setting range
Monitoring-/ disconnection parameters:													
1	Nominal voltage U_N (Delta- or star-voltage depending on rotary switch setting)	230V (400V)	50-230V (87-400V) Step 1V	230V (400V)	50-230V (87-400V) Step 1V	230V (400V)	50-230V (87-400V) Step 1V	230V (400V)	50-230V (87-400V) Step 1V	230V (400V)	50-230V (87-400V) Step 1V	230V (400V)	50-230V (87-400V) Step 1V
2	Overvoltage U>	off	100-130% / off Step 1%	off	100-130% / off Step 1%	108%	100-130% / off Step 1%	off	100-130% / off Step 1%	off	100-130% / off Step 1%	114%	100-130% / off Step 1%
3	Time delay overvoltage t U>	off	0-60s / off Step 0,1s	off	0-60s / off Step 0,1s	60s	0-60s / off Step 0,1s	off	0-60s / off Step 0,1s	off	0-60s / off Step 0,1s	1s	0-60s / off Step 0,1s
4	Overvoltage, 10 min mean value $\overline{U}$>	110%	100-120% / off Step 1%	110%	100-120% / off Step 1%	off	100-120% / off Step 1%	110%	100-120% / off Step 1%	112%	110-115% / off Step 1%	off	100-120% / off Step 1%
5	time delay Overvoltage, 10 min mean value t $\overline{U}$>	3s	0,2-10s / off Step 0,1s	3s	0,2-10s / off Step 0,1s	off	0,2-10s / off Step 0,1s	3s	0,05-10s / off Step 0,05s	off	0,2-10s / off Step 0,1s	off	0,2-10s / off Step 0,1s
6	Overvoltage 2 U>>	115%	100-130% Step 1%	115%	100-130% Step 1%	120%	100-130% Step 1%	115%	100-130% Step 1%	115%	100-130% Step 1%	119%	100-130% Step 1%
7	Time delay overvoltage 2 t U>>	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,2s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,5s	0,05-10s / off Step 0,05s
8	Undervoltage U<	80%	10-100% Step 1%	80%	10-100% Step 1%	80%	10-100% Step 1%	85%	20-100% Step 1%	80%	10-100% Step 1%	87%	10-100% Step 1%
9	Time delay undervoltage t U<	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	2,7s	0,05-10s / off Step 0,05s	0,4s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	2,5s	0,05-10s / off Step 0,05s
10	Undervoltage 2 U<<	off	10-100% / off Step 1%	off	10-100% / off Step 1%	45%	10-100% / off Step 1%	40%	20-100% / off Step 1%	off	10-100% / off Step 1%	80%	10-100% / off Step 1%
11	Time delay undervoltage 2 t U<<	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,3s	0,05-10s / off Step 0,05s	0,2s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,5s	0,05-10s / off Step 0,05s
12	Overfrequency f>	50,2 Hz	50-52Hz / off Step 0,05Hz Random 50,2…51,5Hz	51,5 Hz	50-52Hz / off Step 0,05Hz Random 50,2…51,5Hz	51,5 Hz	50-52Hz / off Step 0,05Hz Random 50,2…51,5Hz	50,5 Hz	50-52Hz Step 0,05Hz Random 50,2…51,5Hz	51,0	50-52Hz Step 0,05Hz	51,5Hz	50-52Hz / off Step 0,05Hz
13	Time delay overfrequency t f>	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,1s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	90s	0-99s / off Step 0,1s
14	Overfrequency 2 f>>	off	50-52Hz / off Step 0,05Hz	off	50-52Hz / off Step 0,05Hz	off	50-52Hz / off Step 0,05Hz	51,5 Hz	50-52Hz Step 0,05Hz	off	50-52Hz / off Step 0,05Hz	52,0Hz	50-52Hz / off Step 0,05Hz
15	Time delay overfrequency 2 t f>>	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,1s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,5s	0,05-10s / off Step 0,05s
16	Underfrequency f<	47,5 Hz	47-50Hz Step 0,05Hz	47,5 Hz	47-50Hz Step 0,05Hz	47,5 Hz	47-50Hz / off Step 0,05Hz	49,5 Hz	47-50Hz Step 0,05Hz	47,0Hz	47-50Hz Step 0,05Hz	47,5Hz	47-50Hz Step 0,05Hz
17	Time delay underfrequency t f<	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,1s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	20s	0-99s / off Step 0,1s
18	Underfrequency 2 f<<	off	47-50Hz / off Step 0,05Hz	off	47-50Hz / off Step 0,05Hz	off	47-50Hz / off Step 0,05Hz	47,5 Hz	47-50Hz Step 0,05Hz	off	47-50Hz / off Step 0,05Hz	47,0Hz	47-50Hz / off Step 0,05Hz
19	Time delay underfrequency 2 t f<<	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,1s	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	0,5s	0,05-10s / off Step 0,05s

No.	Parameter	VDE 0126		VDE-AR-N 4105		BDEW- medium voltage		Italy CEI0-21		ÖVE/ÖNORM E 8001-4-712		Großbritannien G59/3 Low Voltage Grid	
		Default	Setting range	Default	Setting range	Default	Setting range	Default	Setting range	Default	Setting range	Default	Setting range
Connection parameters:													
20	Reactivation after overvoltage U> On	110%	100-120% / off Step 1%	110%	100-120% / off Step 1%	off	100-120% / off Step 1%	110%	100-120% / off Step 1%	112%	100-120% / off Step 1%	114%	100-120% / off Step 1%
21	Reactivation after undervoltage U< On	85%	20-100% Step 1%	85%	20-100% Step 1%	95%	20-100% Step 1%	85%	20-100% Step 1%	80%	20-100% Step 1%	87%	20-100% Step 1%
22	Reactivation after overfrequency f> On	50,05 Hz	50-52Hz Step 0,05Hz	50,05 Hz	50-52Hz Step 0,05Hz	50,05 Hz	50-52Hz Step 0,05Hz	50,10 Hz	50-52Hz Step 0,05Hz	51,0Hz	50-52Hz Step 0,05Hz	51,5Hz	50-52Hz Step 0,05Hz
23	Reactivation after underfrequency f< On	47,5 Hz	47-50Hz Step 0,05Hz	47,5 Hz	47-50Hz Step 0,05Hz	47,5 Hz	47-50Hz Step 0,05Hz	49,9 Hz	47-50Hz Step 0,05Hz	47,0Hz	47-50Hz Step 0,05Hz	47,5Hz	47-50Hz Step 0,05Hz
24	Time delay for reactivation t On	60s	1-600s Step 1s Random 60…600s	60s	1-600s Step 1s Random 60…600s	1s	1-600s Step 1s Random 60…600s	300s	1-600s Step 1s Random 60…600s	30s	1-600s Step 1s	20s	1-600s Step 1s
25	Short time interruption tOnSh	off	on / off	on	on / off	off	on / off	off	on / off	on	on / off	on	on / off
RoCoF/Vector shift:													
26	Rate of Change of Freqency RoCoF	off	0,10-5Hz/s / off Step 0,01Hz/s	off	0,10-5Hz/s / off Step 0,01Hz/s	off	0,10-5Hz/s / off Step 0,01Hz/s	off	0,10-5Hz/s / off Step 0,01Hz/s	off	0,10-5Hz/s / off Step 0,01Hz/s	off	0,10-5Hz/s / off Step 0,01Hz/s
27	Time delay RoCoF t RCF	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s	off	0,05-10s / off Step 0,05s
28	Number of periods RoCoF Perio	10	4-50 Step 1	10	4-50 Step 1	10	4-50 Step 1	10	4-50 Step 1	10	4-50 Step 1	10	4-50 Step 1
29	Vector shift VecSh	off	2-20° / off Step 1°	off	2-20° / off Step 1°	off	2-20° / off Step 1°	off	2-20° / off Step 1°	off	2-20° / off Step 1°	off	2-20° / off Step 1°
30	Number of phases vector shift Phase	1	1 / 3	1	1 / 3	1	1 / 3	1	1 / 3	1	1 / 3	1	1 / 3
General parameters:													
31	Monitoring delay section switches tv KS	0,25s	0,05-10s Step 0,05s	0,25s	0,05-10s Step 0,05s	0,25s	0,05-10s Step 0,05s	0,25s	0,05-10s Step 0,05s	0,25s	0,05-10s Step 0,05s	0,25s	0,05-10s Step 0,05s
32	Mode (only at CEI0-21 Italy)	---	---	---	---	---	---	Mode0	Mode0: Tran- sitori Mode1: Definit	---	---	---	---
33	Switching mode of output relays	RL no	RL no: normal- ly open	RL no	RL no: normal- ly open	RL no	RL no: normal- ly open	RL no	RL no: normal- ly open	RL no	RL no: normal- ly open	RL no	RL no: normal- ly open
34	Number of section switch (only at CEI0-21 Italy)	KS 2	KS 0: [1] KS 1: [2] KS 2: [3] Sync: [4]	KS 2	KS 0: [1] KS 1: [2] KS 2: [3] Sync: [4]	KS 2	KS 0: [1] KS 1: [2] KS 2: [3] Sync: [4]	KS 2	KS 0: [1] KS 1: [2] KS 2: [3] Sync: [4]	KS 2	KS 0: [1] KS 1: [2] KS 2: [3] Sync: [4]	KS 2	KS 0: [1] KS 1: [2] KS 2: [3] Sync: [4]
35	Password Pwd	0000	0000-9999 Step 1	0000	0000-9999 Step 1	0000	0000-9999 Step 1	0000	0000-9999 Step 1	0000	0000-9999 Step 1	0000	0000-9999 Step 1

[1] KS 0: No section switch [2] KS 1: 1 section switch [3] KS 2: 2 section switches [4] Sync: Mains synchronization

Comment on parameter no. 31:
The scan delay of the section switches (tv KS) must be greater than the actual time of the section switches. The adjustable delay is active when the section switches close. (Motor driven sector switches have longer connection times). The monitoring delay when disconnecting is fixed at 250 ms.

Running chart parametrisation



CRC16-value (Test value of parameter setting)

Below, the CRC16 values for the different positions of the two rotary switches are listed for standard and system configuration. The CRC16 values listed are obtained from the standard set, the system configuration and the associated default values of the parameter setting. If different parameters are selected than the default settings, different CRC16 values are obtained. They are not listed here.

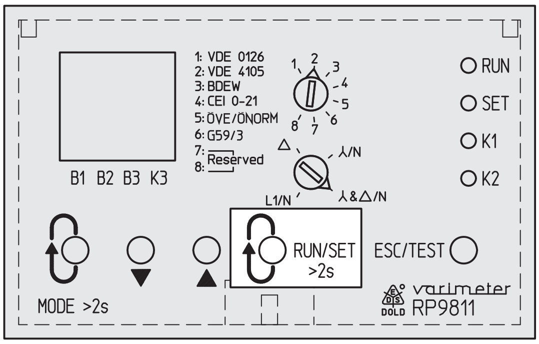
Standard	Mains form	CRC16- value *)
VDE 0126	Y & Δ / N	ddcA
VDE 0126	Y / N	d85F
VDE 4105	Y & Δ / N	3b56
BDEW	Y & Δ / N	18b5
BDEW	Y / N	1d20
BDEW	Δ	1E53
CEI 0-21	Y & Δ / N	3bc4
CEI 0-21	Y / N	3E51
ÖVE/ÖNORM	Y & Δ / N	cb04
G59/3 LV	Y & Δ / N	5dE8
G59/3 LV	Y / N	587d
G59/3 HV 110V	Δ	47d3

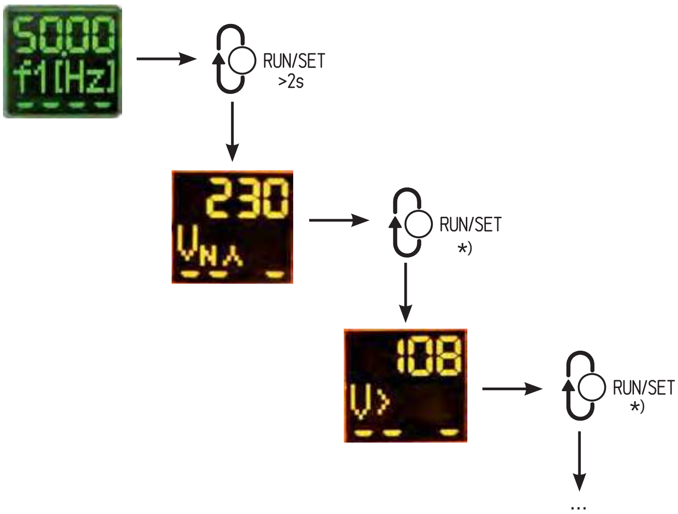
*) Firmware-Version ≥ 04.00

Set parameters

Display mode

All parameters currently set to "active" are sown in the display mode. Scrolling between the different "active" parameters is possible with the RUN/SET button.





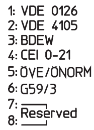
*) briefly pressing the button is sufficient for scrolling

Set parameters

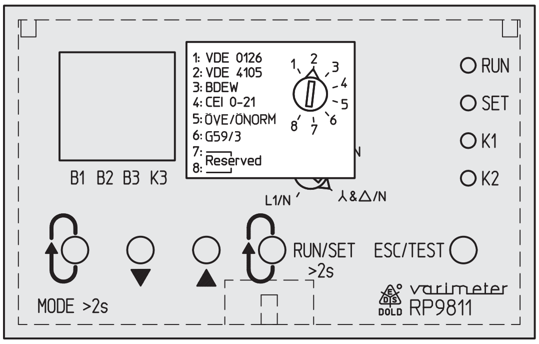
Input-Mode

Via rotary switch the default settings for 6 standards can be adjusted quikkly:

1: VDE 0126
2: VDE-AR-N 4105
3: BDEW-Mittelspannung
4: Italien CEI0-21
5: ÖVE/ÖNORM
6: G59/3
7: Reserved
8: Reserved



The default settings can be selected via the rotary switch thereby accepting the default settings of the parameter table.
The individual parameters can be changed manually if needed.



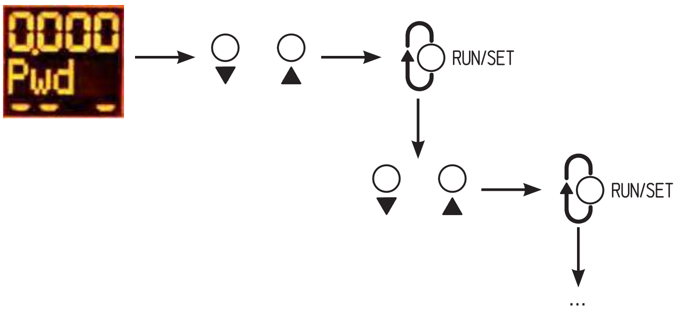
To change the parameters manually, the RUN/SET button must be pressed longer than two seconds. The display mode is accessed. The input mode is accessed when subsequently pressing "▼ ▲". The input mode is also accessed by turning one of the two rotary switches.

Before the values of a parameter can be modified, the password has to be entered correctly, or the default password (factory set) has to be acknowledged by pressing the RUN/SET button 4 times. The display then shows OK !

The password consists of four numbers from 0000-9999

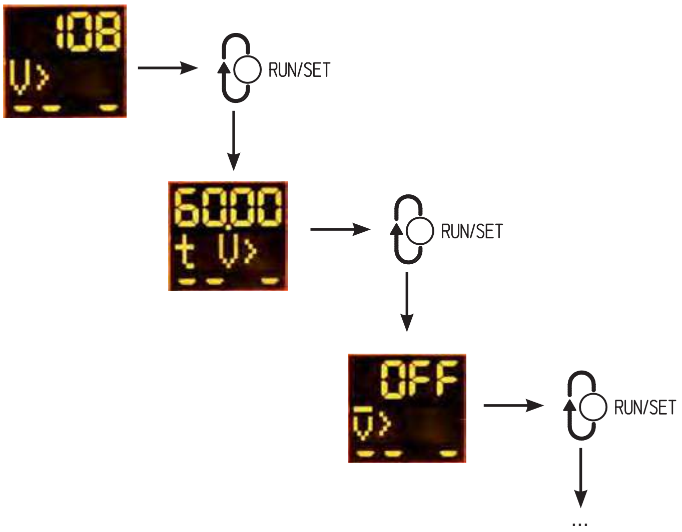
Change of password:
To avoid unintended modifications the following sequence has to be followed:

1. Use RUN/SET button to select parameter no. 35 select “Password PWD”
2. Enter password with buttons ▼ ▲
3. Acknowledge password by pressing RUN/SET button, the display now shows “Pwd 2”
4. Repeat step 2. And 3.until display changes to parameter no. 1
5. Other parameter changes can be made. By pressing RUN/SET button for longer than 2 sec the changes are stored. The device changes to RUN mode display.



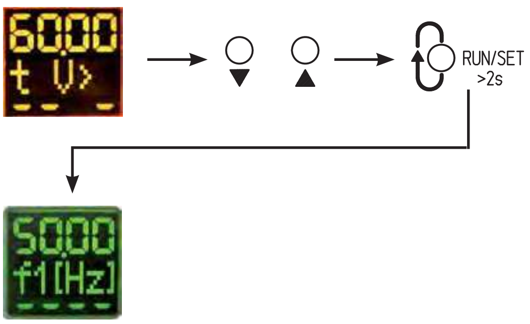
Set parameters

If the password is correct, the different parameters can be changed or parameters can be set to "active" or "inactive". Changing the different parameters is done analogue to the display mode by using the RUN/SET button.



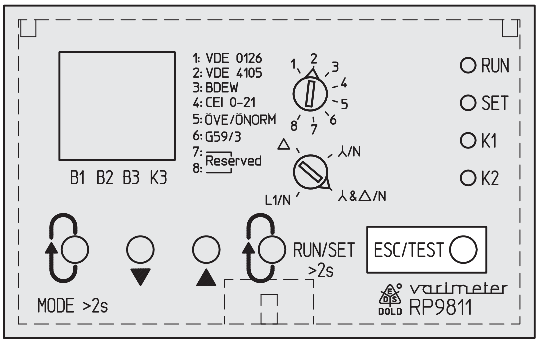
The default values set in the parameters (see parameter table) can be individually adjusted with the ▼ ▲ buttons; however, they must be within the respective setting ranges. The next parameter can be selected with the RUN/SET button and also be adjusted with the ▼ ▲ buttons.

After the desired changes have been made, the new values are saved by pressing the RUN/SET button (> 2 s).

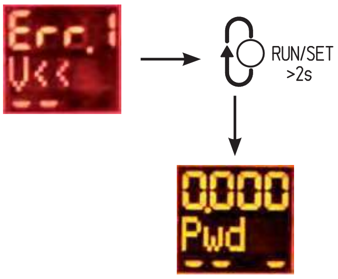


Set parameters

Jumping back to the display mode is possible at any time by pressing the ESC/TEST button without saving the changed parameters.



Wrong or contradictory entries of parameter values are recognised and displayed by the device as errors (setup errors). The error status can be exited by pressing the RUN/SET button longer than two seconds.
The faulty parameters can be corrected back in the input mode.



Error Indication

The failure status of the unit is indicated by a red backlight. If a failure is detected the unit automatically changes to failure memory display. The last 9 failures are stored, where failure 1 is the newest and failure 9 the oldest. The failures are displayed as follows

Failure indication; Failure cause		
Parameter Nr.	**Display**	**Failure**
2	V>	overvoltage
4	$\overline{V}>$	overvoltage, 10 min mean value
6	V>>	overvoltage 2
8	V<	undervoltage
10	V<<	undervoltage 2
12	f1>	overfrequency
14	f1>>	overfrequency 2
16	f1<	underfrequency
18	f1<<	underfrequency 2
26	RoCoF	Frequency change df/dt (Rate of Change of Frequency)
29	VecSh	Vector shift detected (Vector Shift)
	KS1, KS2	failure section switch (broken wire in feedback circuit or section switch contacts welded)
	Sys.5	Measured value deviation between channel 1 and channel 2 too large; locks the memory, cancelling the lock: Switch off auxiliary voltage longer than 30 s.
	Int.8	Failure during system test KS1 and KS2 have not been disconnected from grid
	Setup	The setting of the two potentiometers (standard and mains) is not correct, set values are not plausible (e.g. connection and disconnection value).

When leaving the failure state, the backlight changes from red to yellow in the first step. Only when the failures are acknowledged, either by deleting the failure memory or by changes to the actual value in the display mode, the backlight changes to green. The entries in the failure memory stay valid when resetting a failure message (pressing the pushbutton "Mode" for >2s).

The failure memory is deleted by pressing the buttons "Mode" and "Test" simultaneously for more than 2 seconds in display mode failure or by disconnecting the supply L1/L2/L3/N for a longer period.

Fault Signalling Relay

A third output relay K3 indicates the disconnection of the generator system in the case of a failure (contact 33-34).

Isolated Grid Detection

The RP 9811 includes a passive procedure to detect an isolated network according to chapter 6.5.3 and annex D2 of VDE-AR-N 4105 and chapter A.3.5.3 of ÖVE/ÖNORM E8001-4-712. The 3-phase voltage monitoring allows an isolated network to be detected.

Random Switch Off at Overfrequency

In VDE-AR-N 4105 a frequency range between 50.2 Hz and 51.5 Hz was defined. In this range a step less reduction of the generated power can be made if the generator is controllable.

Non controllable generator systems can alternatively disconnect themselves from the mains in the frequency range of 50.2 Hz and 51.5 Hz. In this case a symmetric distribution within this range of the disconnection frequency for each plant has to be observed. The RP 9811 has a random setting facility within this range, by turning both related switches into position "random". With this setting the connection and reconnection time is automatically selected within a range of 1 ...10 minutes.

Random Controlled Connection T_{on}

The device offers the possibility to use a random control for connection with a delay between 60 and 600 s. Parameter T_{on}: "random"

System Test

When operating the pushbutton „Test" the states of the section switch can be tested for correct function. Pressing the test button disconnects the generator system from the mains.
Evaluation of disconnection time:
When the test function is operated the release time of the section switch is monitored via the feedback circuit. The measured time is shown on the LCD display.
To determine the full disconnection time the measuring and evaluation time is added to the release time of the section switch.

Control inputs B1, B2, B3

Power up conditions (release)
The distributed power generation system is connected to the grid when the following conditions are met at the control inputs B1, B2, B3.

1. Inputs BA-B1 and BA-B2 are bridged
2. Input BA-B3 is open (operates inverted)
3. Both section switches are switched off. KA-K1 and KA-K2 are closed.

KA-K1 and KA-K2 are open after the connection.
If this is not the case, error KS1 or KS2 is indicated on the display.
If both section switches fail, KS1 and KS2 are entered in the error memory.
The error message relay K3 releases in case of error.

Function control input B2 at adjustablle standard CEI 0-21

Mode Transitori (default):

BA-B2 closed : monitoring of tight frequency window
[f>, f<]

BA-B2 open : monitoring of wide frequency window
[f>>, f<<]

Mode Definit:

BA-B2 no function: monitoring of wide frequency window
[f>>, f<<]

Required parameter setting for Mode Definit:

Parameter No. 15 [t f>>]: 1 s
Parameter No. 19 [t f<<]: 4 s

Monitoring of Section Switches at mains synchronization

Via the 2 contacts 13-14 and 23-24 the 2 section switches are controlled. The monitoring of the section switches is made by the feedback circuit (terminals KA-K1, KA-K2),to which the NC contacts of the section switches are connected (see connection diagrams).
The voltage and frequency monitor RP 9811 only connects the generator system to the mains when in disconnected state the feedback circuits KA-K1, KA-K2 are closed, i.e. the section switches are de-energised (NC contacts are closed). As long as the section switch is not energized the feedback circuits KA-K1, KA-K2 must be closed if not the failure "KS" is displayed.
The feedback loops KA-K1, KA-K2 must be open after the section switch is selected, otherwise device 2 performs additional connection attempts. If the connection was not successful after the 3rd attempt, the error "KS" is reported and the error message relay switches to the normal position.

Parameter number of section switches = 0:
Only for simplifying the set-up procedure the monitoring of the feedback circuit can be disabled.
To fulfil the starting conditions, K! and K2 has to be bridged with KA.
If only one section switch is installed, K1 and K2 are connected in parallel.

Function Mains synchronization on generator operation:
Parameter number of section switches = „Sync"
This function is available in units with firmware 02.00 and higher.
See relevant application example.

The monitoring of the Feedback contacts can be disabled with the enabling input BA/B3.
BA/B3 closed = feedback contact section switch 2 is disabled
BA/B3 open = both feedback contacts channel 1 and channel 2 are monitored.
Starting condition: BA/B1-B2-B3 bridged, or with standard CEI 0-21 BA/B1-B3 bridged.

According to the Italian standard CEI 0-21 (< 20 kW)
Using only one section switch is possible. This is permissible for systems < 20 kW.

Coupling switch K1 is connected to terminals 13/14. The feedback contacts terminal K1/K2 of the two section switches must be switched in parallel (bridge between terminal K1 and K2). Setting the number of section switches: Parameter [34] = KS 1 (1 section switch).

Even if only one section switch is connected, monitoring by the RP 9811.03 takes place via two channels.

Note:
If the feedback contacts terminal K1/K2 are bridged. LED K2 indicates the status of channel 2 and is on corresponding to LED K1 of channel 1. The connection condition is identical with systems > 20 kW.

Safety notes

Dangerous voltage.
Electric shock will result in death or serious injury.

Disconnect all power supplies before servicing equipment.

- Faults must only be removed when the relay is disconnected
- The user has to make sure that the device and corresponding components are installed and wired according to the local rules and law (TUEV, VDE, Health and safety).
- Settings must only be changed by trained staff taking into account the safety regulations. Installation work must only be done when power is disconnected.
- Observe proper grounding of all components

Set Up Procedure

The connection has to be made according to the connection examples.

Technical Data

Reactivation: see parameter table "Connection parameters"
Disconnection: see parameter table "Monitoring-/ disconnection parameters"
Accuracy:
voltage measurement: ≤ ± 1 % ± 1 digit (at AC 230 V)
Frequency measurement: ≤ ± 0,02 % ± 1 digit
Reaction time (Disconnection): < 100 ms
Disconnection by vector shift: < 50 ms

Auxiliary Voltage

Auxiliary Voltage	Voltage range	Frequency range
AC/DC 24 ... 80 V	AC 18 ... 100 V	45 … 400 Hz; DC 48 % W*)
	DC 18 ... 130 V	W ≤ 5 %
AC/DC 80 ... 230 V	AC 60 ... 276 V	45 … 400 Hz; DC 48 % W*)
	DC 50 ... 300 V	W ≤ 5 %

*) W = permitted residual ripple of auxiliary supply

Nominal consumption
DC 24, 48 V: 1.5 W
AC 230 V: 4.2 VA

Output

Relay K1 and K2: 1 NO contact each
Relay K3: 1 NO contact
The 3 Output relays are de-energized on trip, after disconnection or failure
Thermal current I_{th}: 5 A
Switching capacity
according to AC 15
NO contact: 3 A / AC 230 V IEC/EN 60 947-5-1
NC contact: 1 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V
NO contact: 3 x 10^5 switch. cycles IEC/EN 60 947-5-1
Short circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
Mechanical life: > 50 x 10^6 switching cycles

General Data

Measuring voltage range: AC 15 ... 300 V (Phase-N)
AC 26 ... 520 V (Phase-Phase)
Frequency range: 46…54 Hz
Enabling inputs
BA / B1, B2, B3: DC 12 V (Ground- and volt-free contact)
Temperature range:
Operation: - 30 ... + 60 °C
Storage: - 40 ... + 70 °C
Altitude: up to 4,000 m IEC 60 664-1
Clearance and
creepage distance
Rated impulse voltage /
Pollution degree:
auxiliary circuit / measuring ciruit /
contacts: 5 kV / 2 IEC 60 664-1
13-14 / 23-24: 4 kV / 2 IEC 60 664-1
(at altitude > 2.000 m the contacts 13-14 / 23-24 must be connectet on the same phase!)
The measuring circuit includes: L1, L2, L3, N, KA, K1, K2, BA, B1, B2, B3
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF irradiation: 10 V/m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge
between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
HF wire guided: 20 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011

Technical Data

Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: thermoplastic with VO behaviour according to UL subject 94
Vibration resistance: Amplitude 0,35 mm
frequency 10...55 Hz, IEC/EN 60 068-2-6
Climate resistance: 30 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection
Cross section: solid, stranded 0.5 ... 4 mm^2
Flexible with plastic sleeve: 0.5 ... 4 mm^2
Multi-wire connection: 0.5 ... 1.5 mm^2 (2 wires with the same diameter)
Stripping length: 6.5 mm
max. fixing torque: 0.5 Nm
Wire fixing: Plus-minus terminal screws / M3 box terminals

Mounting: DIN-rail
Weight: 215 g
Recommended fuse
for measuring inputs: gG / gL 6A

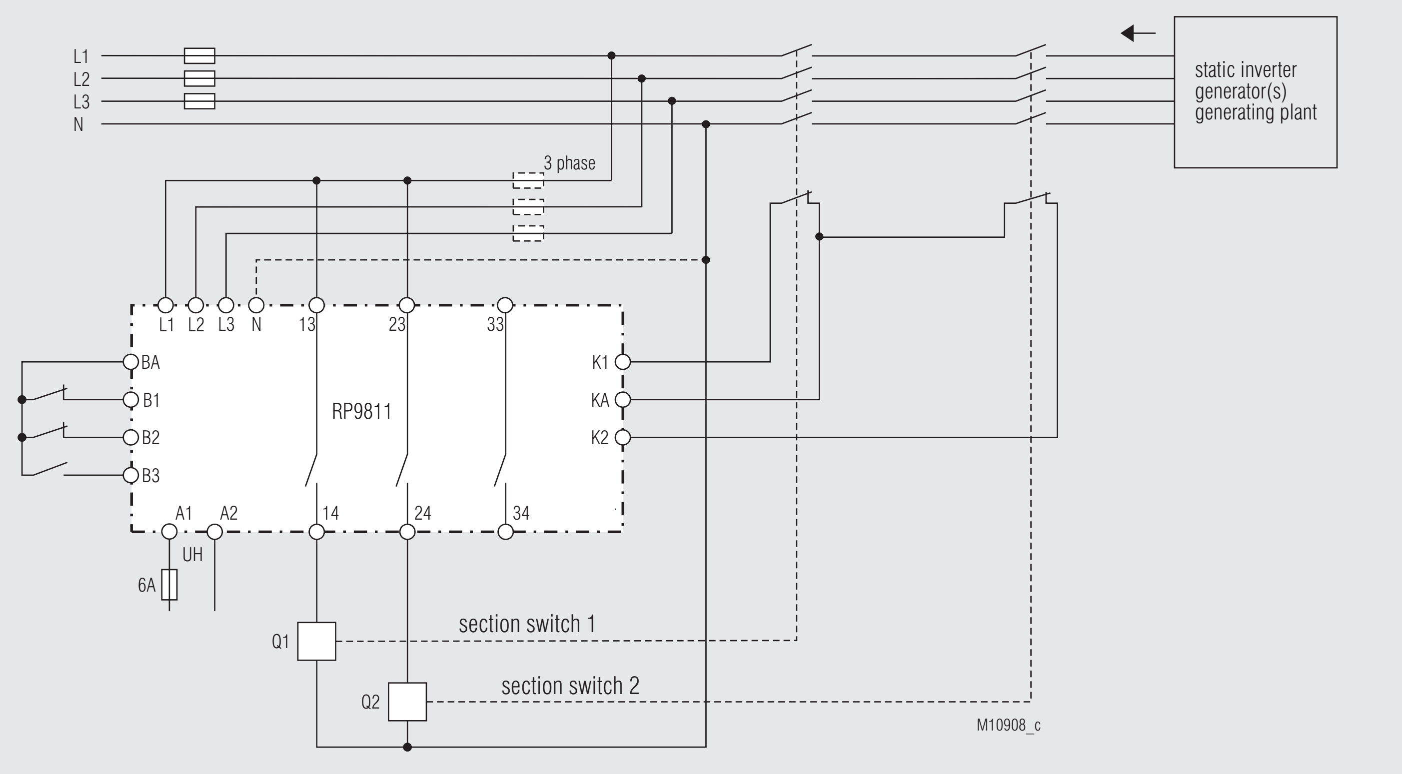
Dimensions

Width x height x depth: 70 x 90 x 71 mm

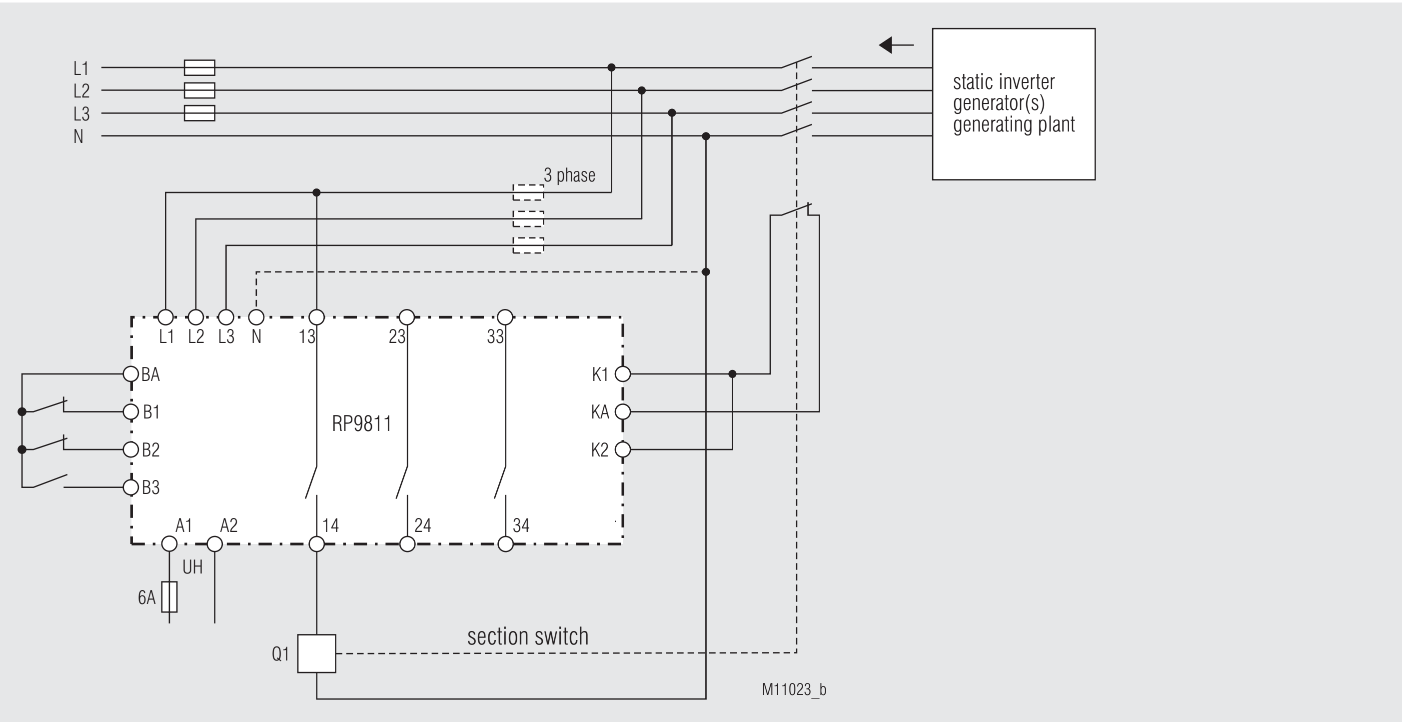
Standard Types

RP 9811.03 3/N AC 400 / 230 V
Article number: 0065562
- Auxiliary voltage U_H: AC/DC 80…230 V

RP 9811.03 3/N AC 400 / 230 V
Article number: 0065698
- Auxiliary voltage U_H: AC/DC 24…80 V

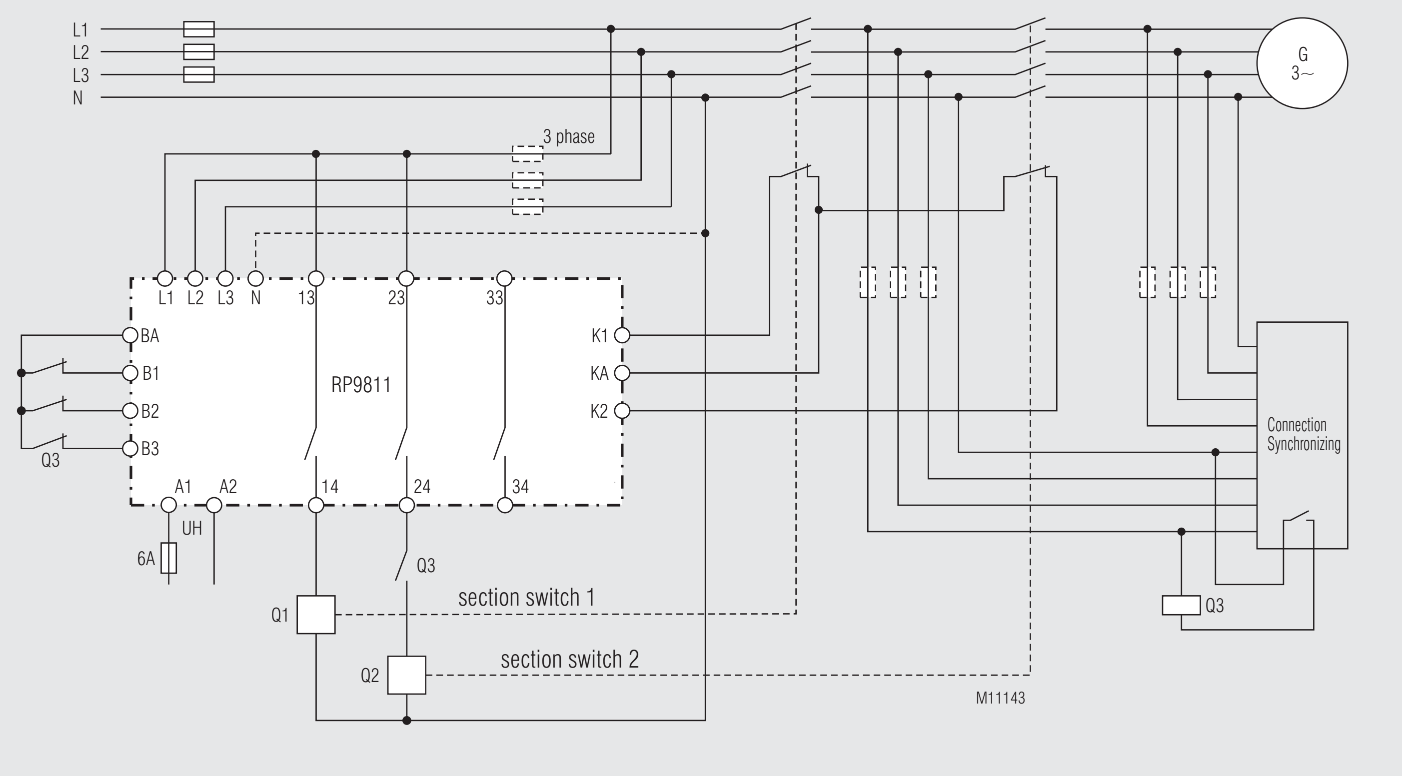


Application example according to DIN VDE-AR-N 4105 (from 30 kW); CEI 0-21 (from 20 kW); BDEW-directive; DIN V VDE V 0126-1-1
2 section switches



Application example according to CEI 0-21 (< 20 kW)
1 section switch

Application Example



Generator operation with mains synchronisation

VARIMETER
Valve Monitor
IK 9076, SK 9076

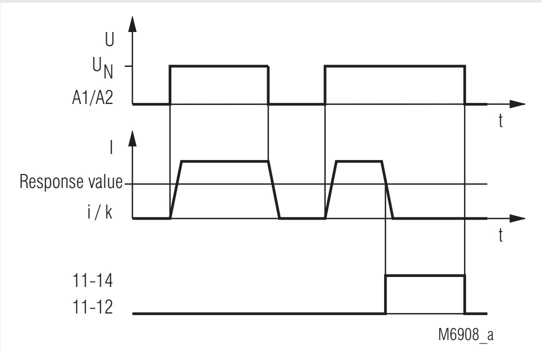
0222125

IK 9076

SK 9076

- According to IEC/EN 60 255, DIN VDE 0435-303
- Current monitor
- Detection of wire breakage
- Fixed switching points
- For DC 24 V
- Energized on trip
- Green LED display for operating voltage
- Red LED display for contact position
- **Devices available in 2 enclosure versions:**
  IK 9076: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK 9076: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 17.5 mm

Function Diagram



Approvals and Markings

Application

For monitoring valves.

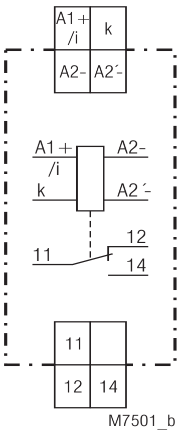
Indicators:

Upper LED:	on, when operating voltage is supplied
Lower LED:	on, when the output relay is activated

Note

IK/SK 9076 has no polarity safeguard!

Circuit Diagram



IK 9076.11, SK 9076.11

Technical Data

Input

Nominal voltage U_N:	DC 24 V	
Voltage range:	0.85 ... 1.2 U_N	
Nominal consumption:	0.35 W	
Switching points (fixed):	Setting value	max. continous current
	0.3 ... 0.7 A *	1.5 A
	0.2 ... 0.4 A	0.9 A
	0.15 ... 0.3 A	0.5 A
	0.05 ... 0.1 A	0.25 A
	* Suitable e.g. for 24 W / 1 A valves	
Permissible measuring current:	1.5 A at an ambient temperature of 55°C	
	2.2 A at an ambient temperature of 35°C	
Maximum overload:	8 A, up to 3 s	

Output

Contacts		
IK 9076.11, SK 9076.11:	1 changeover contact	
Operate/release time:	100 ms / 20 ms	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life:		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	1.5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 10^8 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 55°C	
Clearance and creepage distances		
rated impulse voltage/ pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	6 kV (contact)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9076:	56 g	
SK 9076:	75 g	

Dimensions

Width x height x depth

IK 9076:	17.5 x 90 x 59 mm
SK 9076:	17.5 x 90 x 98 mm

Standard Types

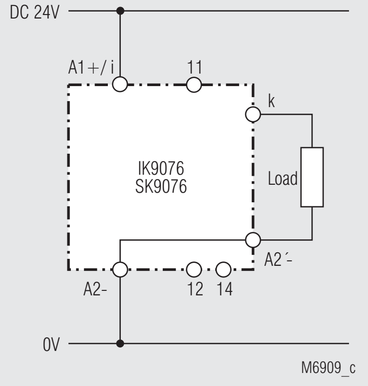
IK 9076.11 DC 24 V < 0.3 A

Article number:	0051708
• Output:	1 changeover contact
• Nominal voltage U_N:	DC 24 V
• Operate time:	< 0.3 A
• Width:	17.5 mm

SK 9076.11 DC 24 V < 0.3 A

Article number:	0054742
• Output:	1 changeover contact
• Nominal voltage U_N:	DC 24 V
• Operate time:	< 0.3 A
• Width:	17.5 mm

Connection Example



VARIMETER
Standstill Monitor
BD 5936

DOLD

0221549

Your Advantage
- Standstill monitoring without sensor

Features
- According to IEC/EN 60255-1, IEC/EN 60255-26
- For standstill monitoring of 3- and 1-phase asynchronous motors
- Line breakage detection in the measurement circuit
- Forcibly guided output contacts:
  2 NO, 2 NC contacts for 250 V AC
- LED indicators for motor standstill, line breakage, and operating voltage
- Wire connection: also 2 x 1.5 mm^2 stranded ferruled (isolated), DIN 46 228/-1/-2/-3/-4 or
  2 x 2.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3
- Width 45 mm

Product Description

The BD 5936 detecting standstills of 3- and 1-phase asynchronous motors. At 2 terminals of the stator winding the BD 5936 measures the voltage of the slowing motor which has been induced.. If the induction voltage approaches 0 this indicates that the device is at a standstill and the output relay is activated.
Additional the monitor detects strand breaks between measurement inputs Z1 / Z2.. If a line breakage is detected, the output relay goes into the normal position (as when the motor is running). This state ist saved and can only be cleared by (briefly) switching off the auxiliary voltage.

Approvals and Markings

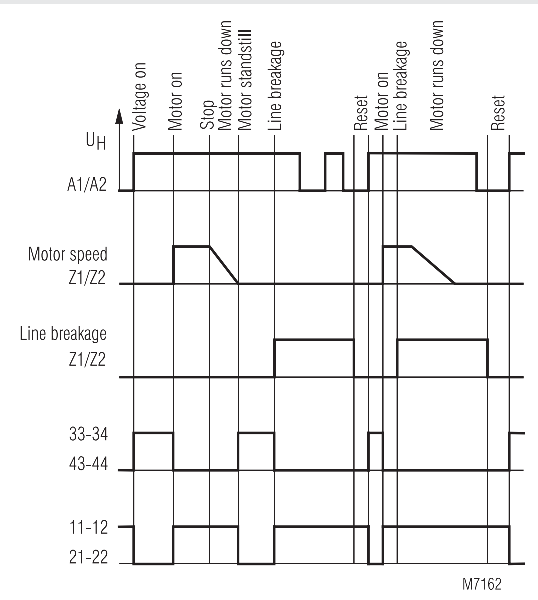
Canada / USA *
A025518 *

* see variants

Applications

For detecting standstills of 3- and 1-phase asynchronous motors, for example, for releasing protective door interlocks of machine tools or for activationg stopping brakes.

Function Diagram



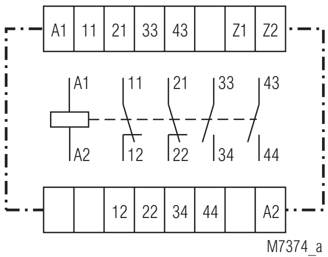
Notes

In the case on the motor wires the Z1 / Z2 connection wire should be installed separately from the motor supply and connected directly to the motor terminals. For longer distances please use twisted pair wires.

Indicators

1st green LED:	comes on when operating voltage present
2nd green LED:	comes on when motor at a standstill
Red LED:	comes on in event of line breakage between Z1 and Z2

Circuit Diagram



Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage U_H
Z1, Z2	Measuring input (connection on motor)
11, 12, 21, 22	Forcibly guided NC contacts
33, 34, 43, 44	Forcibly guided NO contacts

Technical Data

Input

Auxiliary voltage U_H: AC 24, 48, 110, 120, 230 V, AC/DC 24 ... 60 V, 110 ... 230 V (other voltages on request)
Voltage range: 0.8 ... 1.1 U_N
Nominal consumption: approx. 3 VA,3 W
Nominal frequency: 50 / 60 Hz
Measurement/motor voltage: AC 690 V
Response value: approx. 20 mV
Release value: approx. 40 mV

Output

Contacts
BD 5936.17: 2 NO, 2 NC contacts
Contact type: relay, forcibly guided
Output rated voltage: 250 V AC
Thermal current I_{th}: 5 A
Switching capacity IEC/EN 60 947-5-1
to AC 15:
NO contact: 3 A / AC 230 V
NC contact: 2 A / AC 230 V
Electrical life IEC/EN 60 947-5-1
to AC 15 at 2 A, AC 230 V: 10^5 switching cycles
Short circuit strength
max. fuse rating: 6 A gL IEC/EN 60 947-5-1
Mechanical life: 10 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range: - 15 ... + 55 °C at max. 90 % air humidity
Clearance and creepage distances
rated impulse voltage / pollution degree,
Terminals Z1/Z2: IEC 60 664-1
at AC-Auxiliary voltage U_H: 6 kV / 2 (Overvoltage category III)
at AC/DC-Auxiliary voltage U_H: 4 kV / 2 (Overvoltage category II)
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF irradiation: 10 V/m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
HF-wire guided 10 V IEC/EN 61 000-4-6
Interference suppression: Limit value class B EN 55 011
Degree of protection:
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour to UL Subj. 94
Vibration resistance: Amplitude 0,35 mm frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 15 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 1 x 4 mm^2 solid or
1 x 2.5 mm^2 stranded ferruled (isolated) or
2 x 1.5 mm^2 stranded ferruled (isolated) DIN 46 228-1/-2/-3/-4 or
2 x 2.5 mm^2 stranded ferruled DIN 46 228-1/-2/-3
Line attachment: Plus-minus terminal screws M 3,5 box terminal with wire protection
Mounting: DIN rail IEC/EN 60 715
Weigth: 325 g

Dimensions

Width x height x depth: 45 x 74 x 121 mm

UL-Data

Switching capacity:
NO contacts: Pilot duty A300
10A 250Vac G.P.
10A 24Vdc

NC contacts: 10A 250Vac G.P.
10A 24Vdc

Technical data that is not stated in the UL-Data, can be found in the technical data section.

CCC-Data

Thermal current I_{th}: 5 A

Switching capacity

to AC 15:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

BD 5936.17/001 AC 230 V 50/60 Hz
Article number: 0049069
- Output: 2 NO, 2 NC contacts
- Auxiliary voltage U_H: AC 230 V
- With automatic reset for broken wire detection
- Width: 45 mm

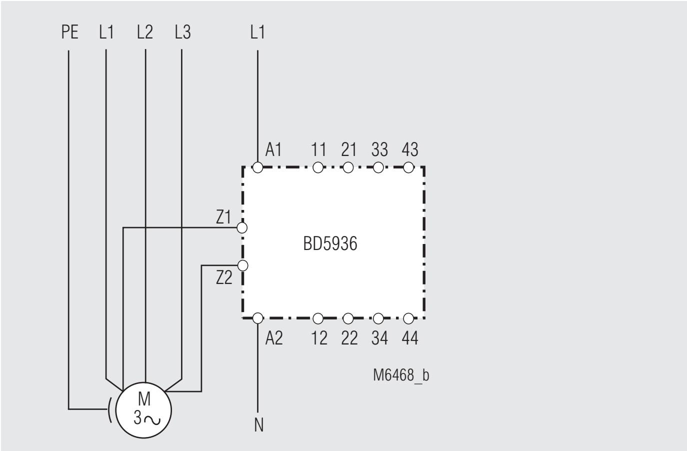
Variants

BD 5936.17: without automatic reset for broken wire detection
BD 5936.17/61: with UL-approval (Canada/USA)
BD 5936: with CCC-approval on request

Ordering example for variants

BD 5936 .17 /_ _ AC 230 V 50 / 60 Hz
- Nominal frequency
- Auxiliary voltage
- Variant, if required
- Contacts
- Type

Connection Example



VARIMETER
Standstill Monitor
IK 9144, IL 9144, SK 9144, SL 9144

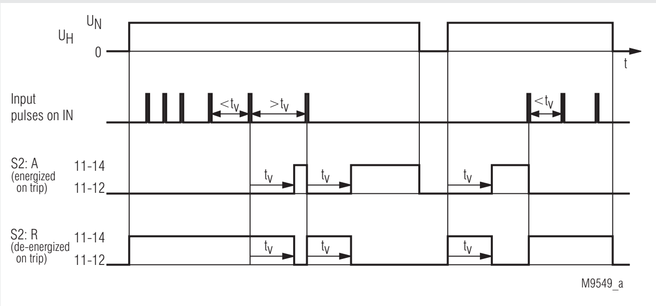
DOLD

0244583

IK 9144 IL 9144

- According to IEC/EN 60 255, DIN VDE 0435-303
- Detection of standstill of rotating machine parts and cyclic pulses
- Detection of blocking or missing pulses
- Monitoring time adjustable between 0.1 ... 20 s (others on request)
- Energized or de-energized on trip
- For input frequency up to 5 kHz(≙ 300000 ipm)
- Universal input, suitable for a variety of sensors (PNP,NPN,2-wire, contact, voltage)
- Input also suitable for SKF sensor bearings
- As option for Namur sensors
- On request with manual reset
- IK 9144 and SK 9144: compact version for DC 24V auxiliary supply
- IL 9144 and SL 9144: for auxiliary supply up to AC 400V with galvanic separation to sensor input
- LED indicators for auxiliary supply, sensor pulses and contact position
- 1 changeover contact (2 changeover on request)
- **Devices available in 2 enclosure versions:**
  IK/IL 9144: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SK/SL 9144: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- IK 9144, SK 9144: width 17.5 mm
- IL 9144, SL 9144: width 35 mm

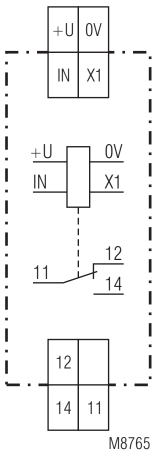
Function Diagram



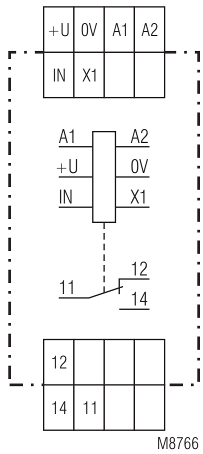
Approvals and Markings

CE

Circuit Diagrams



IK 9144, SK 9144



IL 9144, SL 9144

Applications

Speed monitoring on rotating machine parts, monitoring of cyclic movements, general monitoring of pulse sequences (transportation, conveyors production systems), monitoring of pulse frequency (e.g. flow sensors, anemometers), watchdog function for controllers and PLCs.

Function

The frequency to be monitored is connected to the input terminal IN.

If the time between 2 pulses exeeds the adjusted monitoring time t_v the output relay changes state.

In energized on trip mode (slide switch in position A), the output relay is de-energized when connecting the supply (contacts 11-14 open). It energises (contacts 11-14 closed) when during the monitoring time t_v no pulses are detected on input IN. With a new pulse the relay de-energises immediately and the monitoring time t_v is started again.

In de-energized on trip mode (slide switch in position R), the output relay is energized when connecting the supply (contacts 11-14 closed). It de-energized (contacts 11-14 open), when during the monitoring time t_v no pulses are detected on input IN. With a new pulse the relay energized immediately and the monitoring time t_v is started again.

Indicators

Green LED:	On, when only auxiliary voltage connected to A1 - A2, intermittent red/ green flashing when pulses are on the input IN
Yellow LED:	On, when the output relay is energized (contacts 11-14 closed)

Notes

To the universal input of the speed monitor (terminals +U, X1, IN, 0V) a wide range of different sensors can be connected (capacitive, inductive, ultrasonic, hall effect, optical, reed, etc.) The input is suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660 part 208)
Depending on the type of sensor (3-wire PNP or NPN, 2-wire, contact, voltage) the connection is made to different terminals (see Connection Examples).
The models IL and SL 9144 have a galvanic separation between Input Circuit (+U, X1, IN, 0V) and auxiliary supply (A1, A2 e.g. 230VAC). 24V DC with up to 20mA is provided on the terminals U+/0V for the supply of the sensor. If sensors with higher power consumption are used, the model IK and SK 9144 is suitable, where the sensors and the speed monitor is supplied by DC 24V from an external power supply.
The speed monitors can be operated with SKF sensor bearings. Sensor bearings include ball bearing and speed sensor in a compact way. The actual sensors are hall effect sensors with NPN output. The connection is made as with NPN proximity sensors.
The model /200 is optimised for Namur proximity sensors according to IEC/EN 60 947-5-6 (VDE 0660 part 212). Namur sensors are 2-wire sensors with defined current in on and off state.

Monitoring indicator of sensor input
The upper 2-coloured LED shows indicates the connected supply voltage and the status of the sensor:

Green:	input IN on LOW level
Red:	input IN on HIGH level
Green/Red:	pulses on input IN

Several devices on one sensor
A parallel connection of several monitors to one sensor is possible without problems on the universal input, when several tripping values are required or a range between to limits should be monitored. The corresponding terminals are connected in parallel.

Reaction time
The reaction time is equal to the adjusted monitoring time t_V. To shorten the reaction time the number of incoming pulses should be increased, e. g. by adding sensing points to a rotating part. The monitoring time then can be adjusted shorter.

Maximum input frequency, minimum pulse and space time
Every frequency measuring device detects input pulses only up to a certain maximum input frequency. (This is also a result of a proper interference suppression). If the input frequency is higher then the maximum value, the input pulses are not longer detected, i.e. the monitor detects frequency 0. The maximum frequency is always much higher then the maximum setting value of the highest setting range
Also the maximum switching frequency of the sensors must be observed. In addition every frequency input needs a certain minimum pulse and space duration of the connected sensor to react properly. This is very important with high frequency and a low or high pulse/space ratio (e. g. a small active area on big diameter or a small gap on big diameter at high rotation speed). The minimum pulse or space times are very short on these modules, so that most applications are uncritical (see technical data).

Technical Data

Input Circuit

Universal input:	for PNP-, NPN-, 2-wire sensors, contacts and voltage suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660 part 208)	
IK 9144, SK 9144:	sensor supply by external auxiliary voltage DC 24 V	
IL 9144, SL 9144:	built in power supply approx. DC 24 V, max. 20 mA	
Max. residual current		
of 2-wire sensors:	2 mA (OFF)	
Max. voltage drop		
of 2-wire sensors:	8 V (ON)	
Voltage drive		
input resistance:	approx. 17 kΩ	
Threshold Low		
IK 9055, SK 9055:	approx. 9.2 V	
IL 9055, SL 9055:	approx. 8.4 V	
Threshold High		
IK 9055, SK 9055:	approx. 11 V	
IL 9055, SL 9055:	approx. 10.3 V	

NAMUR Input

IK 9144/200, SK 9144/200, IL 9144/200, SL 9144/200:	für NAMUR-sensors according to IEC/EN 60 947-5-6 (VDE 0660 part 212) (previously EN 50227/DIN 19234)	
No-load operation voltage:	approx. 8.2 V	
Input resistance:	1 kΩ	
Short circuit current:	approx. 8 mA	
Switching thresholds:		
Low:	approx. 1.5 mA	
High:	approx. 1.8 mA	
Response value:	Monitoring time tv adjustable 0.1 ... 20 s (others on request)	
Max. input frequency:	5 kHz	
Minimum pulse and space time:	100 µs	

Auxiliary Circuit

IK 9144, SK 9144 (terminal connection +U/0V):		
Nominal voltage U_H:	DC 24 V	
Voltage range:	19.2 ... 30 V	
Nominal consumption:	max. approx. 0.8 W	
IL 9144, SL 9144 (terminal connection A1/A2):		
Nominal voltage U_H:	AC 24 V, 42 V, 115 V, 127 V, 230 V, 400 V	
Voltage range:	0.8 ... 1.1 U_H	
Nominal consumption:	approx. 4 VA	
Frequency range:	45 ... 400 Hz	

Output

Contacts:	1 changeover contact	
Thermical current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
Switching capacity		
to DC 13		
NO/NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A / 230 V:	1.5 x 10^5 switching cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 941-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range (operation):	-20 ... +60 °C	
Clearance and creepage distances	rated impulse voltage/ pollution degree 4 kV/2	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	1 kV	IEC/EN 61 000-4-4
Surge voltages:	1 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10...55Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	DIN EN 50 005	
Wire connection:	2 x 2.5 mm^5 solid or	DIN 46 228
	2 x 1.5 mm^2 stranded wire with sleeve	DIN 46 228-1/-2/-3
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IK 9144:	approx. 65 g	
SK 9144:	approx. 85 g	
IL 9144:	approx. 140 g	
SL 9144:	approx. 160 g	

Dimensions

width x height x depth

IK 9144:	17.5 x 90 x 59 mm
SK 9144:	17.5 x 90 x 98 mm
IL 9144:	35 x 90 x 59 mm
SL 9144:	35 x 90 x 98 mm

Standard types

IK 9144.11 0.1 ... 20 s U_H DC 24 V
Article number: 0057162
- Universal input, suitable for a variety of sensors (PNP,NPN,2-wire, contact, voltage)
- Energized or de-energized on trip
- Monitoring time adjustable between 0.1 ... 20 s
- Auxiliary voltage U_H: DC 24 V
- Output: 1 changeover contact

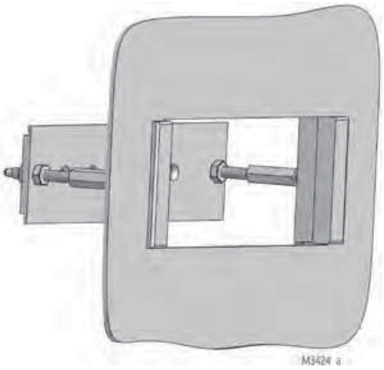
IL 9144.11 0.1 ... 20 s U_H AC 230 V
Article number: 0057161
- Universal input, suitable for a variety of sensors (PNP,NPN,2-wire, contact, voltage)
- Energized or de-energized on trip
- Monitoring time adjustable between 0.1 ... 20 s
- Auxiliary voltage U_H: AC 230 V
- Output: 1 changeover contact

Variants

IK 9144.11/200,
SK 9144.11/200,
IL 9144.11/200,
SL 9144.11/200: Input for NAMUR sensors

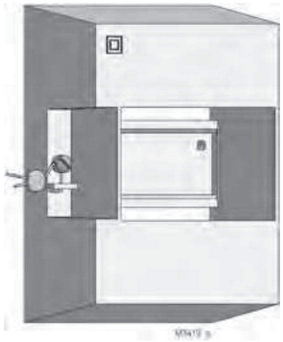
Accessoires

Flush mounting kit
Order reference: KU 4087-150/0056598



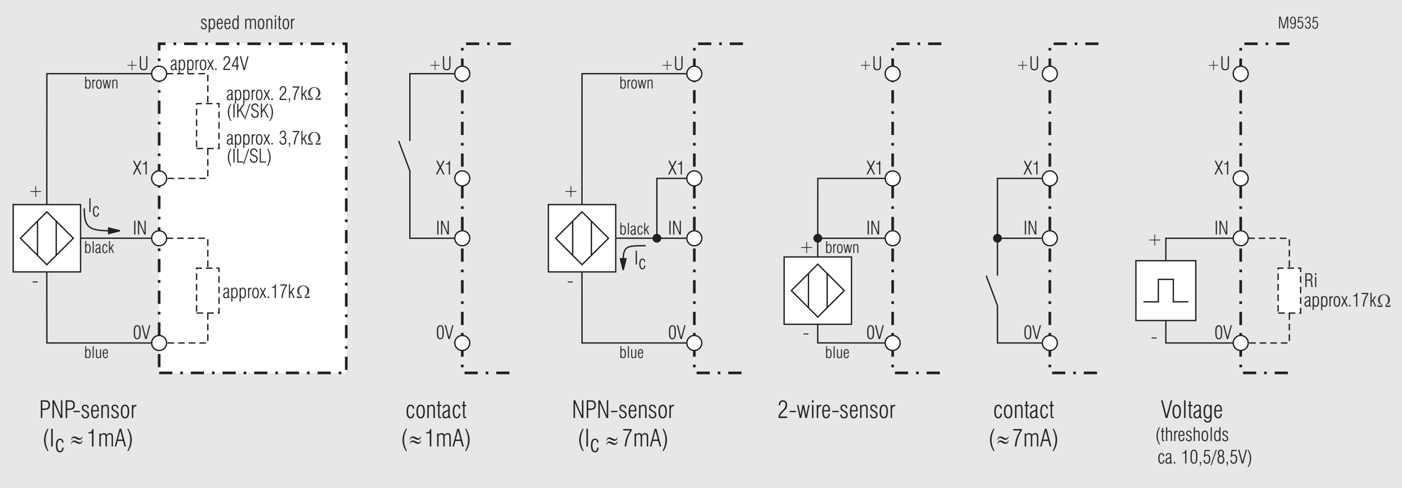
For universal use with:
- I-series devices of 17.5 to 105 mm width
- easy mounting

Mounting kit for surface mounting
KU 4087-100



Types of I-series	Width (mm)	Order reference
IK	17.5	KU4087-100/56763
IL	35.0	KU4088-100/56764
IN	52.5	KU4084-100/56765
IP	70.0	KU4089-100/56766
IR	105.0	KU4090-100/56767

Application Example Universal Input



Note: For IK-models the auxiliary voltage (DC 24 V) must be additionally connected to terminals +U/0V

VARIMETER
Speed Monitor
BA 9055, AA 9050

Replacements:
MK 9055N, MH 9055

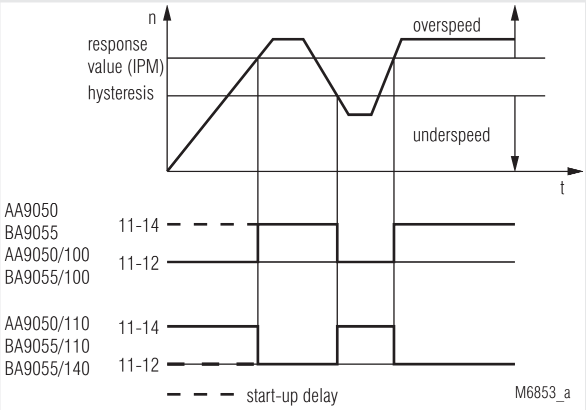
0225072

BA 9055

AA 9050

- According to IEC/EN 60 255-1
- Detection of
  - underspeed
  - overspeed
  - standstill
- Adjustable response value
- BA 9055 with adjustable start-up delay
- AA 9050 with adjustable hysteresis
- Width 45 mm

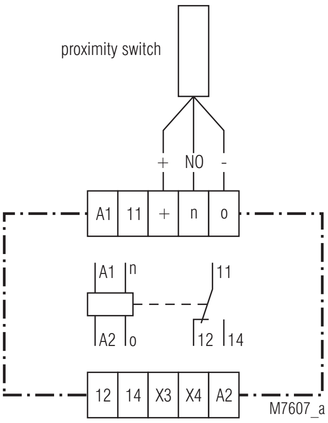
Function Diagram



$t_v\ [s] = \frac{60}{n \cdot z}$

n = speed in rpm
z = sensing points
t_v = switching delay

Circuit Diagram



BA 9055.11, AA 9050.11

Connection Terminals

Terminal designation	Signal description
A1	L / +
A2	N / -
+, o	Current supply proximity sensors
n	Measuring input
X3, X4	Programming terminals
11, 12, 14	Speed indicator relay (two-way contact)

Approvals and Markings

Canada / USA

* see variants

Applications

Speed monitors are used in case where it is necessary not to exceed certain speed limits in order to protect people plants and products against damage. The Speed monitors are used on escalators, conveyors, transfer lines, elevators as well as plants where several drives with a certain speed have to work together.

Function

The measuring principle is to compare frequencies. With a proximity sensor the speed is converted to a speed proportional frequency. This frequency is compared to an internal adjustable frequency reference. If the measured frequency is higher then the reference the output relay is energized on an underspeed monitor or de-energized on an overspeed monitor. The output relay deenergises on an underspeed monitor if the speed goes under the setted hysteresis value. On the overspeed monitor the relay is energized. The reaction time is rather short, as the unit has no intergrating function. To calculate refer to formula in Function Diagram. The power supply for the proximity sensor is built into the unit. **The input is designed for pnp sensors.**
The speed monitor has an integrated start-up delay. The unit is delivered with a bridge between terminals X3-X4. The start-up delay is activated when the power supply is connected to A1-A2.
For the start- up time the output relay is energized. If no start-up delay is required, the bridge must be removed. The start-up delay can be activated also by external contacts connected to X3-X4.
The start-up delay normally is not required with overspeed monitoring. An LED indicates the connected power supply. A second LED indicates the state of the output relay.

Technical Data

Input Circuit

Input:	for proximity sensors, built in power supply DC 24 V, max. 40 mA	
Setting range:	0.05 ... 0.5 lpm	10 ... 100 lpm
	0.1 ... 1 lpm	50 ... 500 lpm
	0.5 ... 5 lpm	100 ... 1 000 lpm
	1 ... 10 lpm	500 ... 5 000 lpm
	5 ... 50 lpm	1000 ... 10 000 lpm
	lpm = Impuls per minute	
Min. pulse length:	1 ms	
Max. frequency:	30 000 lpm	
Setting:	infinite on relative scale	
Setting accuracy:	≤ ± 3 %	
Response value:	0.1 ... 1 of end of scale value	
Hysteresis:		
BA 9055:	2 % of response value	
AA 9050:	2 ... 30 % of response value	
Accuracy:	≤ ± 1 %	
Temperature influence:	≤ ± 0.1 % /°C	
Influence of auxiliary supply:	< ± 0.5 % at 0.9 ... 1.1 U_N	
Start up delay		
BA 9055:	1 ... 20 s	
AA 9050:	10 s (up to 60 min. available)	

Auxiliary Circuit

Auxiliary voltage U_H:	AC 24, 42, 110, 127, 230, 240 V DC 24 V	
Voltage range of U_H:		
AC:	0.8 ... 1.1 U_H	
DC:	0.9 ... 1.2 U_H	
Nominal consumption:	< 4 VA	
Nominal frequency of U_H:	50 / 60 Hz	

Output Circuit

Contacts:	1 changeover contac	
Thermal current I_{th}:	6 A	
Switching capacity to AC 15:	5 A / AC 230 V	IEC/EN 60 947-5-1
Permissible switching frequency:	6 000 switching cycles / h	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:		
80 MHz ... 1 GHz:	10 V/m	IEC/EN 61 000-4-3
1 GHz ... 2,5 GHz:	3 V/m	IEC/EN 61 000-4-3
2,5 GHz ... 2,7 GHz:	3 V/m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-irradiation:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic wiht V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10...55Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection:	2 x 2.5 mm² solid or 2 x 1,5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Screw mounting		
AA 9050:	35 x 50 mm and 35 x 60 mm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BA 9055:	410 g	
AA 9050:	400 g	

Dimensions

Width x height x depth	
BA 9055:	45 x 74 x 124 mm
AA 9050:	45 x 77 x 127 mm

Standard Type

BA 9055 AC 230 V 50/60 Hz 10 ... 100 Ipm 1 ... 20 s

Article number:	0030731
• Output:	1 changeover contact
• Nominal voltage U_N:	AC 230 V
• Setting range:	10 ... 100 Ipm
• Width:	45 mm

Classification to DIN EN 50155 for BA 9055

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Protective coating of the PCB:	No	

Variants

BA 9055, AA 9050:	Standstill and underspeed monitoring with start up delay, closed circuit operation overspeed monitoring with start up delay, open circuit operation
BA 9055/61:	with UL-approval
BA 9055/100, AA 9050/100:	Standstill and underspeed monitoring without start up delay, closed circuit operation overspeed monitoring without start up delay, open circuit operation
BA 9055/110, AA 9050/110:	Standstill and underspeed monitoring without start up delay, open circuit operation overspeed monitoring without start up delay, closed circuit operation
BA 9055/140:	Standstill and underspeed monitoring with start up delay, open circuit operation overspeed monitoring with start up delay, closed circuit operation

Ordering example for variants

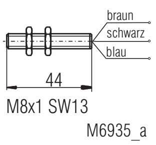
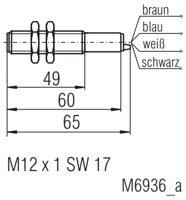
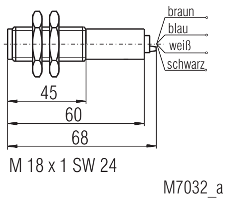
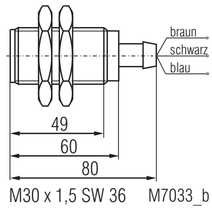
BA 9055 /_ _ _ AC 230 V 50/60 Hz 5 ... 50 lpm 10 s

- 10 s: Start up delay
- 5 ... 50 lpm: Setting range
- 50/60 Hz: Nominal frequency
- AC 230 V: Auxiliary voltage
- /_ _ _: Variant, if required
- BA 9055: Type

Accessories

K 70-34:	Cover for AA 9050 Article number: 0011790

Initiators (proximity sensors), induktive

Type	NA 5001.01.10 pnp NA 5001.01.20 npn	NA 5002.01.34 pnp/npn	NA 5005.01.34 pnp/npn	NA 5010.01.10 pnp NA 5010.01.20 npn
Dimensions				
Enclosure	Metal	Metal	Metal	Metal
Switching distance S_n	1 mm	2 mm	5 mm	10 mm
Switching frequency	5 000 Hz	1 000 Hz	300 Hz	200 Hz
Hysteresis	2 ... 10 %			
Repeat accuracy	5 %			
Voltage range	10 ... 30 V			
Residual ripple	< 10 %			
Continuous current	≤ 200 mA	≤ 100 mA	≤ 100 mA	≤ 400 mA
Output	.10 pnp NO 20 npn NO	.34 pnp NO + npn NO	.34 pnp NO + npn NO	.10 pnp NO .20 npn NO
Indication of output state	LED			
Ambient temperature	- 25 ... 70°C			
Temperature influence	10 %			
Degree of protection	IP 67			
Connection wire	2 m			
Fixing torque	4 Nm	15 Nm	40 Nm	100 Nm
Weight	45 g	70 g	120 g	270 g

Connection Table BA 9055, AA 9050

Type	Wire	Terminal on AA 9050 / BA 9055
NA 5001.01.10	brown +	+
	blue -	0
	black NO	n
NA 5002.01.34 NA 5005.01.34	brown +	+
	white +	+
	blue -	0
	black NO	n
NA 5010.01.10	brown +	+
	blue -	0
	black NO	n

Connection Table BA 9055 / _ _5

Type	Wire	Terminal on BA 9055
NA 5001.01.10	brown +	+
	blue -	0
	black NO	n
NA 5002.01.34 NA 5005.01.34	brown +	+
	white NO	n
	blue -	0
	black -	0
NA 5010.01.10	brown +	+
	blue -	0
	black NO	n

Initiatoren NA 5002.01.34 and NA 5005.01.34 only usable for units without initiator-detection!

VARIMETER
Speed Monitor
IK 9055, IL 9055, SK 9055, SL 9055

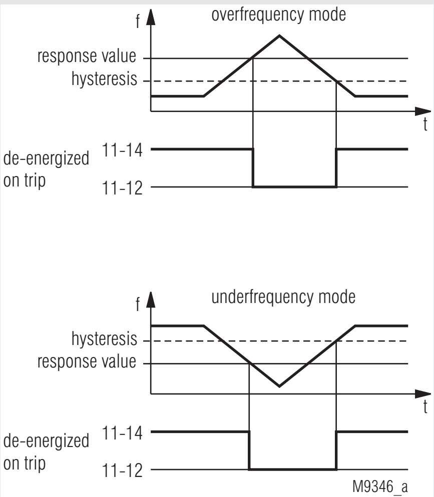
DOLD

0265348

Your Advantage
- Protection of persons, machines and products
- Easy setting
- Universal input, for configuration of different sensors (PNP, NPN, 2-wire, contact, voltage)

Features
- According to IEC/EN 60 255-1
- Detection of over- or underspeed or frequency, function selectable
- 3 selectable ranges for frequency or speed, adjustable tripping value
- Ranges up to 10 kHz (≙ 600.000 ipm) available,therefore suitable for turbines, centrifuges and similar applications
- Adjustable hysteresis
- Input also suitable for SKF sensor bearings
- As option for Namur sensors
- As option for permanent magnet sensors
- As option with adjustable switching delay/start up delay
- On request with manual reset
- IK 9055 and SK 9055: compact version for DC 24 V auxiliary supply
- IL 9055 and SL 9055: for auxiliary supply up to AC 400 V with galvanic separation to sensor input
- De-energized on trip (Energized on trip on request)
- LED indicators for auxiliary supply, sensor pulses and contact position
- 1 changeover contact (2 changeover on request)
- Devices available in 2 enclosure versions:
- IK/IL 9055: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
- SK/SL 9055: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- DIN rail or screw mounting
- IK 9055, SK 9055: width 17.5 mm
  IL 9055, SL 9055: width 35 mm

Function Diagram



Approvals and Markings

*
C US
Canada / USA

* see variants

Applications

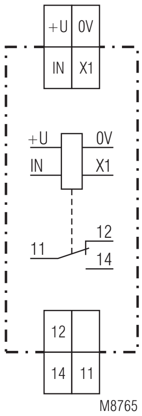
Speed monitoring on rotating machine parts, monitoring of cyclic movements, general monitoring of pulse sequences (transpor-tation, conveyors production systems), monitoring of pulse frequency (e.g. flow sensors, anemometers), pulse monitoring on railway rolling stock

Function

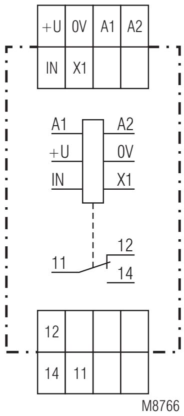
The frequency to be monitored is connected to the input terminal IN. It is compared to the adjusted tripping value.

In overfrequency mode, the output relay switches into alarm position when the preset response value is exceeded. When the system frequency once more falls below the response value minus the preset hysteresis, the output relay will switch back into normal position.
In underfrequecy mode, the output relay switches into alarm position when the actual value falls below the preset response value. When the system frequency once mor exceeds the response value plus hysteresis, the output relay will switch back into normal position.
If de-energized on trip is selected, the output relay is energized (11-14 closed) in normal status. If energized on trip is selected, the output relay is energized (11-14 closed) in alarm status.

Circuit Diagrams



IK 9055, SK 9055



IL 9055, SL 9055

Connection Terminals

Terminal designation	Signal designation
U+, 0V	Supply voltage device and sensor
A1, A2 (only at IL/SL)	Auxiliary voltage input
X1, IN	Connection sensor (see application example)
11, 12, 14	Changeover contact

Indicators

Green LED: On, when only auxiliary voltage connected to A1-A2, intermittent red/green flashing when pulses are on the input IN

Yellow LED: On, when the output relay is energized (contacts 11-14 closed)

Notes

To the universal input of the speed monitor (terminals +U, X1, IN, 0V) a wide range of different sensors can be connected (capacitive, inductive, ultrasonic, hall effect, optical, reed, etc.) The input is suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660, part 208).
Depending on the type of sensor (3-wire PNP or NPN, 2-wire, contact, voltage) the connection is made to different terminals (see Connection Examples).
The models IL and SL 9055 have a galvanic separation between Input Circuit (+U, X1, IN, 0V) and auxiliary supply (A1, A2 e.g. 230 V AC).
24 V DC with up to 20 mA is provided on the terminals U+/0V for the supply of the sensor.
If sensors with higher power consumption are used, the model IK and SK 9055 is suitable, where the sensors and the speed monitor are supplied by DC 24 V from an external power supply.
The speed monitors can be operated with SKF sensor bearings. Sensor bearings include ball bearing and speed sensor in a compact way. The actual sensors are hall effect sensors with NPN output. The connection is made as with NPN proximity sensors.
The model /200 is optimised for Namur proximity sensors according to IEC 60 947-5-6 (VDE 0660 part 212, previously EN 50 227/ DIN 19 234). Namur sensors are 2-wire sensors with defined current in on and off state.
The model /300 is designed to connect permanent magnet sensors. Permanent sensors are simple, robust 2-wire sensors without voltage supply and electronic circuits. They generate an induced voltage while the permanent magnet passes. They are very cost effective and can be used also with high temperature and hard ambient conditions.

Monitoring indicator of sensor input
The upper 2-coloure LED shows the connected supply voltage and the status of the sensor:

Green:	input IN on LOW level
Red:	input IN on HIGH level
Green/Red:	pulses on input IN

Several devices on one sensor
A parallel connection of several monitors to one sensor is possible without problems on the universal input, when several tripping values are required or a range between two limits should be monitored. The corresponding terminals are connected in parallel.

Monitoring function over- or underfrequency
The function can be changed by a slide switch on the front of the unit. Energized on trip or de-energized on trip remains the same when changing the function, also the tripping value remains unchanged. No calculations with hysteresis are necessary.

Hysteresis setting
When the setting value is very low in the lowest range, the hysteresis should not be adjusted to the minimum in order to avoid cycling of the output relay.
In the operating mode underfrequency (<f) at setting values near to the end of the rage the hysteresis can only be set to 4 ... 10 % due to the internal circuit. When there are problems, the next higher range should be selected.

Reaction time
The unit work with an integrating measuring principle, where the mean value of several input pulse periods is calculated. This avoids problems with interference pulses, but the reaction time gets longer. The reaction time relates to the lowest adjustable frequency on the actual unit.

An approximate calculationis: Time constant $(\tau) \approx \frac{2.5}{f_{min}}$

Notes

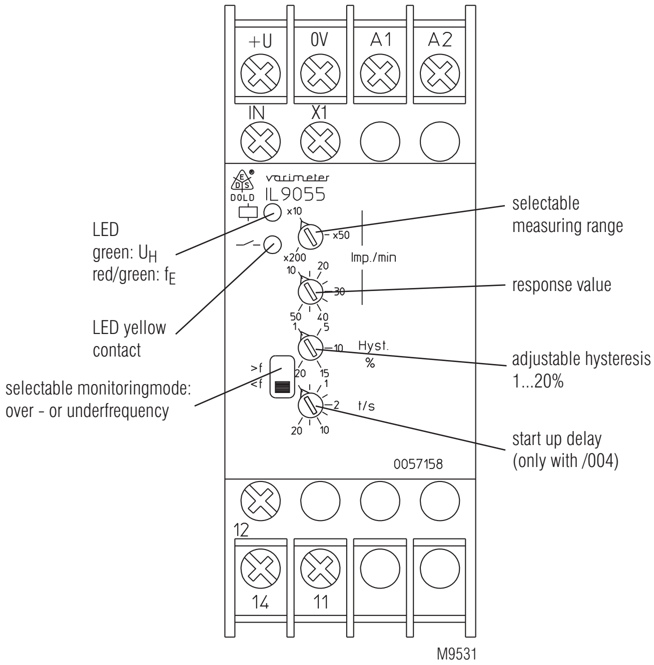
The time constant (τ) is the time after which a change of the input frequency with 63 % influences the calculation. If the input frequency before the change is near to the switching value or the change of the frequency is very low, the reaction time can be shorter then the time constant. The technical data will show always the time constant.
Special models with shorter time constant (limited frequency range) on request.

Maximum input frequency, minimum pulse and space time
Every frequency measuring device detects input pulses only up to a certain maximum input frequency. (This is also a result of a proper interference suppression.) If the input frequency is higher then the maximum value, the input pulses are not longer detected. The monitor detects frequency 0.

The maximum frequency is always much higher then the maximum setting value of the highest setting range (see technical data).
Also the maximum switching frequency of the sensors must be observed. In addition every frequency input needs a certain minimum pulse and space duration of the connected sensor to react properly. This is very important with high frequency and a low or high pulse/space ratio (e.g. a small active area on big diameter or a small gap on big diameter at high rotation speed). If a frequency near to the maximum speed should be detected a pulse/space ratio of 1:1 should be provided by designing the rotating part accordingly. Pulse time is the time the high signal is present at te IN terminal, space time is the time the low signal is present on the IN terminal.
When using PNP sensors or contacts connected to +U the pulse time is identically with the on time of the sensor or contact.
The minimum pulse or space time are very short on these modules, so that most applications are uncritical (see technical data).

Variants with delay or start up delay
Devices with adjustable switching delay or start up delay can be made. The start up delay is started when connecting the auxiliary supply, during this time no frequency mesurement is done. This may be useful in application for underspeed monitoring when the speed monitor is started up with the motor which needs some time to get on operation speed. Without start up delay there would be an alarm when before the motor is on speed. Compared with the standard switching delay a start up delay has the advantage that is only work one time on start up, but after that a change is detected immediately. If the start up delay is not required, (e.g. on function overspeed), the potentiometer "t/s" is set to left end (minimum).

Setting



Technical Data

Input Circuit

Universal input:	for PNP-, NPN-, 2-wire sensors, contacts and voltage suitable for proximity sensors according to IEC/EN 60 947-5-2 (VDE 0660 part 208)
IK 9055, SK 9055:	sensor supply by external auxiliary voltage DC 24 V
IL 9055, SL 9055:	built in power supply approx. DC 24 V,
max. 20 mA	
Max. residual current	
of 2-wire sensors:	2 mA (OFF)
Max. voltage drop	
of 2-wire sensors:	8 V (ON)
Voltage drive	
input resistance:	approx. 17 kΩ
Threshold Low	
IK 9055, SK 9055:	approx. 9.2 V
IL 9055, SL 9055:	approx. 8.4 V
Threshold High	
IK 9055, SK 9055:	approx. 11 V
IL 9055, SL 9055:	approx. 10.2 V

NAMUR Input

IK 9055/200, SK 9055/200,	
IL 9055/200, SL 9055/200:	für NAMUR-sensors according to IEC/EN 60 947-5-6 (VDE 0660 part 212) (previously EN 50227/DIN 19234)
No-load operation voltage:	approx. 8.2 V
Input resistance:	1 kΩ
Short circuit current:	approx. 8 mA
Switching thresholds:	Low approx. 1.5 mA High approx. 1.8 mA

Input

IK 9055/300, SK 9055/300,	
IL 9055/300, SL 9055/300:	for permanent magnet sensors
Input resistance	
at f < 100 Hz:	approx. 50 kΩ
at f = 2 kHz:	approx. kΩ
Input sensitivity	
standard:	approx. 50 $mV_{eff.}$ (at f < 500 Hz)
high:	approx. 20 $mV_{eff.}$ (at f < 250 Hz)
Max. input voltage:	80 $V_{eff.}$
Monitoring mode:	overfrequency („>f") or underfrequency („<f") selectable via slide switch
Response value:	frequency ranges each 3-fold, selectable via rotary switch

Technical Data

Frequency range:			
100 ... 500 500 ... 2500 2000 ... 10000 Impulse/min	50 ... 500 500 ... 5000 5000 ... 50000 Impulse/min	2 ... 20 20 ... 200 200 ... 2000 Hz	10 ... 100 100 ... 1000 1000 ... 10000 Hz
Fineadjustment range:			
infinitely 1:5	infinitely 1:10	infinitely 1:10	infinitely 1:10
Max. Input frequency (Pulse: break = 1:1):			
5 kHz	5 kHz	5 kHz	15 kHz
Min. pulse- and breaktime:			
150 µs	150 µs	150 µs	50 µs
Time constant τ measuring circuit:			
approx. 1.4 s	approx. 3 s	approx. 1.4 s	approx. 0.2 s

Hysteresis	
adjustable infinitely:	1... 20 % of the adjusted response value
Start up delay	
IK 9055/004, SK 9055/004, IL 9055/004, SL 9055/004	
adjustable logarithmically:	0.1 ... 20 s

Auxiliary Circuit

IK 9055, SK 9055	
(terminal connection +U/0V):	
Nominal voltage U_H:	DC 24 V
Voltage range:	19.2 ... 30 V
Nominal consumption:	max. approx. 0.5 W
IL 9055, SL 9055	
(terminal connection A1/A2):	
Nominal voltage U_H:	AC 24 V, 48 V, 230 V (others on request)
Voltage range:	0.8 ... 1.1 U_H
Nominal consumption:	approx. 4 VA
Frequency range:	45 ... 400 Hz

Output

Contacts:	1 changeover contact	
Thermical current I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
nach DC 13		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A / 230 V:	1.5 x 10^5 switching cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 941-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60°C	
Storage:	- 20 ... + 60°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated impulse voltage/ pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	20 V/m	IEC/EN 61000-4-3
1 GHz ... 2 GHz:	10 V/m	IEC/EN 61000-4-3
2 GHz ... 2.7 GHz:	1 V/m	IEC/EN 61000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF-wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011

Technical Data

Degree of protection

Housing:	IP 40	
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, Frequency 10...55Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	DIN EN 50 005	
Wire connection:	DIN 46 228-1/-2/-3/-4	
Cross section:	2 x 0.6 ... 2.5 mm² solid or 2 x 0.28 ... 1,5 mm² stranded wire with and without ferrules	
Stripping length:	10 mm	
Wire fixing:	Plus-Minus-terminal screws M3,5 with self-lifting clamping piece	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail mounting (IEC/EN60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	

Weight

IK 9055:	approx. 65 g
SK 9055:	approx. 85 g
IL 9055:	approx. 140 g
SL 9055:	approx. 160 g

Dimensions

Width x height x depth

IK 9055:	17.5 x 90 x 59 mm
SK 9055:	17.5 x 90 x 98 mm
IL 9055:	35 x 90 x 59 mm
SL 9055:	35 x 90 x 98 mm

CSA-Data

Nominal voltage U_N:

IK 9055, SK 9055:	DC 24 V
IL 9055, SL 9055:	AC 24 V, AC 48 V, AC 230 V
Ambient temperature:	-20 … +60°C
Switching capacity:	3A 240Vac
Wire connection:	60°C / 75°C copper conductors only AWG 20 - 14 Sol Torque 0.6 Nm AWG 20 - 16 Str Torque 0.6 Nm

Technical data that is not stated in the CSA-Data, can be found in the technical data section.

Classification to DIN EN 50155 for IK 9055

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Types

IK 9055.11/60 50 ... 50000 Ipm U_H DC 24 V Hysteresis 1 ... 20 %
Article number: 0059786

- Universal input for PNP-, NPN-, 2-wire sensors, contacts, voltage
- Selectable function: over- or underfrequency
- 3-fold selectable ranges 50 ... 500 Ipm, 500 ... 5000 Ipm, 5000 ... 50000 Ipm
- Response value unfinitely adjustable 1:10
- Hysteresis adjustable: 1 ... 20 %
- Auxiliary voltage U_H: DC 24 V
- De-energized on trip
- Output: 1 changeover contact

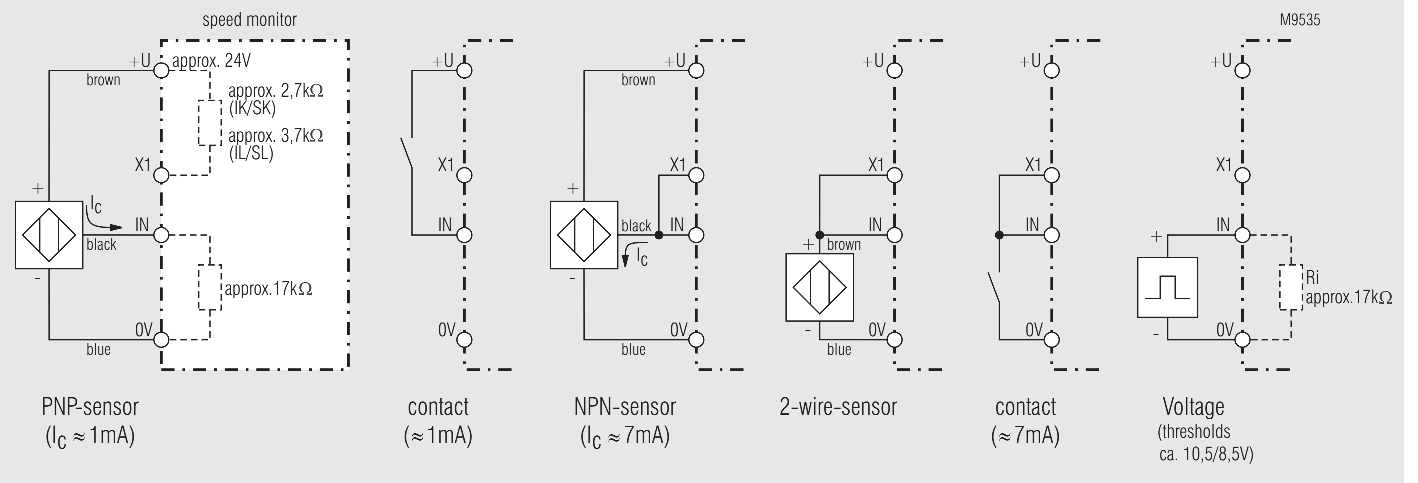
IL 9055.11/60 2 ... 2000 Hz U_H AC 230 V Hysteresis 1 ... 20 %
Article number: 0057157

- Universal input for PNP-, NPN-, 2-wire sensors, contacts, voltage
- Selectable function: over- or underfrequency
- 3-fold selectable ranges 2 ... 20 Hz, 20 ... 200 Hz, 200 ... 2000 Hz
- Response value unfinitely adjustable 1:10
- Hysteresis adjustable: 1 ... 20 %
- Auxiliary voltage U_H: AC 230 V
- De-energized on trip
- Output: 1 changeover contact

Variants

IK 9055. _ _ /60, SK 9055._ _ /60, IL 9055._ _ /60, SL 9055._ _ /60:	with CSA-approval
IK 9055.11/004, SK 9055.11/004, IL 9055.11/004, SL 9055.11/004:	with adjustable start up delay 0.1 ... 20 s
IK 9055.11/200, SK 9055.11/200, IL 9055.11/200, SL 9055.11/200:	input for NAMUR sensors
IK 9055.11/300, SK 9055.11/300, IL 9055.11/300, SL 9055.11/300:	input for permanent magnet sensors

Application Example Universal Input



Note: For IK-models the auxiliary voltage (DC 24 V) must be additionally connected to terminals +U/0V

VARIMETER
Speed Monitor
MK 9055N, MH 9055

DOLD

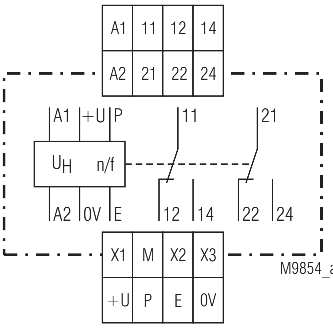
0266141

MK 9055N MH 9055

Your Advantage
- Protection of persons, machines and products
- Easy setting
- Universal input, for configuration of different sensors (PNP, NPN, 2-wire, contact, voltage)
- with fast reaction at low speed

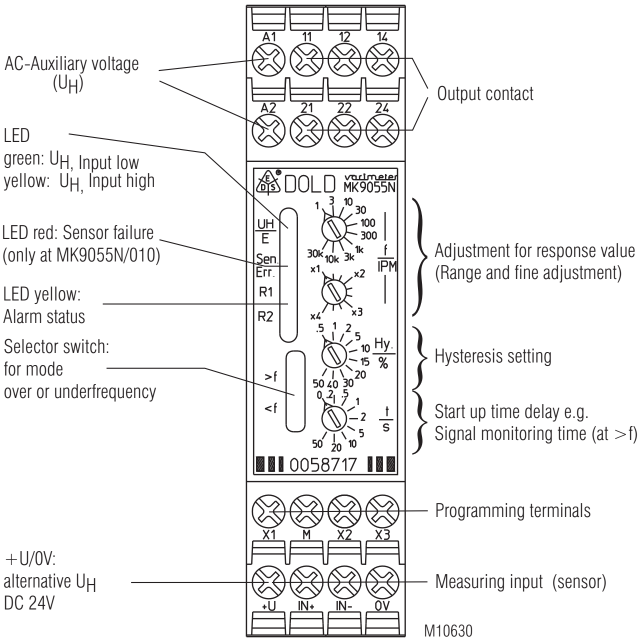
Features
- According to IEC/EN 60 255-1, VDE 0435 part 303
- Detection of high or low-rpm / stand still (adjustable function)
- Large setting range 1 ... 120.000 IPM or 0.15 ... 20.000 Hz (10 ranges each)
- As option with input for NAMUR-sensors with sensor and wire protection against interruption and short circuit
- Adjustable hysteresis 0.5 ... 50 %
- Adjustable start up time delay 0 ... 50 s, control with external contact
- Adjustable monitoring time for missing input signal at function overfrequency; additional using as standstill level
- Programmable via termminals:
  - Alarm delay of 0 ... 100 s
  - with manual reset or auto reset
- LED-indication for auxiliary voltage, measuring input and output relay; additional LED for indication of wire- / sensor failure at NAMUR-input
- Auxiliary voltages AC 230 V and DC 24 V in one unit
- 2 changeover contacts, closed circuit operation
- Open circuit operation on request
- As option with analogue output, proportionally to speed
- Device available with 2 response values and seperately controlled output relays for under- and overfrequency see MK 9055N/5_ _
- MH 9055 with wide input range for auxiliary voltage (AC/DC 24 ... 60 V or AC/DC 110 ... 230 V)
- 2 possible compact designs
  MK 9055N: Width 22,5 mm
  MH 9055: Width 45 mm

Circuit Diagram



M9854_a

Setting

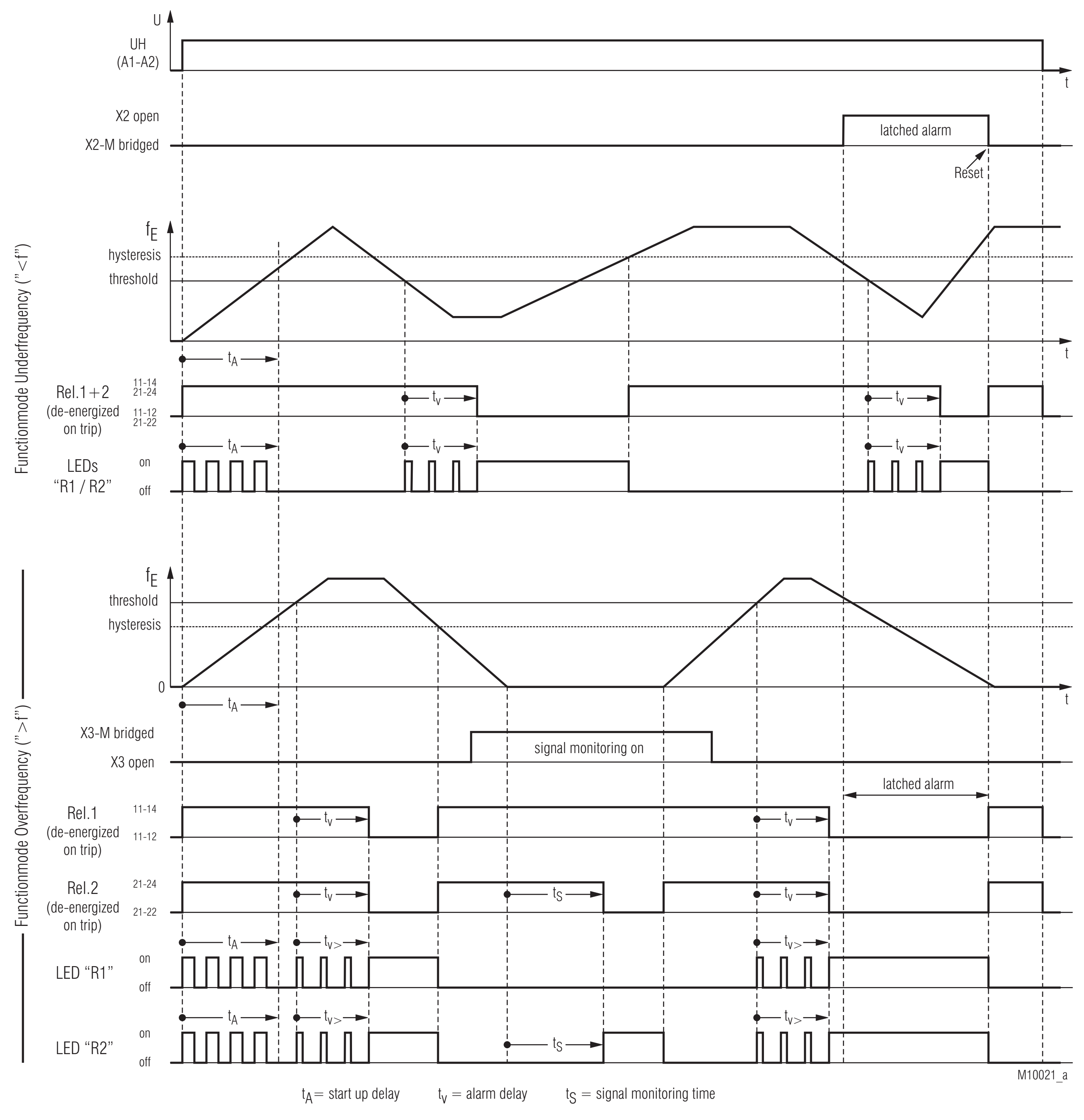


M10630

Approvals and Markings

CE

Application
- Speed monitoring on rotating machine parts
- monitoring of cyclic movements
- general monitoring of pulse sequences (transportation, conveyors, production systems),
- monitoring of pulse frequency (e.g. flow sensors, anemometers)



U
UH
(A1-A2)
t
X2 open
X2-M bridged
latched alarm
Reset
Functionmode Underfrequency ("<f")
fE
hysteresis
threshold
t
tA
Rel.1+2
(de-energized
on trip)
11-14
21-24
11-12
21-22
tv
LEDs
"R1 / R2"
on
off
Functionmode Overfrequency (">f")
fE
threshold
hysteresis
0
t
X3-M bridged
X3 open
signal monitoring on
latched alarm
Rel.1
(de-energized
on trip)
11-14
11-12
Rel.2
(de-energized
on trip)
21-24
21-22
tS
tv>
LED "R1"
LED "R2"
M10021_a
tA= start up delay
tv = alarm delay
tS = signal monitoring time

Function

The auxiliary supply is connected to terminals A1-A2. An operation with alternatively DC 24 V is possible via terminals +U / 0V.
Different sensors can be connected to the measuring input that detects the speed pulses.
The input frequency is compared to the setting value (response value = fine tunig x range).
As the device measures the periods duration the fastest frequency measurement is possible.
In overfrequency mode (switch on front in pos. “>f”) the output relays switches to alarm state if the input frequency rises above the response value for a longer time then selected on the terminals. If the measuring frequency drops again under the hysteresis value, the output relay switches back to good state without delay.
In underfrequency mode (switch on front in pos. “<f”) the output relays switches to alarm state, if the input frequency drops below the response value for a longer time then selected on the terminals. If the measuring frequency rises again above the hysteresis value, the output relay switches back to good state without delay.
If manual reset is chosen, the output relay stays in tripped position, even if the frequency is back to normal. The reset is made by bridging terminals X2-M or by disconnecting the auxiliary supply.
In alarm state the yellow LEDs „R1“ / „R2“ are continuously on, during time delay they flash with short pulse.
In de-energized on trip mode the output relay is energized in good state (contacts 11-14, 21-24 etc. closed).
In energized on trip mode the output relay is energized in alarm state (contacts 11-14, 21-24 etc. closed).
If start up delay is selected a timer is started after connection of auxiliary supply that disables the measuring circuit for the adjusted time on terminal X3. During this time the frequency measurement is disabled, the yellow LEDs "R1" and "R2" flash symmetrically and the output relays remain in “good” position.
This start up delay avoids an alarm e.g. when starting a generator or motor.
IIn overfrequency mode missing input signal can be monitored as option: If the signal is missing longer then the selected monitoring time, relay 2 (contacts 21-22-24) and LED “R2” indicate alarm.
The variant /010 (NAMUR sensor input) includes broken wire and short circuit monitoring of the sensor and connection wire. A red LED indicates this failure and the output relays switch off.

Indicators

Upper LED "UH/E":	- green:	Auxiliary supply is present, measuring input is Low
	- yellow:	Auxiliary supply is present, measuring input is High
	- Iintermittent red/green flashing if U_H and impuls sequence present	
Red LED "Sen.Err": (only at NAMUR input)	- on, when broken wire or interruption at sensor ciruit detected	
Lower LED „R1“ (yellow):	- on, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active	
Lower LED „R2“ (yellow):	- on, when alarm state (under- / overfrequency) flashes (with short pulse) when time delay is active	
	- additional flashes at signal monitoring alarm LEDs "R1" and "R2" flash together during start up delay	

Notes

Universal measuring input
The universal input of the speed monitor (terminals +U, P, E, 0V) can handle a large variety of sensors (inductive or capacitve proximity sensors, ultra sonic, halleffect, optical sensors, light barriers, reed contacts etc.). The input is suitable for all sensors according to IEC / EN 60947-5-2 (VDE 0660 part 208).
Depending on the sensor that is used (3-wire PNP or NPN, 2-wire, contact) the connection to the input terminals could be different (see Connection Examples).
As the speed monitor is suitable for a very high maximum frequency, RC-elements need to be installed to suppress bouncing of contact sensors (see Connection Examples). It is possible to use standard RC-elements suitable for contact protection or RF interference protection.

NAMUR input
The Variant M_9055N/010 is optimzed for the connection of NAMUR sensors according to IEC / EN 60947-5-6 (VDE 0660 Teil 212; former EN 50227 / DIN 19234). These 2-wire-sensors are connedted to terminals IN+ / IN- (see application example).
Namur sensors have a defined current in ON as well as in OFF state. This allows to detect short circuits and broken wire on sensor and connection wires with this variant. Together with the upper green/yellow LED the type of failure is indicated:
Red LED "Sen..Err" ON and upper LED "UH/E" lights up green:
Broken wire at input circuit
Red LED "Sen..Err" ON and upper LED "UH/E" lights up yellow:
Short circuit at input circuit

Instead of a NAMUR sensor also a contact sensor with correspondent resistor circuit can be used (see Connection Examples).The suggested resistors are necessary to avoid broken wire or short circuit detection alarm. If the resistors are connected directly on the sensor side, the wiring still is monitored. Because of contact bouncing of mechanical contacts a capacitor has to be connected on the measuring input terminals.

Sensor supply, 24V DC auxiliary supply as alternative
The input circuit (+U, P, E, 0V) is galvanic separated to the auxiliary supply A1, A2 (eg. AC 230V). By connecting AC 230V auxiliary voltage on terminals A1-A2 the unit provides a voltage of approx. 24 V max 20mA to supply external sensors. If the auxiliary supply is DC 24V or sensors with higher power consumption are used, the DC 24V auxiliary supply is connected to terminals +U / 0V. The sensors are also supplied from this source. (In this case there is no galvanic separation between auxiliary supply and measuring input).

Monitoring indicator of sensor input
The upper 2-coloure LED shows the connected supply voltage and the electrical state of the measuring input:
Green: input E ist on LOW level
Yellow: input E ion HIGH level
Depending on the type of sensor (PNP, NPN, 2-wire, NO or NC contact) the actual state (active or inactive) is indicated.
Green / yellow: input pulses from sensor present

Several speed monitors on one sensor
Parallel operation of several speed monitors on one sensor is possible the universal input e.g. to monitor several speed levels. The corresponding terminals are all connected in parallel.

Start up delay / monitoring of measuring signal.
The start up time delay (t_A) can be adjusted with the lowest potentiometer on the front side of the unit and is activated when connecting the auxiliary supply. If no start-up delay is required the potentiometer is turned fully antic-clockwise (t=0).
In underfrequency mode (“<f”) the start up delay can be extended/restarted at any time with a control contact between terminals X3-M. As long as X3-M is bridged the start up delay is continuously on and the frequency is not measured. When the link on X3-M is opened the start up delay time restarts.
In overfrequency mode (“>f”) with a bridge on X3-M, the lowest potentiometer sets the measuring signal monitoring time (t_S) (The adjusted time values t_A / t_S are identically).

When signal monitoring in mode “>f” is selected by bridging X3-M the measuring input is monitored as follows:
If during the adjusted monitoring time interval no measuring signal is detected, measuring signal alarm is indicated. As soon as the measuring signal returns the alarm status is reset (auto reset selected) and the monitoring interval t_S starts again.
The alarm status is indicated on relay 2 (contacts 21-22-24) and LED “R2” and can be easily differentiated from under/over frequency alarm where

Notes

both relays (contacts 11-12-14 and 21-22-24) and LEDs “R1”and “R2”) are active.
The detection of missing measuring signal can increase the safety in critical applications on overfrequency. It detects if the measuring signal is connected to the input of the device and works correctly: It can be checked if the frequency input still delivers pulses. If a Namur sensor is used with variant /010 higher safety can be achieved by the integrated short circuit and broken wire detection.

Second speed level / detection of overspeed and standstill
The signal monitoring time setting in the overfrequency mode can also be used as second speed level, e.g. to detect standstill in addition to overspeed. To achieve this, the monitoring time is adjusted on the lower potentiometer to the reverse value of the pulse frequency that indicates standstill.

Programming terminals (M-X1-X2-X3):

Attention! The terminals M-X1-X2-X3 have no galvanic separation to the measuring circuit (+U / P / E / 0V) e.g. auxiliary voltage DC 24 V

M: Common connection (Ground) of the programming terminals (identically with 0V)

X1: A response delay of 0…100 s after connection of auxiliary supply is achieved by connecting a X1 to M with a potentiometer or fixed resistor (0.25 W) see technical data. The delay can be stopped by bridging X1 to M at any time. If no start up delay is required the terminals X1-M must be linked.

X2: Manual reset with NO contact push button on X2-M, auto reset with terminals X2-M bridged.

X3: When X3-M is bridged in mode “underfrequency” the start up delay is continuously active or the time is restarted. In mode overfrequency the monitoring of the measuring signal is switched on by bridging X3-M.

Adjustment aid for start up delay and alarm delay
During the elapse of start up delay and alarm delay the yellow LED „R1“ and „R2“ is flashing with a frequency of 2 Hz. To set a specific time value in seconds the number of flash pulses can be used to check the setting: Number of flash pulses divided by 2 = time delay in seconds.

Variants with Analogue Output Indicating the Actual Speed / Frequency

With this variant the programming terminal X3 is replaced by terminal UA or IA, that provides an analogue signal proportional to the speed with reference to terminal 0V. This signal is either 0 ... 10 V or 0 ... 20 mA or 4 ... 20 mA. As the X3 terminal is not available, these variants do not offer indication of missing speed signal in overfrequency mode and the start up delay can only be initiated when the auxiliary supply is switched on.
With the variant /017 (NAMUR sensor input with analogue output 4 ... 20 mA) the analogue output also indicates a sensor or wiring failure by switching the output to 0 mA.
The analogue output has no galvanic separation to measuring input and the alternative auxiliary supply on terminals +U/0V

Technical Data

Frequency Measuring Input

Universal Input (+U / P / E 0V)

for PNP-, NPN-, 2-wire sensors, contacts and voltages, connection see application examples;
suitable for all proximity sensors according to IEC / EN 60947-5-2 (VDE 0660 part 208)
built in power supply approx. DC 24 V / max. 20 mA on terminals +U / 0V;
Alternatively external auxiliary voltage supply DC 24 V via terminals +U / 0V

Max. residual current
at 2-wire sensors: 2 mA (OFF state)
Max. voltage drops
at 2-wire sensors: 8 V (ON state)
Voltage control
Input resistance: approx. 17 kΩ
Low-capability: ≤ 8 V
High-capability: ≥ 11 V

NAMUR Input (Variant /010) IN+ / IN-

for NAMUR sensors according to IEC/EN 60947-5-6 (VDE 0660 part 212)
No-load voltage: approx. 8.2 V
Input resistance: approx. 1 kΩ
Short circuit current: approx. 8 mA
response value
Low: typ. 1.55 mA
High: typ. 1.75 mA
Broken wire threshold: ≤ 0,15 mA
short circuit threshold: ≥ 6 mA

Alternatively external auxiliary voltage supply DC 24 V via terminals +U / 0V

Common Data for Inputs

response value
10 ranges: 1 ... 120.000 IPM

range	1	2	3	4	5	6	7	8	9	10
Imp. / min	1 to 4	3 to 12	10 to 40	30 to 120	100 to 400	300 to 1.200	1.000 to 4.000	3.000 to 12.000	10.000 to 40.000	30.000 to 120.000

or 0.15 ... 20.000 Hz

range	1	2	3	4	5	6	7	8	9	10
Hz	0.15 to 0.6	0,5 to 2	1,5 to 6	5 to 20	15 to 60	50 to 200	150 to 600	500 to 2.000	1.500 to 6.000	5.000 to 20.000

Fine adjustment: infinite 1:4
Max. input frequency
(Impuls : Pause = 1 : 1)
Range 1 ... 4: 1.5 kHz
Range 5 ... 7: 5 kHz
Range 8 ... 10: 25 kHz
Min. pulse- and breaktime
Range 1 ... 4: 350 µs
Range 5 ... 7: 100 µs
Range 8 ... 10: 20 µs
Stability of the setting threshold at variation of auxiliary voltage and temperature: 2 %
Hysteresis: infinetely variable: 0.5 ... 50 % of the setting response value
Reaction time of Frequency monitoring: (Alarm delay set to 0) Duration of 1 cycle (inverse value of adjusted frequency) + 10 ms (at over frequency: inverse value of signal frequency + 10 ms)
Response delay: adjustable 0 ... 100 s with resitor/potentiometer across terminals X1-M:

R / kΩ:	0	15	22	33	47	68	100	150	220	470	∞
t_v / s:	0	0.3	0.7	1.3	2.3	5	9	15	25	50	100

Technical Data

Time between connection of auxiliary supply and ready to mesure: approx. 0.4 s (with start up delay is 0)
Start up time delay / signal monitoring time: continously variable on logarithmic scale; t_A: 0 ... 50 s, t_S: 0,1 ... 50 s

Auxiliary Voltage (A1-A2; e.g. +U / 0V)

Auxiliary voltage U_H:	AC 115, 230, 400 V + DC 24 V each (via terminals +U / 0V) (Terminals +U / 0V has no galvanic separation to measuring input)
	AC/DC 24 ... 60, 110 ... 230 V (only for MH-version possible)
Voltage range	
AC:	0.8 ... 1.1 U_H
DC:	0.85 ... 1.2 U_H
AC/DC:	0.75 ... 1.2 U_H
Frequency range	
AC:	45 ... 440 Hz
Nominal consumption:	
AC:	approx. 4 VA
DC:	approx. 2 W

Contact Output (11-12-14, 21-22-24)

Contacts:	2 changeover contacts	
Thermal curren I_{th}:	4 A	
Switching capacity		
to AC 15		
NO contacts:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13		
NO contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contacts:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrcal life		
to AC 15 at 1 A, AC 230 V:	1,5 x 10^5 switch.cycl.	IEC/EN 60 947-5-1
short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanicl life:	≥ 30 x 10^6 switching cycles	

Analogue Voltage Output (variant /0_5, terminal "UA" against "0V")

Nominal output voltage:	0 ... 10 V, linear proportional to the speed / frequency, without galvanic separation to measuring input and DC 24 V-supply
Load:	max. 10 mA
Scale:	0 V at 0 IPM / Hz 5 V at setting end of scale value of speed / frequency 10 V at input frequency = 2 x end of scale value
Accuracy:	3 %

Analogue Output (variant /0_6, e.g. 0_7; terminal "IA" against "0V")

Output:	0 ... 20 mA bzw. 4 ... 20 mA, linear proportional to the speed / frequency, without galvanic separation to measuring input and DC 24 V-supply
Max. burden:	500 Ω
Scale:	0 mA e.g. 4 mA at 0 IPM / Hz 10 mA e.g. 12 mA at setting end of scale value 20 mA at input frequency = 2 x end of scale value
Fault signal at NAMUR input:	at output 4 ... 20 mA (variant /017) on sensor failure currentt drops tp 0
Accuracy:	3 %

Technical Data

General Data

Nominal operating mode:	continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distance		
rated impulse voltage / pollution degree:		
Contact to measuring input:	4 kV / 2	IEC 60 664-1
Contact to auxiliary circuit:	4 kV / 2	IEC 60 664-1
Contact to Contact:	4 kV / 2	IEC 60 664-1
Auxiliary circuit A1-A2 to measuring input:	4 kV / 2	IEC 60 664-1
Programming terminals M-X1-X2-X3:	without galv. separat. to measuring input	
Auxiliary voltage DC 24 V (an +U / 0V):	without galv. separat. to measuring input	
Analogue output, optional (UA / IA):	without galv. separat. to measuring input	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage between wires for power supply:	1 kV	IEC/EN 61 000-4-5
HF-wire guided	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	1 x 4 mm² solid or 2 x 2.5 mm² solid or 1 x 2.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4 oder 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/	
Wire fixing:	Plus-minus terminal screws M3,5 box terminals with wire protection	
Fixing torque:	0.8 Nm	
Mounting:	DIN-rail	IEC/EN 60 715
Weight:	approx. 210 g	

Dimensions

Width x height x depth:

MK 9055N:	22.5 x 90 x 97 mm
MH 9055:	45 x 90 x 97 mm

Standard Type

MK 9055N.12 1 ... 120.000 IPM U_H AC 230 V
Article number: 0058715

- Universal input for PNP-, NPN-, 2-wire-sensors, contacts, voltage
- Selectable function: over- or underfrequency
- Selectable signal monitoring at overfrequency mode
- 10-fold selectable ranges: 1 ... 120.000 IPM
- Response value unfinitely adjustable 1:4
- Hysteresis: adjustable from 0.5...50 %
- Start up time delay / signal monitoring time: adjustable from 0 ... 50 s
- Response delay: settalbe with external resitor to 0...100 s
- Alarm storing or auto-reset selectable
- Auxiliary voltage U_H: AC 230 V + DC 24 V
- Closed circuit operation
- Output: 2 changeover contacts
- Width: 22.5 mm

Standard Type

MK 9055N.12   0,15 ... 20.000 Hz U_H AC 230 V
Article number: 0058716

- Universal input for PNP-, NPN-, 2-wire-sensors, contacts, voltage
- Selectable function: over- or underfrequency
- Selectable signal monitoring at overfrequency mode
- 10-fold selectable ranges: 0,15 ... 20.000 Hz
- Response value unfinitely adjustable 1:4
- Hysteresis: adjustable from 0.5...50 %
- Start up time delay / signal monitoring time: adjustable from 0 ... 50 s
- Response delay: settalbe with external resitor to 0...100 s
- Alarm storing or auto-reset selectable
- Auxiliary voltage U_H: AC 230 V + DC 24 V
- Closed circuit operation
- Output: 2 changeover contacts
- Width: 22.5 mm

Variants

M_ 9055_.12/0_ _

0 Standard
5 Analogue output 0 ... 10 V (instead of terminal X3)
6 Analogue output 0 ... 20 mA (instead of terminal X3)
7 Analogue output 4 ... 20 mA (instead of terminal X3)

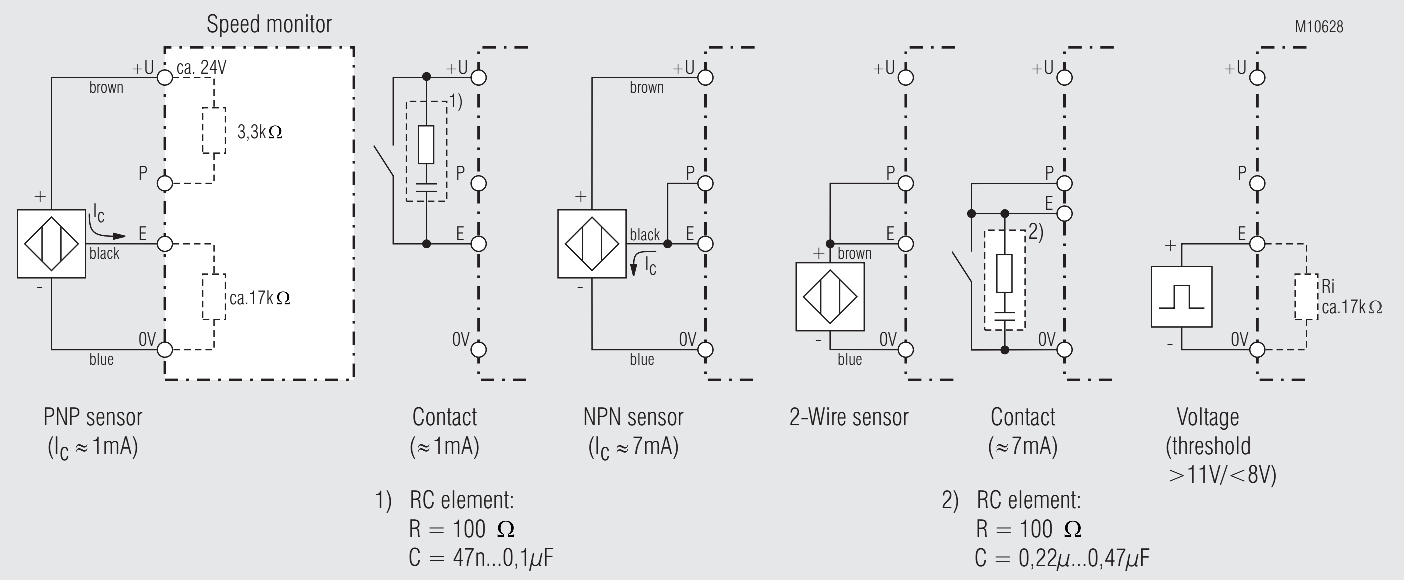
0 Universal input (standard)
1 NAMUR input with sensor monitoring

Ordering example for variants

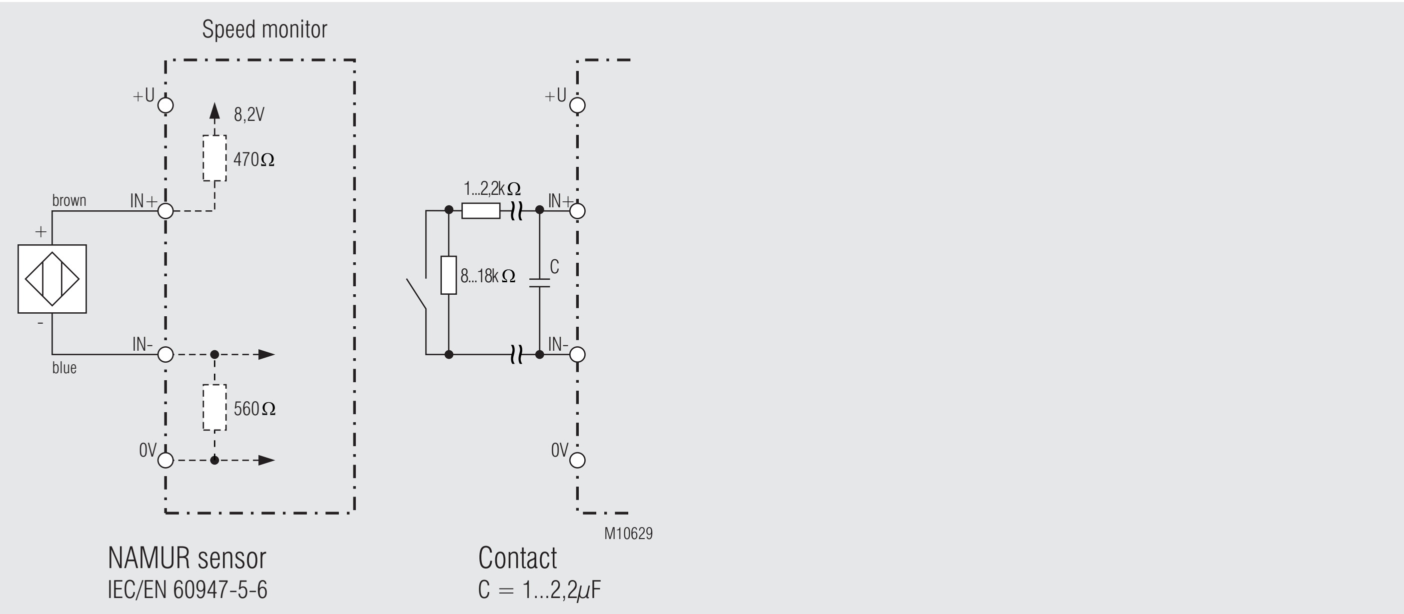
MK 9055N .12 /010 1 ... 120.000 IPM U_H AC 230 V

- Auxiliary voltage
- Response value 1 ... 120.000 IPM or 0.15 ... 20.000 Hz
- Variant, if required
- Contacts
- Type

Application Examples



Universal input



NAMUR input only at M_ 9055.12/01_

VARIMETER
Level Sensing Relay
IL 9151, SL 9151, MK 9151N

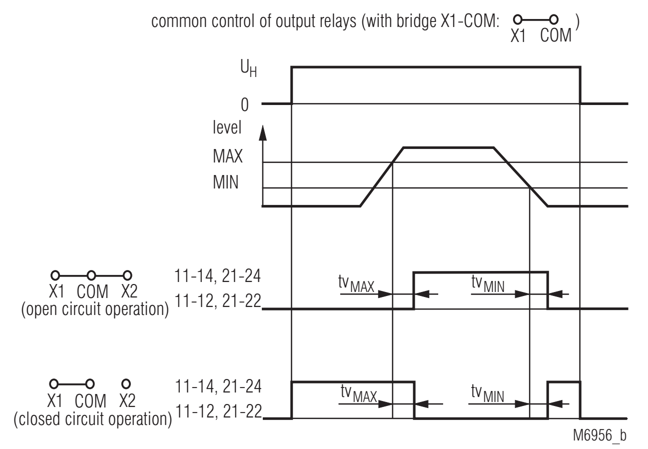
DOLD

IL 9151 SL 9151 MK 9151N

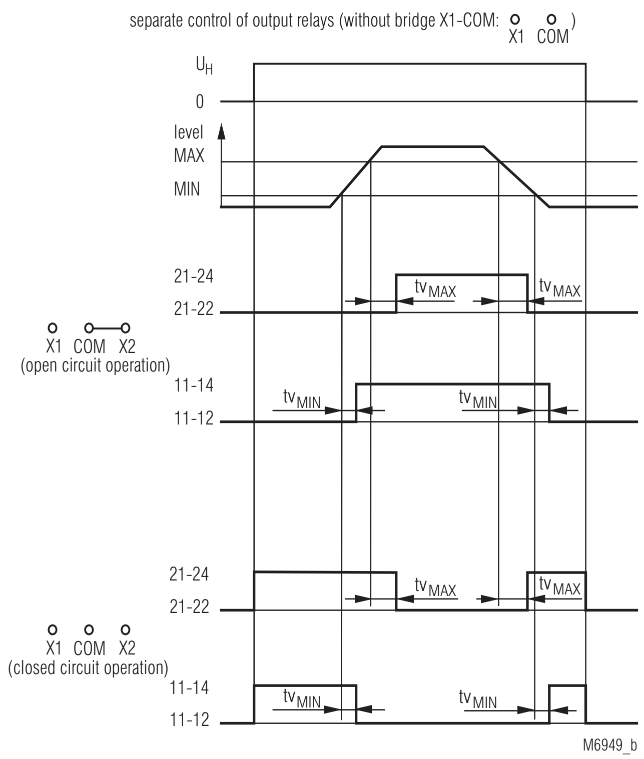
0225266

- According to IEC/EN 60 255-1
- 3 probe connections for 2-point and 1-point level control
- Also for use as moisture detector
- High interference resistance of the Measuring Circuit, which is isolated from the mains
- Max. wire length to the probes: 1500 m
- Large setting range: 2 ... 450 kΩ this permits differentiation between fluid and foam
- Separately adjustable response and release time delay 0.2 ... 20 s for MIN- and MAX-level
- Programmable for:
  - 2 separate controllable output relays for MIN and MAX level
  - common controlled output relays for 2-point hysteresis level control
  - open circuit operation
  - closed circuit operation
- Measuring Circuit for probes works with internally generated AC voltage (approx. 30 Hz), electrolytic behaviour does not occur in the liquid
- For auxiliary voltages of 24 ... 415 V AC or 24 V DC
- LEDs for operation and state of contact
- 2 changeover relays with 1 changeover contact each
- IL 9151 and SL 9151 with safe separation according to IEC/EN 61 140, IEC/EN 60 947-1
- Devices available in 3 enclosure versions:
  IL 9151: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9151, MK 9151N: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- IL/SL 9151: 35 mm width
  MK 9151N: 22.5 mm width

Function Diagrams



common control of output relays



seperate control of output relay

Approvals and Markings

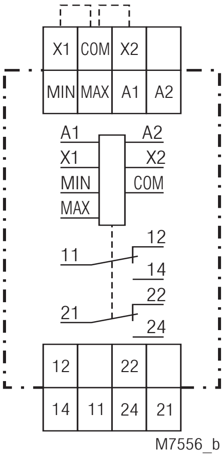
CE CCC A025518 [1]

[1] only IL 9151, MK 9151N

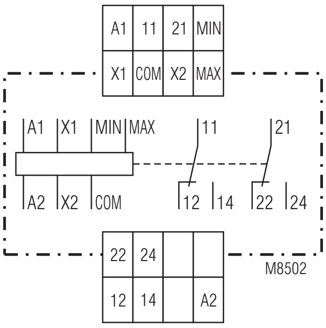
Application

- Level monitoring and control for conductive liquids and powders, e.g. maximum and minimum filling levels, overfilling and protection against dry running
- Monitoring and control of the mixing ratio of conductive liquids
- General resistance monitoring tasks, e.g. limit temperature detection with PTC
- Contact protection relay with time delay

Circuit Diagrams



IL 9151.12, SL 9151.12



MK 9151N.12

Connection Terminals

Terminal designation	Signal designation
A1, A2	Auxiliary voltage AC oder DC
MIN, MAX, COM	Electrode connection
X1 - COM	Selection operating mode via bridge
X2 - COM	Selection de-energized or energized via bridge
11, 12, 14	Contacts Rel. 1
21, 22, 24	Contacts Rel. 2

Indicators

IL/SL 9151

green LED:	on, when auxiliary supply connected
yellow LED:	on, when relay MIN active
red LED:	on, when relay MAX active

MK 9151N

green LED:	on, when auxiliary supply connected
yellow LED "MIN":	on, when relay MIN active
red LED "MAX":	on, when relay MAX active

Notes

All commercially available probes are suitable.
The reference probe for level measurement is generally located at the lowest point of the container and must always be connected to the "COM" terminal. The container itself can be used as a reference probe if it consists of conductive material.

On the level "MIN" and "MAX" the other probes are installed and connected to the corresponding inputs of IL 9151. It is also possible to connect only one probe.

2-point level control
The 2-point control is selected when a liquid should be kept between "MIN" and "MAX" level. 2 operation modes can be selected:

without bridge X1 - COM:	separate control of output relays for "MIN" and "MAX" level
with bridge X1 - COM:	common control of both output relays

When the relays are separately controlled each output relay is operated by the corresponding probe circuit. For each level the time delay can be set separately (tv_{MIN} and tv_{MAX}).

When the relays are controlled together, these work like a relay with 2 changeover contacts as follows:

If the liquid rises above the "MAX" level the output relays switch over after the delay time of tv_{MAX} and start e.g. a pumpt to sink the liquid. If the level goes under the "MAX" level the output relays remain activated until the "MIN" level is reached. Now the output relays switch back after the time delay of tv_{MIN} and stop the pump. The whole process starts again when the level reaches the "MAX" probe.

Notes

1-point level control
1-point level control (see Figure) is especially suitable for protection against overfilling and dry running on containers with a free inlet/outlet. In this configuration, all that is required besides the reference probe "COM" is the "MAX", which must be located at the desired limit level. The output relay switches over after the set delay time if the fluid level exceeds or falls below the limit level, which permits fluid to be pumped out or added.

Without bridge X1 - COM only relay "MAX" (contacts 21-22-24) switch, with bridge X1 - COM both relays switch together. If for each output relay a separate time delay is necessary, the unit has to be set to separate control of the outputs and the "MIN" and "MAX" inputs are connected to the same probe. Please note that the resistance of the liquid is divided up on both input circuits. Therefore the response value must be setted to the double value.

If separate output control is selected with 1-point control for each output relay the time delay can be setted separately.

Because of the settable time delay of 0.2 to 20 sec for each probe circuit, it is possible to suppress early switching caused by waves on the liquid. Also time depending level control can be realised. The delay works integrating and is active when the liquid goes over as well as under the probe level.

The wide setting range allows easily an optimum setting so that the unit can differentiate between foam and liquid. The response value must be set to a value high enough, that the unit reacts when the liquid, but not when the foam reaches the probe (for setting procedure the time delay is set to min. value).

Technical Data

Input

Setting range of the fluid resistance:	2 ... 450 kΩ (response value)	
Setting:	on logarithmically divided absolute scale	
Switching point hysteresis:	approx. 4 % (at 450 kΩ) ... 15 % (at 2 kΩ) of the set value	
Voltage and temperature influence:	< 2 % of the set value	
Max. cable length to the probes:	Set value	Cable length (at 100 nF/km)
	450 kΩ	50 m
	100 kΩ	200 m
	35 kΩ	500 m
	10 kΩ	1500 m
	5 kΩ	3000 m
Max. sensing voltage:	approx. AC 10 V (internally generated)	
Max. sensing current:	approx. AC 1.5 mA (internally generated)	
Response and release times		
tv_{MIN}, tv_{MAX}:	0.2 ... 20 s for both output relays separate settable Setting on logarithmically-divided absolute scale	

Auxiliary Circuit

Auxiliary voltage U_H:	AC 24, 42, 110, 230 V DC 24 V
Voltage range of U_H	
AC:	0.8 ... 1.1 U_N
DC:	0.85 ... 1.25 U_N
Nominal power consumption	
AC:	approx. 2 VA
DC:	approx. 1 W
Frequency range:	45 ... 400 Hz

Output

Contacts		
IL/SL 9151.12, MK 9151N.12:	2 x 1 changeover contact	
Thermal current I_{th}:	4 A	
Switching capacity		
IL/SL 9151:		
to AC 15		
NO contact:	5 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	2 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
MK 9151N:		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
IL/SL 9151:		IEC/EN 60 947-5-1
to AC 15at 1 A, AC 230 V:	2 x 10^5 switching cycles	
MK 9151N:		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	1.5 x 10^5 switching cycles	
Short circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range:		
Operation:	- 20 ... + 60°C	
Storage:	- 25 ... + 70°C	
Altitude:	< 2.000 m	
Clearance and creepage distances		
rated rated impulse voltage voltage / pollution degree		IEC 60 664-1
IL/SL 9151:		
input / Auxiliary Circuit:	6 kV / 2 (at U_H = DC 24 V: 1kV)	
input / output circuit:	6 kV / 2	
MK 9151N:		
input / Auxiliary Circuit:	4 kV / 2 (at U_H = DC 24 V: 1 kV)	
input / output circuit:	4 kV / 2	
auxiliary / output circuit A1-A2 (AC):	4 kV / 2	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz:	3 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:		
IL/SL 9151:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Min. cross section:	0,6 mm	
Insulation of wires or sleeve length:	10 mm	
MK 9151N:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Min. cross section:	0.5 mm²	
Abisolierlänge der Leiter:	8 mm	
Wire fixing:		
IL/SL 9151:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
MK 9151:	Box terminal with wire protection	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9151:	approx. 165 g	
SL 9151:	approx. 192 g	
MK 9151N:	approx. 180 g	

Dimensions

Width x height x depth	
IL 9151:	35 x 90 x 59 mm
SL 9151:	35 x 90 x 98 mm
MK 9151N:	22.5 x 90 x 98 mm

CCC-Data

Nominal voltage U_N:		
MK 9151N:	AC 24, 42, 110, 230 V DC 24 V	
Switching capacity		
to AC 15		
NO contact:	1.5 A / AC 230 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Standard Type

IL 9151.12 2 ... 450 kΩ AC 230 V 0.2 ... 20 s
Article number: 0049135
- Settable response value: 2 ... 450 kΩ
- Auxiliary voltage U_H: AC 230 V
- Response and release delay: 0.2 ... 20 s
- 2 output relays with 1 changeover contact each
- With safe separation
- Width: 35 mm

SL 9151.12 2 ... 450 kΩ AC 230 V 0.2 ... 20 s
Article number: 0051552
- Settable response value: 2 ... 450 kΩ
- Auxiliary voltage U_H: AC 230 V
- Response and release delay: 0.2 ... 20 s
- 2 output relays with 1 changeover contact each
- With safe separation
- Width: 35 mm

MK 9151N.12 2 ... 450 kΩ AC 230 V 0.2 ... 20 s
Article number: 0054100
- Settable response value: 2 ... 450 kΩ
- Auxiliary voltage U_H: AC 230 V
- Response and release delay: 0.2 ... 20 s
- 2 output relays with 1 changeover contact each
- Width: 22.5 mm

Variants

MK 9151N.12/001: time delay, when level drops under setting value
MK 9151N.12/002: time delay, when level rises over setting value

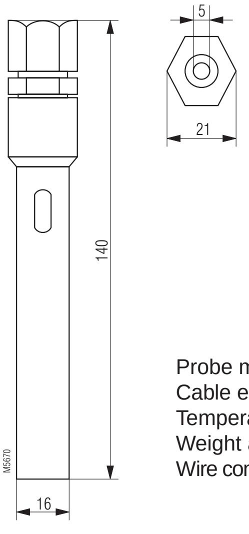
Ordering example for variants

MK 9151 N .12 /00_ 2 ... 450 kΩ AC 230 V 0.2 ... 20 s

- 0.2 ... 20 s: Response and release delay
- AC 230 V: Auxiliary voltage
- 2 ... 450 kΩ: Response value
- /00_: Variant, if required
- .12: Contacts
- MK 9151 N: Type

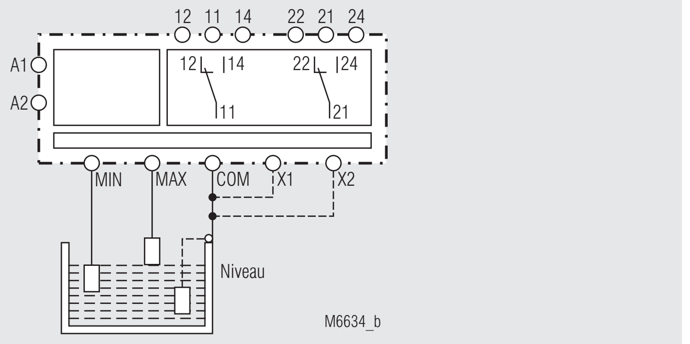
Accessories

OA 5640: Standard probe
Article number: 0016045

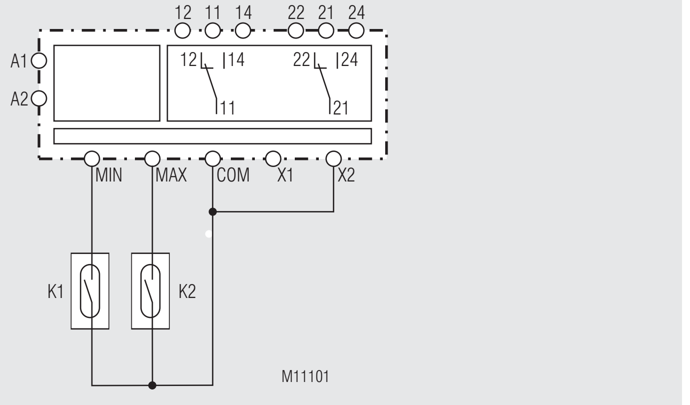


Probe made of stainless steel,
Cable entry PG 9,
Temperature range 0 ... +60°C,
Weight approx. 0.1 kg
Wire connection 2.5 mm² stranded wire with sleeve

Application Example



IL 9151, SL 9151 with safe separation according to IEC/EN 61 140, IEC/EN 60 947-1



Application as contact protection relay, e.g. for two reed contact switches (K1, K2).

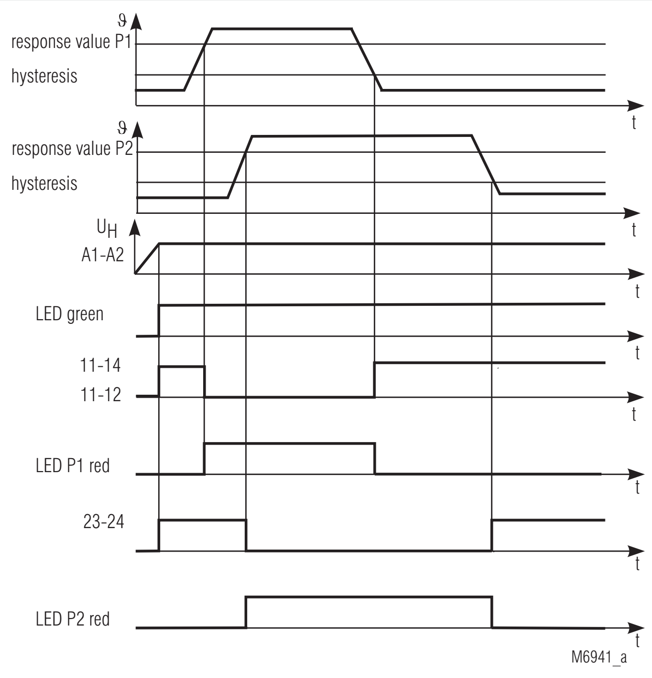
VARIMETER
Temperature Monitoring Relay
BA 9094

0225238

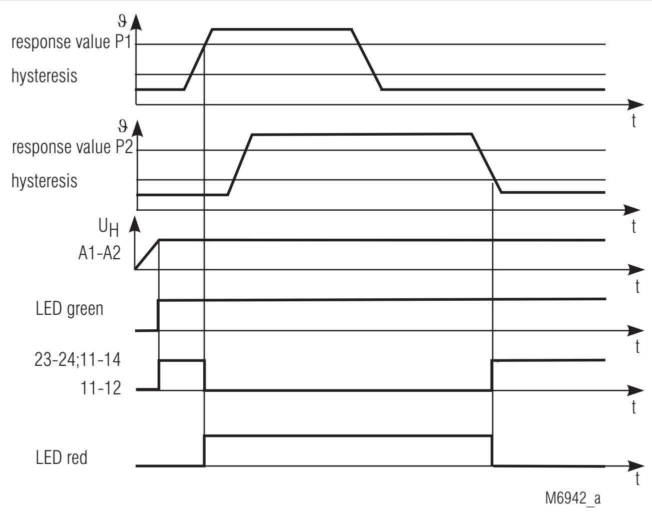
BA 9094/001

- According to IEC/EN 60 255, VDE 0435
- 2 PT 100 inputs with separate outputs or alternatively common output
- Optionally 1 PT 100 input with 2 separate outputs for 2 different response values
- Separate adjustable response and release values for each input
- Optionally with fixed response and release values
- Broken wire detection in sensor circuit
- Closed circuit operation
- 2 wire connection
- Width 45 mm

Function Diagrams



BA 9094.28, BA 9094.28/100



BA 9094.20

Approvals and Markings

CE

Applications

Monitoring of temperature e.g. Motors, ball bearings, etc.

Function

On overtemperature and broken wire the output relay deenergises

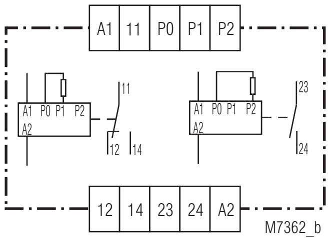
Indicator

green LED:	on, when auxiliary supply connected
red LED P1, P2:	on, when overtemperature

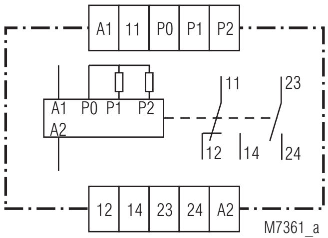
Notes

An input which is not used must be bridged

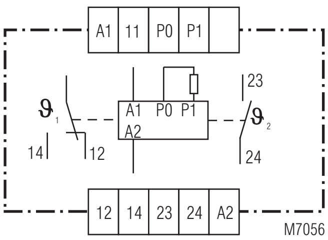
Circuit Diagrams



BA 9094.28



BA 9094.20



BA 9094.28/100

Technical Data

Input

Inputs:	2 PT 100 inputs	
Setting range response value:	20°C ... 100°C	
	other ranges on request	
Hysteresis:	85 % ... 95 % of response value	

Auxiliary Circuit

Auxiliary voltage U_H:	AC 24, 42, 110, 127, 230 V	
	DC 24 V	
Voltage range:	0,8 ... 1,1 U_H	
Nominal consumption:	3,4 VA	
Nominal frequency:	50/60 Hz	

Output

Contacts:		
BA 9094.28:	1 changeover contact for P1	
	1 NO contact for P2	
BA 9094.20:	1 changeover, 1 NO contact for P1, P2	
Thermal current I_{th} :	6 A	
Switching capacity to AC15:		
BA 9094.28:	5 A / AC 230 V	IEC/EN 60 947-5-1
BA 9094.20:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
BA 9094.28: to AC 15 at 5 A, AC 230 V:	> 0,1 x 10^6 switching cycles	
BA 9094.20: to AC 15 at 1 A, AC 230 V:	> 0,1 x 10^6 switching cycles	
Short-circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60 °C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppressions:	Limit value class B	EN 55 011
Degree of protection:		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	
Terminal designation:	EN 50 005	
Wire connection:	2 x 2,5 mm^2 solid or	
	2 x 1,5 mm^2 stranded wire with sleeve	
	DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	320 g	

Dimensions

Width x height x depth: 45 x 74 x 132 mm

Standard Type

BA 9094.28 AC 230 V 50/60 Hz 2 x 20 ... 100°C

Article number:	0048194	stock item
• Output:	1 changeover contact for P1	
	1 NO contact for P2	
• Nominal voltage U_N:	AC 230 V	
• Response value:	2 x 20 ... 100°C	
• Width:	45 mm	

Variants

BA 9094. _ _ /001:	with fixed response and release value
	Response value:
	135°C ± 2°C
	other values on request
	Release value:
	125°C ± 2°C
	other values on request
BA 9094.28/100:	only 1 PT 100 input
	with 2 seperate outputs for
	2 different response values

Ordering example for variants

BA 9094 .28 AC 230 V 50 / 60 Hz 20°C ... 100°C 20°C ... 100°C

- Response value P2
- Response value P1
- Nominal frequency
- Auxiliary supply
- Contacts
- Type

BA 9094 .28 /_ _ _ AC 230 V 50 / 60 Hz 135°C 125°C 135°C 125°C

- Release value P2
- Response value P2
- Release value P1
- Response value P1
- Nominal frequency
- Auxiliary voltage
- Variant, if required
- Contacts
- Type

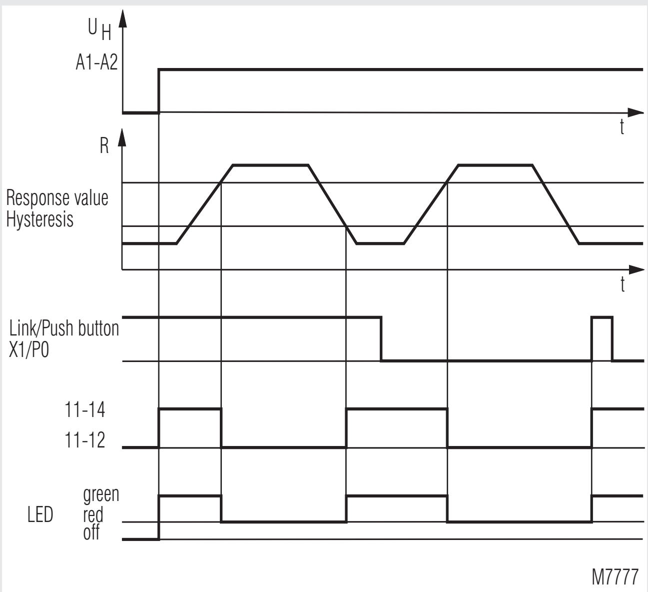
VARIMETER
Temperature Monitoring Relay
IK 9094, IL 9094, SK 9094, SL 9094

0233819

- According to IEC/EN 60 255-1
- 1 PT100 input, 2-wire connection
- 3 temperature ranges
- Adjustable response value
- Adjustable Hysteresis with wide range 3 ... 30 °C or 1 ... 15°C
- Broken wire detection in sensor circuit
- Programmable hysteresis or latching function via terminal X1
- IK 9094 no galvanic separation between measuring and Auxiliary Circuit
- Closed circuit operation
- LED indicator for operation and state of output relay
- 1 changeover contact
- As option with response value up to - 50°C, e.g. for refrigeration plants
- As option with galvanic separation between measuring and Auxiliary Circuit
- Devices available in 2 enclosure versions:
  I-model: depth 59 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  S-model: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- DIN rail or screw mounting
- IK 9094, SK 9094: 17.5 mm width
  IL 9094, SL 9094: 35 mm width

Approvals and Markings

Function Diagram



Applications

- Monitoring of temperature e.g. Motors, ball bearings, rooms, refrigeration plants, etc.
- Temperature control
- Monitoring of humidity, see relay workshop no. 19
- For industrial and railway applications

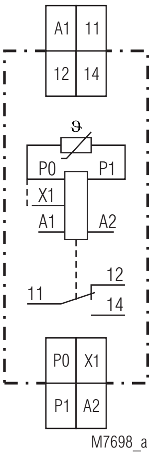
Function

On terminals P0 - P1 the resistance of the PT 100 is measured.
On overtemperature and broken wire the output relay deenergises

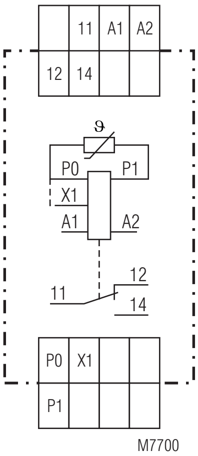
Indicators

LED:	green, when auxiliary supply connected
LED:	red, when overtemperature

Circuit Diagrams



IK 9094.11, SK 9094.11



IL 9094.11, SL 9094.11

Connection Terminal

Terminal designation	Signal designation
A1, A2	Auxiliary voltage
P0, P1	Connection for resistance thermometer PT100
X1, P0	Control input (manual reset / hysteresis function) X1/P0 nicht gebrückt: manual reset X1/P0 gebrückt: Hysteresis function
11, 12, 14	Changeover contact

Notes

Setting
Easy to set the temperature in °C:

Response value:	Upper switch sets range (3 positions) + Middle potentiometer sets response value in °C
Release value:	Lower potentiometer sets Hysteresis in °C

To operate the unit as temperature controller it has to be set to hysteresis function and to a small hysteresis (e.g. 3 °C).

With link X1-P0:	Hysteresis function
Without link X1-P0:	Latching function (the relay stays in off postion even if the temperature is correct again.

The latching can be reset by bridging X1-P0 for a short time (Push button) or by disconnecting the auxiliary supply.

The IK/SK 9094 is designed to operate 2 wire PT 100 sensors. Therefore the setting must be corrected when using longer wires with about 2.6 °C per Ω of the connection wires (e.g. 2 pole cable 2 x 1.5 mm^2 of 40 m length has about 1Ω).

A temperature sensor with insulation must be used (AC 300 V).

Technical Data

Input

Inputs :	P0 and P1 for PT100 sensors according to DIN 43 760 / DIN IEC 751 X1 to set hysteresis or latching function:
- with bridge X1-P0:	hysteresis function
- without bridge X1-P0:	latching function (Fault signal remains stored when temperature goes over set point)
Setting range of response value:	0 ... 150°C in 3 ranges (0 ... 50°C, 50 ... 100°C, 100 ... 150°C) (on request 100 ... 250°C in 3 ranges of 50°C)
IL/SL 9094.11/010:	- 50 ... +25°C in 3 ranges (- 50 ... -25°C, -25 ... 0°C, 0 ... +25°C)
Release value:	Adjustable hysteresis on absolute scale 3 ... 30°C,
IL/SL 9094.11/010:	Hysteresis 1 ... 15°C adjustable (Release value = response value minus hysteresis)
Voltage and temperature influence:	< 1 % of setting value
Measuring current:	approx. 2.5 mA
Dissipation of PT 100:	approx 0.6 mW
Voltage on open terminals P0-P1:	approx. 6 V
Broken wire detection:	A broken wire in the PT 100 sensor wires is detected as fault (over-temperatur)

Auxiliary Circuit (A1-A2)

Auxiliary voltage U_H	
IK/SK 9094:	AC/DC 24 V
IL/SL 9094:	AC 230 V (galvanic separation to measuring circuit)
Voltage range	
at AC:	0.8 ... 1.1 U_N
at DC:	0.9 ... 1.25 U_N
Nominal consumption	
IK/SK 9094.11	
at AC:	approx. 1 VA
at DC:	approx. 0.6 W
IK/SK 9094.11/001	
at AC:	approx. 1.2 VA
at DC:	approx. 0.7 W
IL/SL 9094.11:	approx. 2 VA
Nominal frequency (AC):	50/60 Hz
Galvanic isolation between measuring and auxiliary inputs	
IK/SK 9094.11/001	DC 1000 V
IL/SL 9094.11:	4 kV / 2

Output

Contacts		
IK/SK 9094.11, IL/SL 9094.11:	1 changeover contact	
Thermal current I_{th} :	4 A	
Switching capacity		
to AC 15		
NO contact:	3 A, AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A, AC 230 V	IEC/EN 60 947-5-1
to DC 13 at 0.1 Hz:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	≥ 3 x 10^5 Switching cycles	
Short circuit strength max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 Switching cycles	

Technical Data

General Data

Operating mode:	Continuous operation	
Temperature range		
Operation:	- 20 ... + 60 °C	
Storage:	- 25 ... + 60 °C	
Relative air humidity:	max. 95 %	
Altitude:	< 2,000 m	
Clearance and creepage distances		
rated impulse voltage / pollution degree		
IK/SK 9094.11:		
Between A1-A2 auxiliary supply:	0.5 kV / 2	IEC 60 664-1
IK/SK 9094.11/001:		
Between measuring input P0-P1 (-X1) and auxiliary supply:	1 kV / 2	IEC 60 664-1
IL/SL 9094.11:	4 kV / 2	IEC 60 664-1
Between input and output contacts:	4 kV / 2 (basis insulation)	IEC 60 664-1
Airgap:	≥ 3 mm	
Creepage distance on PCB:	≥ 3 mm,	
Inside enclosure:	≥ 5.5 mm	
Outside enclosure:	≥ 5.5 mm	
Overvoltage category:	III	
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation		
80 MHz ... 1 GHz:	10 V / m	IEC/EN 61 000-4-3
1 GHz ... 2 GHz:	10 V / m	IEC/EN 61 000-4-3
2 GHz ... 2.7 GHz:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply		
IK/SK 9094:	0.5 kV	IEC/EN 61 000-4-5
IL/SL 9094:	2 kV	IEC/EN 61 000-4-5
HF wire guided:	10 V	IEC/EN 61 000-4-6
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04 IEC/EN 60 068-1	
Terminal designation:	EN 50 005	
Wire connection:		
Cross section:	2 x 2.5 mm² solid 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Stripping length:	10 mm	
Wire connection:	Flat terminals with self-lifting clamping pieceIEC/EN 60 999-1	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail mounting (IEC/EN 60715) or screw mounting M4, 90 mm hole pattern, with additional clip available as accessory	
Weight		
IK 9094:	65 g	
SK 9094:	83 g	
IL 9094:	137 g	
SL 9094:	164 g	

Dimensions

Width x heigth x depth

IK 9094:	17.5 x 90 x 59 mm
SK 9094:	17.5 x 90 x 98 mm
IL 9094:	35 x 90 x 59 mm
SL 9094:	35 x 90 x 98 mm

Classification to DIN EN 50155 for IK 9094

Vibration and shock resistance:	Category 1, Class B	IEC/EN 61 373
Ambient temperature:	T1 compliant T2, T3 and TX with operational limitations	
Protective coating of the PCB:	No	

Standard Types

IK 9094.11 AC/DC 24 V 0 ... 150°C
Article number: 0051642
SK 9094.11 AC/DC 24 V 0 ... 150°C
Article number: 0054753
- Output: 1 changeover contact
- Auxiliary voltage U_H: AC/DC 24 V
- Response value: 0 ... 150°C
- Width: 17.5 mm

IL 9094.11 AC 230 V 0 ... 150°C
Article number: 0056024
SL 9094.11 AC 230 V 0 ... 150°C
Article number: 0056100
- Output: 1 changeover contact
- Auxiliary voltage U_H: AC 230 V
- Response value: 0 ... 150°C
- Width: 35 mm

Variants

IK 9094.11 /001:	with galvanic isolation between measuring and Auxiliary Circuit
IL 9094.11/010:	for refrigeration plants Art.-no.: 0056080

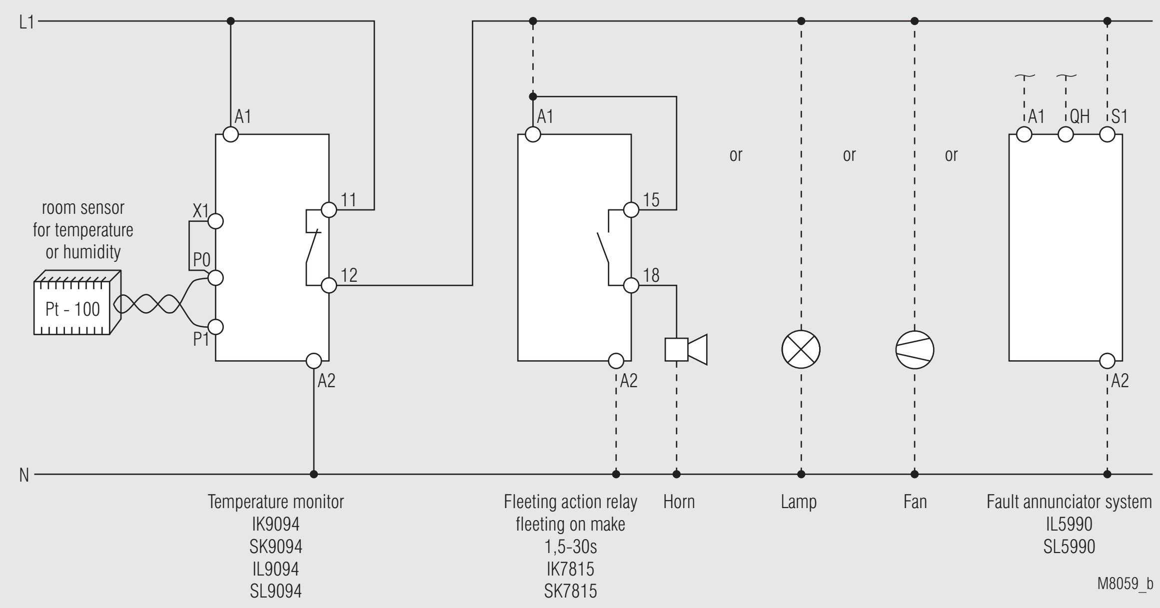
Ordering example for variants

IK 9094 .11 /_ _ _ AC/DC 24 V 0 ... 150°C

- Response value
- Auxiliary voltage
- Variant, if required
- Contacts
- Type

Accessories

ET 4086-0-2:	Additional clip for screw mounting Article number: 0046578



L1
N
A1
A2
X1
P0
P1
11
12
room sensor
for temperature
or humidity
Pt - 100
15
18
or
or
or
QH
S1
Temperature monitor
IK9094
SK9094
IL9094
SL9094
Fleeting action relay
fleeting on make
1,5-30s
IK7815
SK7815
Horn
Lamp
Fan
Fault annunciator system
IL5990
SL5990
M8059_b

VARIMETER
Thermistor Motor Protection Relay
BA 9038, AI 938

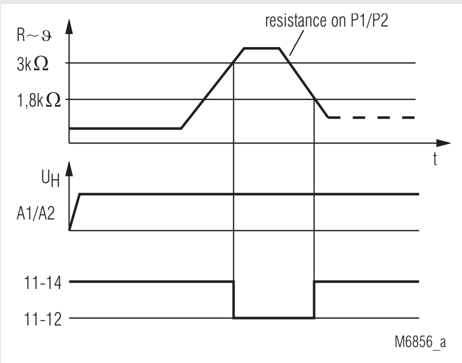
0225095

BA 9038

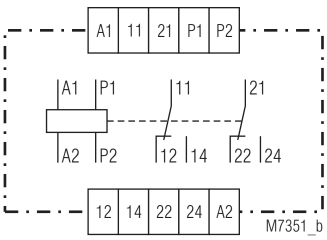
AI 938

- According to DIN VDE 0660 part 302 (pr EN 60 947-8) and part 303
- 1 input for PTC-resistors or bimetal contacts
- Broken wire detection in sensor circuit
- Optionally with no voltage reclosing interlock
- Closed circuit operation
- 1 or 2 changeover contacts
- Width 45 mm

Function Diagram



Circuit Diagram



BA 9038.12, AI 938.002,

Approvals and Markings

CE

Applications

To protect against thermal overload of motors caused by high switching frequency, heavy duty starting, phase failure on one phase, bad cooling, high ambient temperature.

Function

As sensors special PTC-resistors are use, which are normally built into the motor windings. Up to 6 PTC resistors can be connected in series. When the resistance reaches a certain value, the output relay deenergizes. An LED comes on. The thermistor motor protection relay works with closed circuit operation and also detects broken wire on the sensor circuit. Please note, that contact 11-12 and 21-22 may be closed for a short moment while the voltage is switched on.
The models AI 938.001/03 and BA 9038.11/003 include a thermal reclosing interlock. When the response temperature is reached the output relay deenergizes and the push button on the relay front comes out after approx. 1 s. This unit has no indicator LED.
The model BA 9038.__/100 includes an electromagnetic reclosing interlock. When the response temperature is reached the output relay deenergizes and the push button on the relay front comes out immediately. This model has 2 LEDs. One indicates connected auxiliary supply, the other one overtemperature.
The output relay of the units with reclosing interlock remains deenergized, also when the temperature goes back to normal. The interlock is no voltage safe, so also on loss of voltage its actual state is stored (VDE 0113 § 5.4.2).
By pressing the button on the front the module can be reset again.

Notes

The wires of the sensor circuit must not be influenced by other voltages therefore they should be routed separately or screened and earthed at one end only. The total resistance of the wiring should not exceed 100 Ω.

Technical Data

Input Circuit

Response value:	≥ 3 kΩ
Release value:	≤ 1.8 kΩ
Number of sensors:	1 ... 6 pcs
Operate delay:	≤ 20 ms
Release delay:	≤ 15 ms

Auxiliary Circuit

Auxiliary voltage U_H:	AC 24, 42, 110, 127, 230, 240 V
Voltage range of U_H:	0.8 ... 1.1 U_N
Nominal consumption:	2.2 VA
Nominal frequency of U_H:	50 / 60 Hz

Output

Contacts		
BA 9038.11:	1 changeover contact	
AI 938.001:	1 changeover contact	
BA 9038.12:	2 changeover contacts	
AI 938.002:	2 changeover contacts	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V		
2 changeover contacts:	0.5 x 10^5 switching cycles	
1 changeover contact:	2.5 x 10^5 switching cycles	
at 0.05 A:		
2 changeover contacts:	10 x 10^6 switching cycles	
1 changeover contact:	30 x 10^6 switching cycles	
Short-circuit strength		
max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	> 30 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	6 kV (air)	IEC/EN 61 000-4-2
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wired and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppressions:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Screw fixing:		
AI 938:	35 x 50 mm and 35 x 60 mm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:		
BA 9038:	250 g	
AI 938:	240 g	

Dimensions

Width x height x depth:	
BA 9038:	45 x 74 x 124 mm
AI 938:	45 x 77 x 127 mm

Standard Types

BA 9038.11/003 AC 230 V 50 / 60 Hz

Article number:	0028829
• Output:	1 changeover contact
• Auxiliary voltage U_H:	AC 230 V
• with thermal reclosing interlock (manual reset)	
• Width:	45 mm

Variants

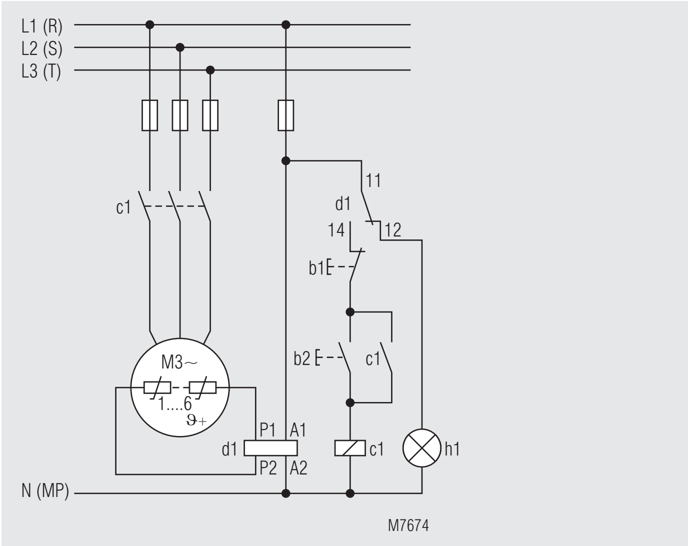
BA 9038.11:	without thermal reclosing interlock (manual reset function)
BA 9038. _ _ /100:	with electro magnetic reclosing interlock (manual reset function)
AI 938.001:	without thermal reclosing interlock (manual reset function)

Ordering example for variants

BA 9038 ._ _ /_ _ _ AC 230 V 50/60 Hz

- Nominal frequency
- Auxiliary voltage
- Variant, if required
- Contacts
- Type

Application Example



VARIMETER
Thermistor Motor Protection Relay
IL 9163, SL 9163

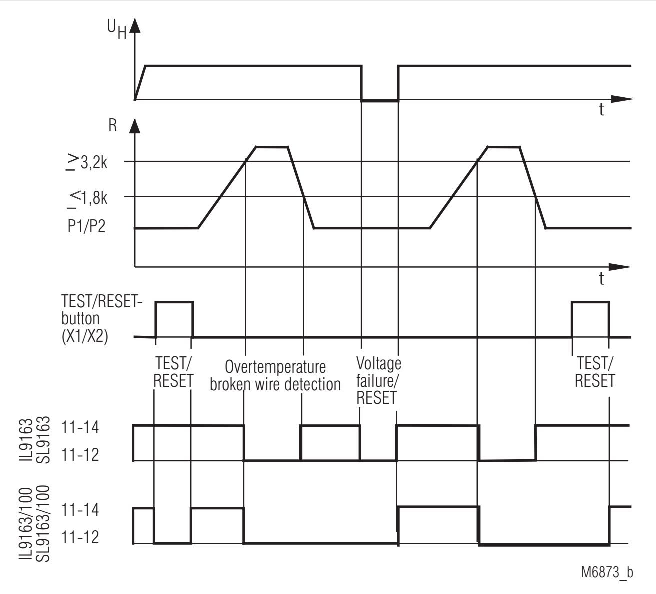
DOLD

0225152

IL 9163 SL 9163

- According to IEC/EN 60 255-1
- Monitoring of:
  - overtemperature
  - broken wire detection in sensor circuit
- 1 input for 1 to 6 PTC-resistors
- With manual reset variant /100
- Optionally with button for reset and test function
- Remote reset on A1/A2 (NC contact) or X1/X2 (NO contact)
- Closed circuit operation
- LED indicator for
  - auxiliary supply
  - state of contact
- 2 changover contacts
- Devices available in 2 enclosure versions:
  IL 9163: depth 58 mm, with terminals at the bottom for installation systems and industrial distribution systems according to DIN 43 880
  SL 9163: depth 98 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

Function Diagram



Approvals and Markings

CE

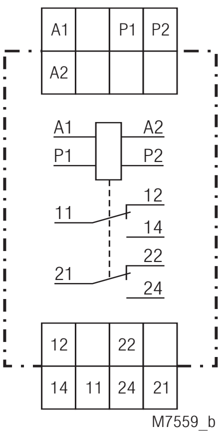
Applications

To protect against thermal overload of motors caused by high switching frequency, heavy duty starting, phase failure on one phase, bad cooling, high ambient temperature.

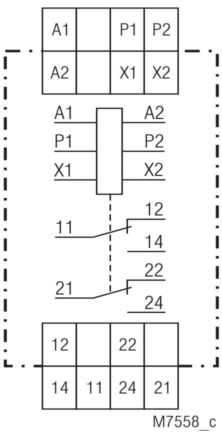
Function

If one of the sensors in the Measuring Circuit reaches the response temperature (or broken wire is detected), the device indicates failure. This failure is stored in the device /100 even if the temperature goes back to normal. The unit can be resetted by pressing the Test/Reset button, by bridging X1/X2 for a short moment or by disconnecting the auxiliary supply for a short time.
Test/Reset button:
Besides the reset function this button provides in normal operation a test facility. The unit indicates fault as long as the button is activated.

Circuit Diagram



IL 9163.12,
SL 9163.12



IL 9163.12/100,
SL 9163.12/100

Indicators

green LED: on, when auxiliary supply connected
red LED: on, when overtemperature or broken wire is detected

Notes

The unit with AC/DC 24 V has no galvanic separation between auxiliary supply (A1/A2) and measuring input (P1, P2), and therefore it should only be used for battery powerd systems or with safety transformers according to IEC/EN 60 742.

Technical Data

Measuring Circuit

Temperature sensors:	PTC-Resistor according to DIN 44081/082
No. of sensors:	1 ... 6 in series
Response value:	3.2 ... 3.8 kΩ
Release value:	1.5 ... 1.8 kΩ
Loading of measuring circuit:	< 5 mW (at R = 1.5 kΩ)
Broken wire detection:	> 3.1 kΩ
Measuring voltage:	≤ 2 V (at R = 1.5 kΩ)
Measuring current:	≤ 1 mA (at R = 1.5 kΩ)
Voltage at broken wire:	DC approx. 9 V
Current when short circuit on input:	DC approx. 1.1 mA

Auxiliary Circuit

Auxiliary voltage U_H:	AC/DC 24 V	
	AC 110, 230, 400 V	50 / 60 Hz
Voltage range:	AC 0.9 ... 1.1 U_H	
at 10 % residual ripple:	DC 0.9 ... 1.25 U_H	
at 48 % residual ripple:	DC 0.9 ... 1.1 U_H	
Nominal consumption:	AC: 1.5 VA	
	DC: 0.85 W	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Max. bridging time on failure of aux. supply:	approx. 70 ms	
Operate delay:	< 40 ms	
Release delay:	< 100 ms	

Control input (X1/X2)

Function:	Remote reset with NO contact (voltage free)
Remark:	This input is not galvanic separated from measuring input P1/P2

Output

Contacts		
IL/SL 9163.12:	2 changeover contacts	
Thermal current I_{th}:	5 A	
Switching capacity		
to AC 15		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V:	≥ 5 x 10^5 switching cycles	
to AC 15 at 5 A, AC 230 V:	≥ 1.5 x 10^5 switching cycles	
Short-circuit strength max. fuse rating:	4 AgL	IEC/EN 60 947-5-1
Mechanical life:	≥ 1 x 10^8 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated rated impulse voltage voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
HF-wire guided	10 V	IEC/EN 16 000-4-6
Interference suppressions:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529

Technical Data

Housing:	Thermoplastic with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded ferruled DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self-lifting clamping piece	IEC/EN 60 999-1
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight		
IL 9163:	150 g	
SL 9163:	200 g	

Dimensions

Width x height x depth	
IL 9163:	35 x 90 x 58 mm
SL 9163:	35 x 90 x 98 mm

Standard Type

IL 9163.12 AC 230 V 50 / 60 Hz

Article number:	0049222
• Auxiliary voltage U_H:	AC 230 V
• Automatic reset	
• Width:	35 mm

SL 9163.12 AC 230 V 50 / 60 Hz

Article number:	0054752
• Auxiliary voltage U_H:	AC 230 V
• Automatic reset	
• Width:	35 mm

Variant

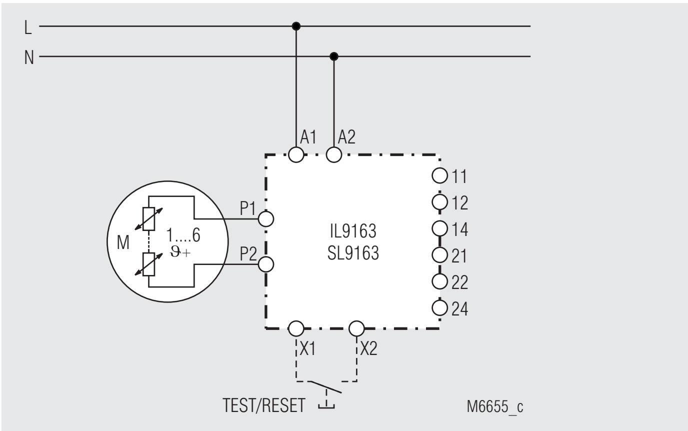
IL 9163.12/100:	2 changeover contacts with manual reset

Ordering example for variant

IL 9163 .12 /_ _ _ AC 230 V 50 / 60 Hz

Nominal frequency
Auxiliary voltage
Variant, if required
Contacts
Type

Application Example



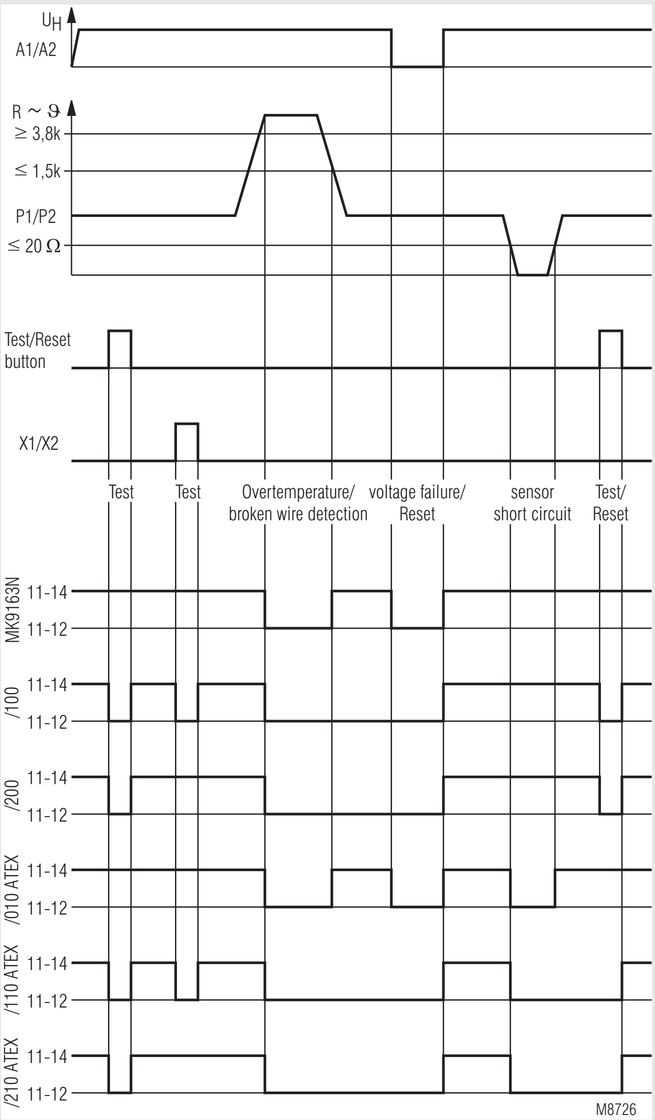
VARIMETER EX
Thermistor Motor Protection Relay
MK 9163N, MK 9163N-ATEX

DOLD

0245068

MK 9163N

Function Diagram



Your advantages
- Reliable temperature monitoring of motors
- Rapid fault location

Features
- According to DIN EN 60947-5-1, DIN EN 60947-8, DIN EN 60079-14, DIN EN 61508, DIN EN 50495, DIN EN 13849
- Monitioring of
  - overtemperature
  - broken wire detection in sensor circuit
  - short circuit detection in sensor circuit
- 1 input for 1 to 6 PTC-resistors
- De-energized on trip
- LED-indicator for
  - auxiliary supply
  - state of contact
- Output with 2 changeover contacts
- As option with manual reset, internal reset button and external remote reset X1/X2
- Wire connection: also 2 x 1.5 mm² stranded ferruled, or 2 x 2.5 mm² solid DIN 46 228-1/-2/-3/-4
- As option with pluggable terminal blocks for easy exchange of devices
  - with screw terminals
  - or with cage clamp terminals
- Width 22.5 mm

Approvals and Markings

1) 2)
A025518

1) For devices with ATEX-approval
Directive 94/9/EG
EU-Test certificate no.

03 ATEX 3117 II (2) G [Ex e] [Ex d] [Ex px] [Ex n]
II (2) D [Ex tb] [Ex tc]

2) Approval not for all variants; on request

Applications

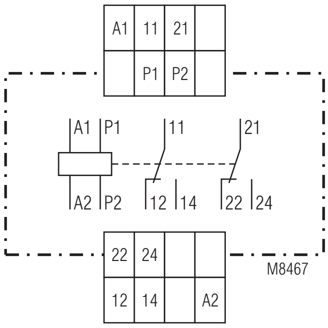
- To protect against thermal overload of motors caused by high switching frequency, havy duty starting, phase failure on one phase, bad cooling, high ambient temperature
- Temperature monitoring of bearings, transmissions, oil and cooling liquids.

Devices with ATEX-approval:
Temperature monitoring of explosion protected Motors by „extended safety" EX e DIN EN 60079-7, „pressure proof enclosure" EX d DIN EN 60079-1 or „overpressure enclosure" Ex px in gas containing atmosphere as well as „protection by enclosures" Ex t DIN EN 60079-31 in dust containing atmosphere. The thermistor Motor protection relay protects Standard and Explosion proof Motor against overheating due to overload accoding to DIN EN 60079-14 and DIN EN 60079-0.

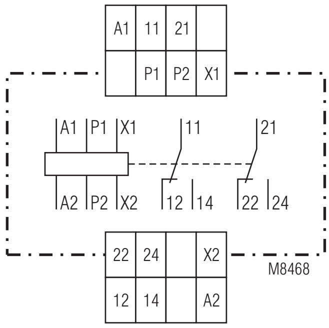
Function

If one of the sensors in the measuring circuit reaches the response temperature (or broken wire is detected), the device indicates failure. This failure is stored in the device with manual reset, even if the temperature goes back to normal. The unit can be reset by pressing the Test/Reset button, by bridging X1/X2 for a short moment or by disconnecting the auxiliary supply for a short time.
Test/Reset button:
Besides the reset function this button provides in normal operation a test facility. The unit indicates fault as long as the button is activated (see also under "Variants").

Circuit Diagrams



MK 9163N.12,
MK 9163N.12/010-ATEX



MK 9163N.12/100, MK 9163N.12/200,
MK 9163N.12/110-ATEX,
MK 9163N.12/210-ATEX

Indicators

green LED:	on, when auxiliary supply connected
red LED:	on, when overtemperature or broken wire, short circuit is detected

Technical Data

Input Circuit

Response value:	3.2 ... 3.8 kΩ
Release value:	1.5 ... 1.8 kΩ
Broken wire detection:	> 3.8 kΩ
Short circuit on measuring circuit:	< 20 Ω
Loading of measuring circuit:	< 5 mW (bei R = 1.5 kΩ)
Measuring voltage:	≤ 2 V (bei R = 1.5 kΩ)

Auxiliary Circuit

Auxiliary voltage U_H:	AC/DC 24 V	
	AC 110, 230, 400 V	50 / 60 Hz
Voltage range:	AC 0.8 ... 1.1 U_H	
at 10 % residual ripple:	DC 0.9 ... 1.25 U_H	
at 48 % residual ripple:	DC 0.8 ... 1.1 U_H	
Nominal consumption:	AC: 1.5 VA	
	DC: 0.85 W	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Max. bridging time on failure of aux. supply:	20 ms	
Operate delay:	< 40 ms	
Release delay:	< 100 ms	

External Remote Reset X1/X2

Function:	External remote reset X1/X2 with NO contact (voltage free)
Remark:	This input is not galvanic separated from measuring input P1/P2

Output

Contacts:		
MK 9163N, MK 9163N-ATEX:	2 changeover contacts	
Thermal current I_{th}:	5 A	
Switching capacity MK 9163N		
to AC 15		
NO contacts:	2 A / AC 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1
Switching capacity MK 9163N-ATEX		
to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	2 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
at 4 A, AC 230 V, cosφ = 0.6:	1.5 x 10^6 switching cycles	
Short-circuit strength		
max. line circuit breaker:	C 16 A	DIN EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

Technical Data

General Data

Operating mode:	Continous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC/EN 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between wires for power supply		
at AC 230 V:	2 kV	IEC/EN 61 000-4-5
at DC 24 V:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppressions:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0-behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.2 mm, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:		EN 50 005
Wire connection		DIN 46 228-1/-2/-3/-4
Screw terminals (integrated):	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled or 2 x 1.5 mm² stranded ferruled or 2 x 2.5 mm² solid	
Insulation of wires or sleeve length:	8 mm	
Plug in with screw terminals		
max. cross section for connection:	1 x 2.5 mm² solid or 1 x 2.5 mm² stranded ferruled	
Insulation of wires or sleeve length:	8 mm	
Plug in with cage clamp terminals		
max. cross section for connection:	1 x 4 mm² solid or 1 x 2.5 mm² stranded ferruled	
min. cross section for connection:	0.5 mm²	
Insulation of wires or sleeve length:	$12^{\pm 0.5}$ mm	
Wire fixing:	Plus-minus terminal screws M 3.5 box terminals with wire protection or cage clamp terminals	
Fixing torque:	max. 0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	160 g	

Dimensions

Width x height x depth	
MK 9163N:	22.5 x 90 x 102 mm
MK 9163N PC:	22.5 x 111 x 102 mm
MK 9163N PS:	22.5 x 104 x 102 mm

Technical Data

Safety Related Data

Values according to EN 61508 / EN 50495

SIL:	1 (Typ B)	
T_1 (Proof Test Intervall):	2	a
HFT:	0	
SFF:	36,6	%
PFD_G:	$7{,}83 \times 10^{-3}$	
λ_{du} [FIT]:	894	
λ_{dd} [FIT]:	0	
λ_{su} [FIT]:	516	
λ_{sd} [FIT]:	0	
Mode of operation:	low demand mode	
Architecture:	1001	

Values according to EN 13849:

Category:	1	
PL:	c	
MTBF:	81	a
$MTTF_d$:	63,8	a
DC_{avg}:	0	%

The a.m. data for functional safety is valid for an ambient temperature of 40°C respecting also selfheating.
Data for other ambient temperatures are available on request.

Ordering example for variants

MK 9163N .12 _ _ / _ _ _ ATEX AC/DC 230 V 50/60 Hz

- Nominal frequency
- Nominal voltage
- Variant, if required
- Type of terminals
  without indication:
  terminal blocks fixed, with screw terminals
  PC (plug in cage clamp):
  pluggable terminal blocks with cage clamp terminals
  PS (plug in screw):
  pluggable terminal blocks with screw terminals
- Contacts
- Type

CCC-Data

Thermal current I_{th}: 4 A

Switching capacity

to AC 15:	1,5 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:	1 A / DC 24 V	IEC/EN 60 947-5-1

Technical data that is not stated in the CCC-Data, can be found in the technical data section.

Options with Pluggable Terminal Blocks

Screw terminal
(PS/plugin screw)

Cage clamp terminal
(PC/plugin cage clamp)

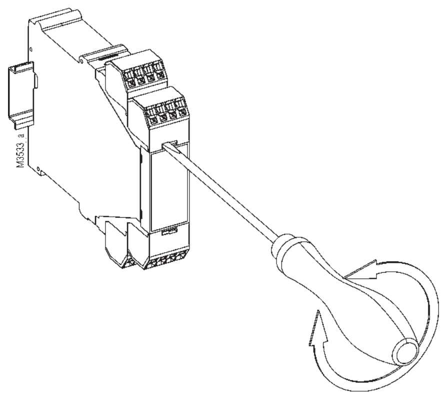
Standard Type

MK 9163N.12/110-ATEX	AC 230 V 50/60 Hz
Article number:	0056453
• with Test/Reset button	
• Output:	2 changeover contacts
• Nominal voltage U_N:	AC 230 V
• Width:	22.5 mm

Notes

Removing the terminal blocks with cage clamp terminals

1. The unit has to be disconnected.
2. Insert a screwdriver in the side recess of the front plate.
3. Turn the screwdriver to the right and left.
4. Please note that the terminal blocks have to be mounted on the belonging plug in terminations.



Variant

MK 9163N.12 / _ _ _ _ _ _ _

- ATEX with approval
- 0 free
- 0 without short circuit detection
  1 with short circuit detection (ATEX)
- 0 without RESET
  1 with RESET and test function via built in button and X1/X2
  2 with RESET and test function via built in button, at X1/X2 RESET function only

Available variants
MK 9163N.12
MK 9163N.12/100
MK 9163N.12/200
MK 9163N.12/010 ATEX
MK 9163N.12/110 ATEX
MK 9163N.12/210 ATEX

Manufacturing Data

Each unit is marked with the manufacturing date e.g. "Bj. KW 49/02". The unit had been produced in week 49 – 2002.

Additional Remarks and Safety Instructions

Use on motors in explosion hazardous areas
Thermal protection on motors that are equipped with PTC sensors according to DIN 44 081 or DIN 44 082 or DIN EN 60034-11 type A (DIN EN 60947-8). When used on motors of protection degree EX and EX d only the sensor wire leads through the Ex-area. The motor proteciton relay has to be mounted outside the Ex-area, but monitors devices operated in the Ex-area.

Safety integrity level SIL 1
To fulfil SIL 1 a cyclic function test of the protection device has to be provided. This can be done manually during manintenance (see below).

The function test must be carried out all 2 years.

Test facilities for set-up and manintenance
A test of the unit can be made by simulating the resistance oon the sonsor input. During maintenance these tests can also be made.

- Test of short circuit detection: Bridge sensor input (this test is possible without disconnection of the sensor).
- Test of broken wire detection: Disconnect sensor wire.
- Test of overtemperature function: Change restistance on input from low 50 ... 1500 Ω to 4 kΩ.

The RESET button can also be used for test purpose (see Function Diagram)

Installation
The DC 24 V version has no galvianic separation between auxiliary supply (A1, A2) and the sensor circuit (P_1, P_2). These units are only allowed to be connected to transformers according to DIN EN 61 558 or to battery supply.

Wiring
The sensor and control wires have to be installed separately from the motor wires. When strong inductive or capacitve influence is expected from parallel installed high courrent wires, screened wire should be used.

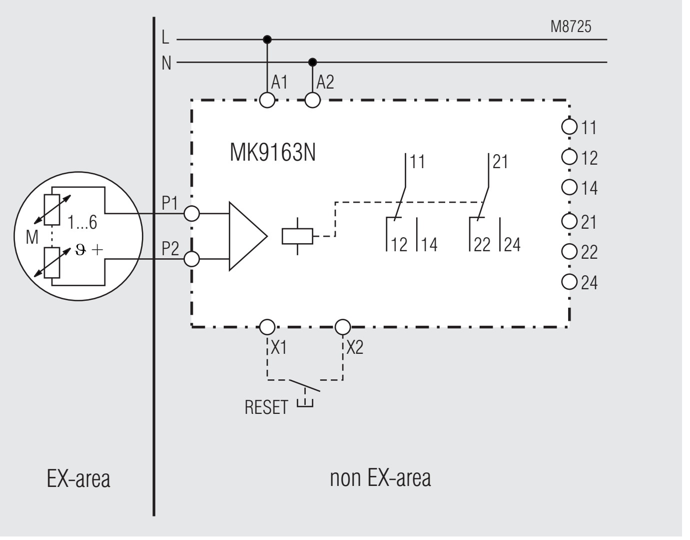
Wire length
The max. wire length of the sensor circuit is:

Diameter (mm²):	4	2.5	1.5	0.5
max. wire length (m):	2 x 550	2 x 250	2 x 150	2 x 50

Safety instructions

- Installation, test and replacement may only be carried out by qualified specialist staff and the applicable safety rules must be observed. The data for functional safety in explosion hazardous areas have to be respected.
- Details of the motor supplier and the details about the explosion protection from the EC-type examination certificates for explosion proof motors have to be respected.
- For the test and the maintenance of motor protection devices for explosion proof machines, the EN 60079-17 and the safety rules that result from the motor application and the corresponding type of protection have to be respected (EC ATEX Directive 94/9/EC and DIN EN 60079-14).
- The motor protection relay has to switch off the motor immediately also when it is controlled by an inverter. The control circuit must allow this. In this case the sensor wires must be lead separately. The use of wires inside the motor connection cable is not allowed.
- If variants are used that have no no-voltage safe reset function additional measures have to be applied in order to disable safely the restart of the motor until the fault is removed if this leads to a dangerous situation.
- The relay must only be opened by the manufacturer.
- The relay must only be replaced by equivalent devices marked according to the relevant safety rules.
- The permitted ambient conditions must be observed.
- Devices that show obvious transportation damage must not be used in safety relevant applications.

Application Example



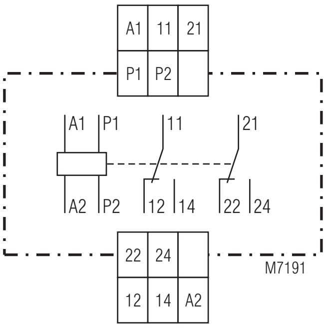
VARIMETER EX
Thermistor Motor Protection Relay
MK 9003 ATEX

DOLD

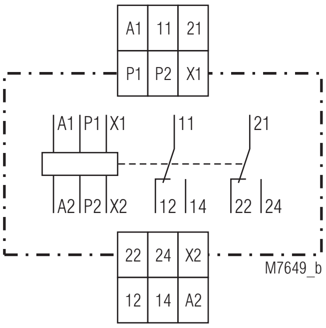
0241525

MK 9003.12/11120

Circuit Diagrams



MK 9003.12/0_ _ _ _



MK 9003.12/1_ _ _ _

Your advantages
- Reliable temperature monitoring of motors
- Rapid fault location

Features
- According to pr EN 60 947-8, EN 60 079-14
- Detection of
  - overtemperature
  - broken wire in sensor circuit
  - short circuit in sensor circuit
- 1 input for 1 to 6 PTC-reistors
- Functions as options or settable with DIP-switches:
  - automatic reset (fault is not stored)
  - manual reset (fault is stored)
  - manual reset only on start-up
  - manual reset on and also after start-up
- No voltage safe manual reset
- Closed circuit operation
- LED indicators for
  - auxiliary supply
  - contact position
  - overtemperature, broken wire or short-circuit in sensor circuit
- 2 changeover contacts
- Button for reset function
- Remote reset via terminals X1 / X2 (NO contact)
- Optionally safe separation according to IEC/EN 61 140, IEC/EN 60 947-1, 6 kV/2 between:
  - auxiliary voltage and measuring circuit
  - auxiliary voltage and output contacts
  - measuring circuit and output contacts
  - the 2 changeover contacts (only with 2 changeover contacts)
- Width 22.5 mm

Approvals and Markings

[1] Directive 94/9/EG
EG type test no.

02 ATEX 3057 II (2) G [Ex e] [Ex d] [Ex px] [Ex n]
II (2) D [Ex tb] [Ex tc]

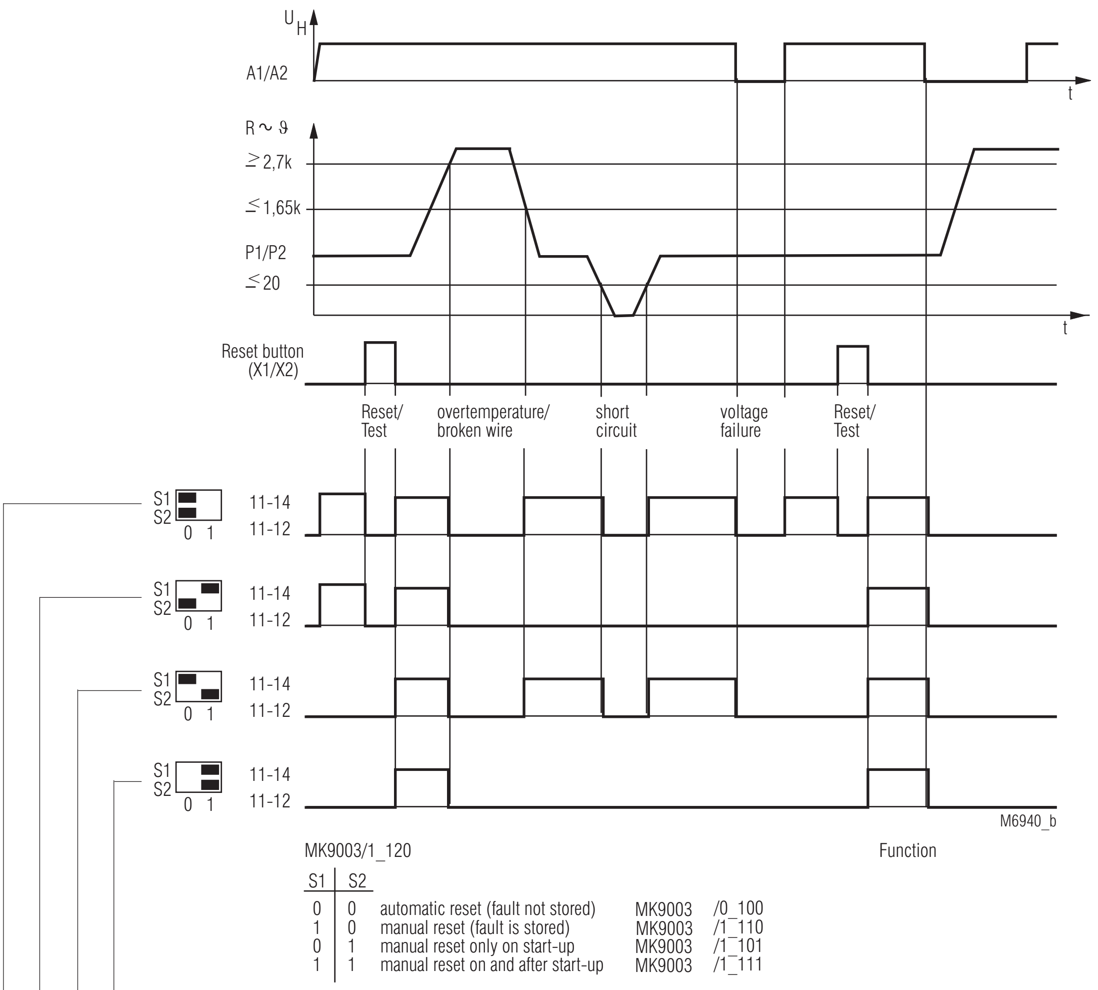
Application

Temperature monitoring of explosion protected Motors by „extended safety“ EX e DIN EN 60079-7, „pressure proof enclosure“ EX d DIN EN 60079-1 or „overpressure enclosure“ Ex px in gas containing atmosphere as well as „protection by enclosures“ Ex t DIN EN 60079-31 in dust containing atmosphere. The thermistor Motor protection relay protects Standard and Explosion proof Motor against overheating due to overload accoding to DIN EN 60079-14 and DIN EN 60079-0.

Indicators

green LED:	on, when supply voltage connected
red LED:	on, when output contact de-energized
yellow LED:	on, when overtemperature of failure in

sensor circuit



With manual reset, also after voltage failure (no start-up reset)
After the failure is gone manual reset must be made (reset button on unit or remote reset X1-X2) to bring the unit in operating mode (no voltage safe).
After voltage failure manual reset must always be made.

Activation after power on (start-up reset)
After the failure is removed the contacts switch back automatically to active condition. After voltage failure manual reset must always be made.

With manual reset (fault is stored)
After the failure is gone manual reset must be made (reset button on unit or remote reset X1-X2) to bring the unit in operating mode (no voltage safe).

Automatic reset
After the failure is removed the contacts switch back automatically to active condition.

Technical Data

Input

Response value:	2.7 ... 3.1 kΩ	
Release value:	1.5 ... 1.65 kΩ	
Broken wire on meas. circuit:	> 3.1 kΩ	
Short circuit on meas. circuit:	< 20 Ω	
Loading of measuring circuit:	< 2.5 mW (at R = 1.5 kΩ)	
Voltage on measuring circuit:	≤ 2 V (at R = 1.5 kΩ)	

Auxiliary Circuit

Auxiliary voltage U_H:	AC 24, 110, 230, 400 V	50 / 60 Hz
	DC 24 V	
Voltage range:	0.85 ... 1.1 U_H	
Nominal consumption		
AC:	1.5 VA, cos φ = 0.95	
Nominal frequency:	50 / 60 Hz	
Frequency range:	45 ... 65 Hz	
Max. bridging time on voltage failure:	20 ms	
Operate delay:	approx. 18 ms	
Release delay:	approx. 12 ms	

Remote Reset on MK 9003/1 _ _ _

Function:	remote reset X1 / X2 with voltage free NO contact
Remark:	input X1 / X2 has no galvanic separation to measuring input P1 / P2

Output

Contacts		
MK 9003.12:	2 changeover contacts	
Thermal current I_{th}:	4 A	
Switching capacity		
to AC 15:		
NO contact:	3 A / AC 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / AC 230 V	IEC/EN 60 947-5-1
to DC 13:		
NO contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
NC contact:	1 A / DC 24 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 5 A, AC 230 V:	1 x 10^5 switching cycles	IEC/EN 60 947-5-1
Short circuit strength		
max. fuse rating:	6 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 50 x 10^6 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 55°C	
Storage temperature:	- 40 ... + 85°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	6 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61000-4-2
Fast transient:	4 kV	IEC/EN 61000-4-4
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0-behaviour according to UL subject 94	
Vibration resistacne:	amplitude 0.35 mm frequency 10 ... 55 Hz, IEC/EN 60 068-2-6	
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection		
max. cross section	2 x 2,5 mm^2 solid or 2 x 0,75 mm^2 stranded wire with sleeve DIN 46228-1/-2/-3/-4 or 2 x 1,5 mm^2 strand.wire w. sl. DIN 46228-4	
min. cross section:	0,5 mm^2 solid or stranded wire with sleeve	
Insulation of wires or sleeve length:	8 mm	
Wire fixing:	Plus-Minus-terminal screws M3,5 with self-lifting clamping pieceIEC/EN 60 999-1	
Fixing torque:	0.8 Nm	
Mounting:	DIN rail	IEC/EN 60 715
Weight:	162 g	

Dimensions

Width x height x depth:	22.5 x 82 x 99 mm

Technical Data

Safety Related Data

Values according to EN 61508 / EN 50495:

SIL:	1 (Type B)	
T_1 (Proof Test Intervall):	2	a
HFT:	0	
SFF:	45,67	%
PFD_G:	9,94 x 10^{-3}	
λ_{du} :	1135	FIT
λ_{dd} :	0	FIT
λ_{su} :	945	FIT
λ_{sd} :	0	FIT
Mode of operation:	low demand mode	
Architecture:	1001	

Values according to EN 13849:

Category:	1	
PL:	c	
MTBF:	55	a
$MTTF_d$:	50,5	a
DC_{avg}:	0	%

The a.m. data for functional safety is valid for an ambient temperature of 40°C respecting also selfheating.
Data for other ambient temperatures are available on request.

Standard Type

MK 9003.12/11120 ATEX AC 230 V
Article number: 0055727 stock item

- Output: 2 changeover contacts
- Function programmable on S1 and S2
- With short circuit detection
- With safe separation according to IEC/EN 61 140, IEC/EN 60 947-1
- Auxiliary voltage U_H: AC 230 V
- Width: 22.5 mm

Variants

MK 9003.12 / _ _ _ _ _ ATEX

- 00 automatic reset
- 10 manual reset
- 01 manual reset only on start-up
- 11 manual reset on and also after start up
- 20 function programmable on S1 and S2

- 1 with short circuit detection

- 0 without safe separation
- 1 with safe separation (see Application example)

- 0 without RESET-function (only with MK 9003._ _/1_100)
- 1 with RESET-function with MK 9003._ _/1_110 MK 9003._ _/1_101 MK 9003._ _/1_111 MK 9003._ _/1_120

available variants (others with short circuit detection on request)
MK 9003/00100 ATEX
MK 9003/01100 ATEX
MK 9003/10110 ATEX
MK 9003/11110 ATEX
MK 9003/11120 ATEX

Ordering example for variants

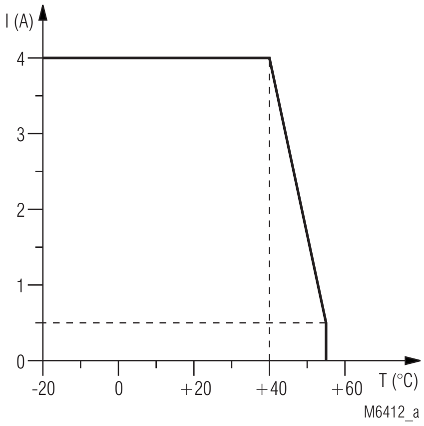
MK 9003 .12 /_ _ _ _ _ ATEX AC 230 V 50 / 60 Hz

- 50 / 60 Hz: Nominal frequency
- AC 230 V: Auxiliary voltage
- /_ _ _ _ _: Variant
- .12: Contacts
- MK 9003: Type

Accessories

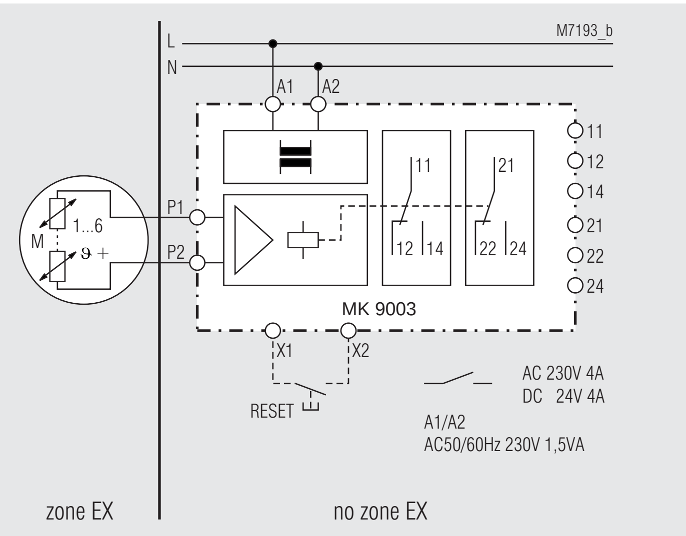
ET 4752-143: Marking plate
Article number: 0043203

Characteristic



Continuous current limit curve

Application Example



Thermistor motor protection relay shown as variant MK 9003/_1_ _ _ , with safe separation according to IEC/EN 61 140, IEC/EN 60 947-1, 6 kV/2 between:

- Auxiliary voltage and measuring circuit
- Auxiliary voltage and output contacts
- Measuring circuit and output contacts
- the 2 changeover contacts (only with 2 changeover contacts)

Note: See also **Installation**

Production Date

Every unit is labelled with the production date e.g. "Bj. KW 49/02".
The device was produced in week 49, 2002.

Additional Information and Safety Instructions

Use on motors in explosion hazardous areas
Thermal protection on motors that are equipped with PTC sensors according to DIN 44 081 or DIN 44 082 or DIN EN 60034-11 type A (DIN EN 60947-8) .In applications with motors of the explosion protection class Ex e and Ex d only the sensor with it's connection wire leads into the Ex area. The motor proteciton relay has to be mounted outside the Ex-area, but monitors devices operated in the Ex-area.

Safety integrity level SIL 1
To fulfil SIL 1 a cyclic function test of the protection device has to be provided. This can be done manually during manintenance (see below).

The function test must be carried out all 2 years.

Test facilities for set-up and manintenance
A test of the unit can be made by simulating the resistance oon the sonsor input. During maintenance these tests can also be made.

- Test of short circuit detection: Bridge sensor input (this test is possible without disconnection of the sensor).
- Test of broken wire detection: Disconnect sensor wire.
- Test of overtemperature function: Change restistance on input from low 50 ... 1500 Ω to 4 kΩ.

The RESET button can also be used for test purpose (see Function Diagram)

Installation
The DC 24 V version has no galvianic separation between auxiliary supply (A1, A2) and the sensor circuit (P_1, P_2). These units are only allowed to be connected to transformers according to DIN EN 61 558 or to battery supply.

Wiring
The sensor and control wires have to be installed separately from the motor wires. When strong inductive or capacitve influence is expected from parallel installed high courrent wires, screened wire should be used.

Wire length
The max. wire length of the sensor circuit is:

Diameter (mm^2):	4	2.5	1.5	0.5
max. wire length (m):	2 x 550	2 x 250	2 x 150	2 x 50

Safety instructions

- Installation, test and replacement may only be carried out by qualified specialist staff and the applicable safety rules must be observed. The data for functional safety in explosion hazardous areas have to be respected.
- Details of the motor supplier and the details about the explosion protection from the EC-type examination certificates for explosion proof motors have to be respected.
- For the test and the maintenance of motor protection devices for explosion proof machines, the EN 60079-17 and the safety rules that result from the motor application and the corresponding type of protection have to be respected (EC ATEX Directive 94/9/EC and DIN EN 60079-14).
- The motor protection relay has to switch off the motor immediately also when it is controlled by an inverter. The control circuit must allow this. In this case the sensor wires must be lead separately. The use of wires inside the motor connection cable is not allowed.
- If variants are used that have no no-voltage safe reset function additional measures have to be applied in order to disable safely the restart of the motor until the fault is removed if this leads to a dangerous situation.
- The relay must only be opened by the manufacturer.
- The relay must only be replaced by equivalent devices marked according to the relevant safety rules.
- The permitted ambient conditions must be observed.
- Devices that show obvious transportation damage must not be used in safety relevant applications.

Noise Filter
MK 5130N, LG 5130

DOLD

0272373

MK 5130N LG 5130

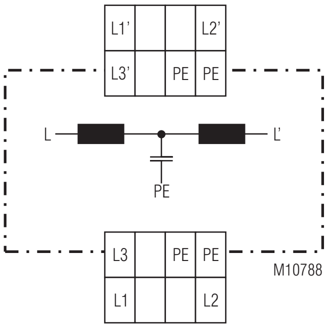
Your Advantages

- Reliable operation of measuring relays and other low consumption loads in systems with high frequency noise
- Protection of measuring inputs / measuring relays by reduction of noise
- More precise and constant measuring results
- Increasing the availability of plants

Features

- 3-phsase noise filter for measuring relays
- Noise suppression of wire bound interference
- Broadband suppression of high frequencies
- For nominal voltages up to 3 AC 1000 V
- PE connection for increased suppression level
- 2 models available:
  MK 5130N: depth 97 mm
  LG 5130: depth 121 mm
- Width: 22.5 mm

Circuit Diagram



Approvals and Markings

CE

Applications

- Operation of measuring relays on inverters and equipment with high frequency noise voltage
- Noise suppression for circuits and loads up to 50 mA per phase
- Reduction of noise created by electric tools, contactors and luminescent lamps

Connection Terminals

Terminal designation	Signal designation
L1, L2, L3	Input phase voltages
L1', L2', L3'	Output phase voltages
PE	Connection for protective conductor

Notes

The noise filter is connected with its input terminals L1/L2/L3 to the inverter output and the measuring relay or device to be protected to the filter outputs L1'/L2'/L3'.
It is not mandatory to connect the PE to the corresponding device terminals but it increases the filter effect.
The maximum current in each filter path is 50 mA. So this filter can also be used in the auxiliary supply of low consumption equipment.
If only one line should be filtered, the 3 paths could be connected in series increasing the filter effect, or in parallel increasing the current capacity to 150 mA.

Function

Increased numbers of inverters create on their outputs steep commutation edges that create noise and high frequency leaking currents on direct connected equipment. Devices that are connected to inverters can be disturbed or damaged. The HF components can be conducted to other parts of the system e.g. via the DC 24 V supply.
This could happen on measuring relays that are connected to the inverter output. The auxiliary supply of the measuring relay has a galvanic separation from the measuring input, but coupling capacitances in the power supply can create a high frequency connection to the measuring input. Certain frequencies will then create leakage currents from inverter to auxiliary supply.
In principle all monitoring devices connected to inverter outputs may be subject to interference. It is also possible that these devices conduct the interference to other parts of the system.
The noise filter MK 5130N / LG 5130 have in each path for the 3 phases (input L1/L2/L3 - output L1'/L2'/L3') 4 inductances connected in series to provide broad band filtering up to very high frequencies. If also PE is connected, a Y-capacitor connected to PE gets active and provides increased filtering. (T-filter).
By connecting the MK 5130N / LG 5130 between inverter and measuring relay / device to be protected, the current flowing via coupling capacitances is extremely reduced, as the filter elements create a rising impedance with rising frequency. This avoids disturbance or damage on connected devices.

Technical Data

Nominal voltage U_N
without PE connection: max. 3 AC 1000 V
with PE connection: max. 3/N AC 860 / 500 V
Current carrying capacity
per path: max. 50 mA
Ohmic resistance
per path: approx. 140 Ω

Impedance per path (approximate values):

f / Hz	10 k	20 k	50 k	100 k	200 k	300 k	500 k	1 M	2 M	3 M	5 M ... 30 M
without PE:	2.5 kΩ	4.5 kΩ	10 kΩ	16 kΩ	20 kΩ	23 kΩ	30 kΩ	30 kΩ	30 kΩ	25 kΩ	22 kΩ
with PE:	2.5 kΩ	4.5 kΩ	10 kΩ	10 kΩ	18 kΩ	55 kΩ	160 kΩ	300 kΩ	770 kΩ	1 MΩ	1 MΩ

General Data

Nominal operating mode: Continuous operation
Temperature range
Operation and storage: - 40 ... + 70°C
Relative air humidity: 93% at 40°C
Altitude: < 2,000 m
EMC
Electrostatic discharge: 8kV (air) IEC/EN 61 000-4-2
Fast transients: 4 kV IEC/EN 61 000-4-4
Surge voltages
between
power supply L/N: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
HF wire guided: 20 V IEC/EN 61 000-4-6
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplastic with V0 behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm
frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 40 / 070 / 04 IEC/EN 60 068-1
Wire connection: 1 x 4 mm² solid or
2 x 2.5 mm² solid or
1 x 2.5 mm² stranded wire with sleeve or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/-4 or
2 x 2.5 mm² stranded wire with sleeve
DIN 46 228-1/-2/-3/
Wire fixing: Plus-minus terminal screws M 3.5
box terminals with wire protection
Fixing torque: 0.4 Nm
Mounting: DIN rail IEC/EN 60 715
Weight:
MK 5130N: approx. 130 g
LG 5130: approx. 140 g

Dimensions

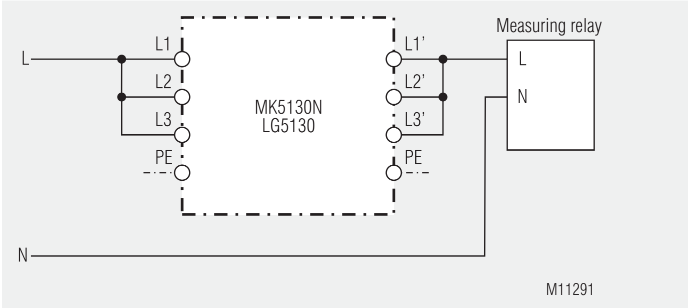
Width x heigth x depth:
MK 5130N: 22.5 x 90 x 97 mm
LG 5130: 22.5 x 90 x 121 mm

Standard Types

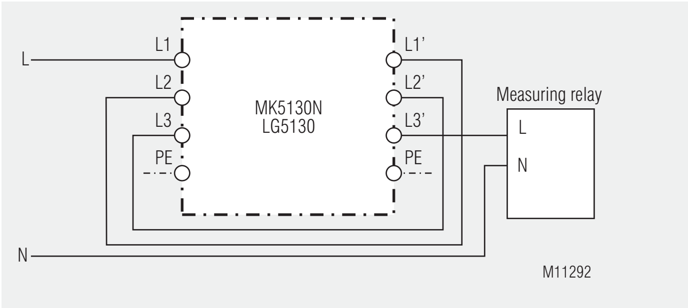
MK 5130N
Article number: 0065014
- Width: 22.5 mm
- Depth: 97 mm

LG 5130
Article number: 0065015
- Width: 22,5 mm
- Depth: 121 mm

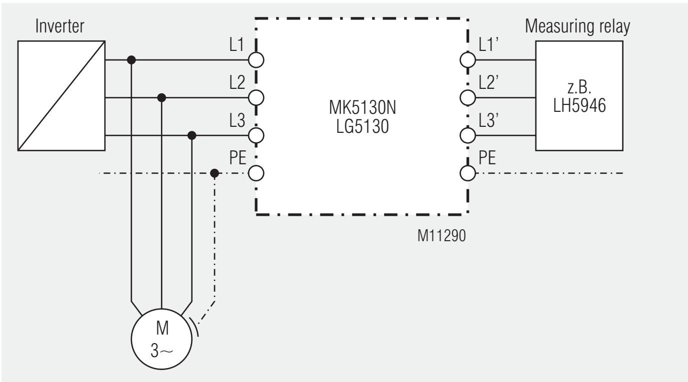
Connection Examples



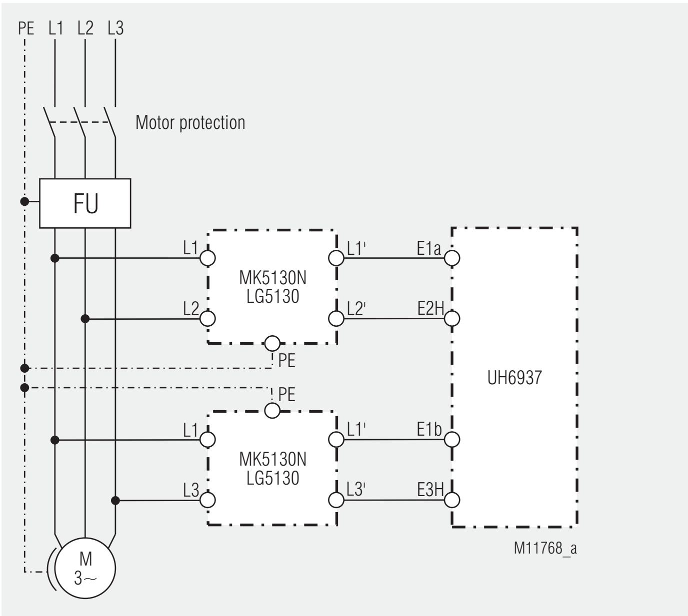
Noise filtering in a single wire with max. current capacity 150 mA



Noise filtering in a single wire with max. current capacity 50 mA



Noise filtering between the 3 phases of an inverter and a measuring relay

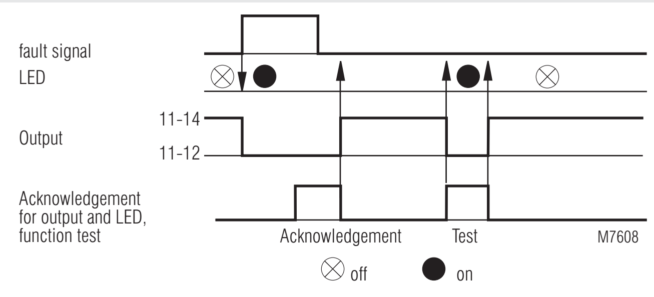


Inverter monitoring function, 3-phase with frequency monitor UH 6937

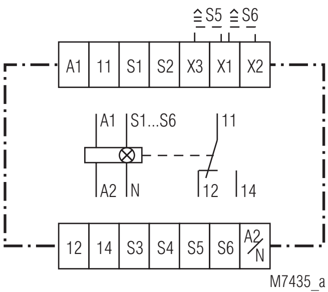
INFOMASTER
Fault Annunciator System
EH 9997

- Common alarm annunciator for 6 signals
- Optionally for up to 8 signals
- Closed circuit operation
- Optionally with open circuit operation
- With LED for each fault signal
- Inputs up to AC/DC 300 V
- With relay output for common signal
- Pushbutton for fault signal acknowledgement and function test
- Front surface 96 x 96 mm

Function Diagram



Circuit diagram



EH 9997.11

Approvals and Markings

CE

Application

Monitoring of industrial plants and buildings

Indication

LEDs for each fault signal
Continuous light when fault signal applied

Notes

It must be observed, that the fault inputs are not seperated from the supply voltage (common terminal A2/N). In case of DC-signals the minus-pole always to be connected to A2.
By removing the bridges X1/X3 - X1/X2 on the backside, the function of the fault signal can be changed, so that the faults 5 and 6 will only be indicated optically and the output relay will not be influenced.

The EH 9997 will be supplied unlabled.
Individual lable on demand.

Technical Data

Input

Inputs:	between AC/DC 12 and 300 V in 3 sectors; AC/DC 12 ... 70 V, AC/DC 70 ... 160 V, AC/DC 160 ... 300 V	
Nominal voltage U_N:	AC/DC 24, 42, 48 V AC 110 ... 127, 220 ... 240 V	
Special voltage: external resistor		
DC 60 V:	820 Ω	ZWS 8 SL
DC 110 V:	2.2 kΩ	ZWS 20 SL
DC 220 V:	4.7 kΩ	ZWS 20 SL
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption:	AC 230 V, 9 VA DC 24 60 110 220 V 1 2.5 5 10 W	
Nominal frequency:	50 / 60 Hz	

Technical Data

Output

Contacts

EH 9997.11:	1 changeover contact	
Thermal current I_{th}:	6 A	
Switching capacity		
to AC 15		
NO contact:	3 A / 230 V	IEC/EN 60 947-5-1
NC contact:	1 A / 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	0.1×10^6 switching cycles	
Short circuit strength		
max. fuse rating:	6 AgL	IEC/EN 60 947-5-1
Mechanical life:	$> 30 \times 10^6$ switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	4 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing	Thermoplast with V0 behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	humid heat	IEC/EN 60 068-2-30
Terminal designation:	EN 50 005	
Wire connection:	2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self lifting clamping piece	IEC/EN 60 999-1
Mounting:	2 clamps with screws	
Weight:	300 g	

Dimensions

Width x height x depth:	96 x 96 x 129 mm
Front panel cut-out:	Diameter 91^{+1} mm

Standard Type

EH 9997.11 AC 220 ... 240 V	50/60 Hz AC/DC 160 ... 300 V	
Article number:	0013214	stock item
• Output:	1 changeover contact	
• Nominal voltage U_N:	AC 220 ... 240 V	
• Inputs:	AC/DC 160 ... 300 V	

Variants

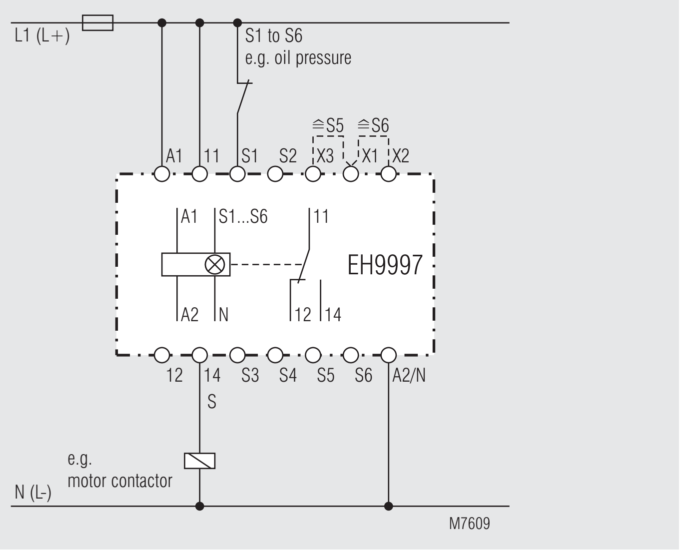
EH 9997/013:	During function test, common signal will not be operated
EH 9997/074:	Open circuit operation
EH 9997/075:	8 signals; all stored, indicated and switching common output

Ordering example for variants

EH 9997 .11 /_ _ _ AC 230 ... 240 V AC/DC 160 ... 300 V 50/60 Hz

- Nominal frequency
- Inputs
- Nominal voltage
- Variant, if required
- Contacts
- Type

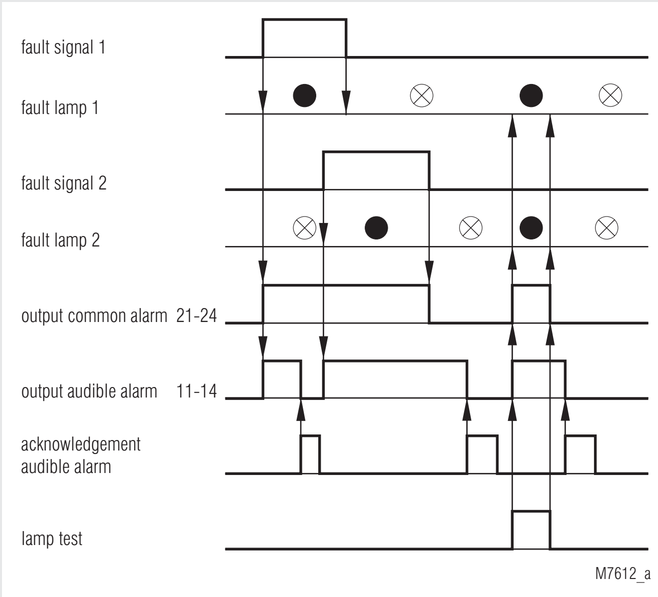
Connection Example



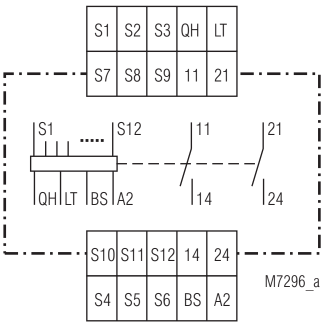
INFOMASTER
Fault Annunciator System
AD 5960

- According to IEC/EN 60 255, DIN VDE 0435-303
- Common alarm annunciator for 12 signals
- 1 relay for common signal and horn
- Inputs up to AC/DC 230 V
- 1 connection for acknowledgement button of horn and lamp test
- Width: 45 mm

Function Diagram



Circuit Diagram



Approvals and Markings

CE

Application

Monitoring of industrial plants and buildings

Notes

The inputs and the lamp test input "LT" are to be controlled with the same phase voltage. In case of connection of different phases the fault annunciator can be destroyed. The fault annunciator AD 5960 is not suitable for the use of lamps with transformers. If the fault annunciator lamps should be controlled with another voltage than that of the inputs, we recommend our fault annunciators AN 5969 or EP 9969, which have relay outputs.
By shock or vibration during transportation the relay contacts may switch to the wrong state. This is typical when bistable relays are used. By connecting nominal voltage to one of the inputs the contacts are brought into right state to achieve a safe switching, the inputs S_1 ... S_{12} have to be activated at least 60 ms.

Technical Data

Input

Nominal voltage U_N: AC/DC 24, 42, 110, 230 V
Voltage range: 0.8 ... 1.1 U_N
Nominal frequency: 50 / 60 Hz
Fault signal current per input

Voltage AC/DC:	24	42	110	230 V
Current $\hat{I}_s$:	440	280	180	150 mA

Input current load* at input of lamp test

Voltage AC/DC:	24	42	110	230 V
Current Î:	5.3	3.4	2.2	1.8 A

Current shape see caracteristic
* without connection of the external signal lamp

Output

Contacts: 1 NO contact each for common alarm and audible alarm
Operate time of Relay "Horn": approx. 20 ms
Recovery time "Horn": approx. 5 s
(min. necessary time between the occurance of a fault and the acknowledgement of the audible alarm)
Operate time of common alarm relay: ≤ 1 s
Actuation time for lamp test input: ≥ 2 s
Switching capacity: AC 250 V / 5 A
Loading: 1 A per external signal lamp, however totally max. 5 A
Thermal current I_{th}: 8 A

General Data

Operating mode: Continuous operation
Temperature range: - 20 ... + 60°C
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 IEC 60 664-1
EMC
HF-irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages between
wires for power supply: 2 kV IEC/EN 61 000-4-5
between wire and ground: 4 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplast with V0-behaviour according to UL subject 94
Vibration resistance: Amplitude 0.35 mm frequency 10...55HzIEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 2 x 2.5 mm² solid or 2 x 1.5 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4
Wire fixing: Flat terminal with self-lifting clamping piece IEC/EN 60 999-1
Mounting: DIN rail IEC/EN 60 715
Weight: 200 g

Dimensions

Width x height x depth: 45 x 77 x 127 mm

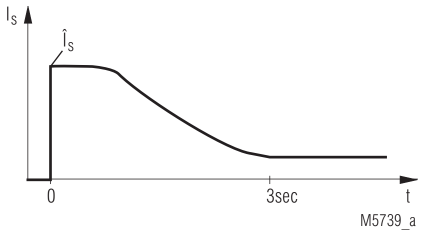
Standard Type

AD 5960 AC/DC 230 V 50/60 Hz
Article number: 0028134 stock item
- Output: 1 NO contact each for common alarm and audible alarm
- Auxiliary voltage U_H: AC/DC 230 V
- Inputs: AC/DC 230 V

Ordering Example

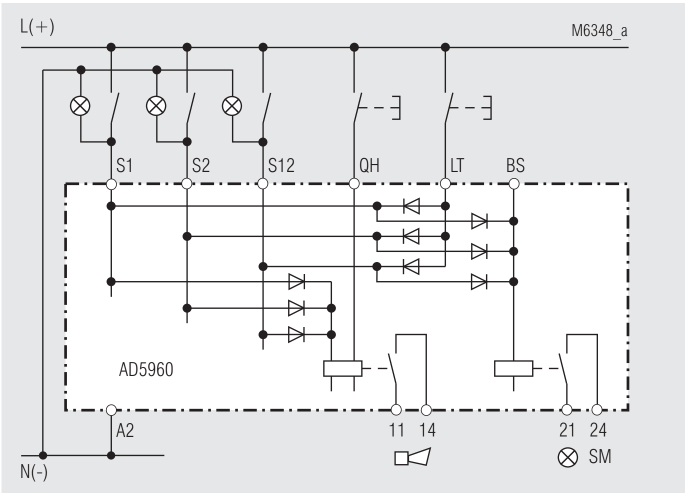
AD 5960 AC/DC 230 V 50 / 60 Hz
- Nominal frequency
- Nominal voltage
- Type

Characteristic



Current curve of the inputs and of the lamp test inputs

Connection Example



INFOMASTER
Fault Annunciator System
IL 5990, IL 5991, SL 5990, SL 5991

DOLD

0231217

IL 5990 IL 5991 SL 5990 SL 5991

- According to DIN 19235
- Common alarm annunciator
- Expandable from 4 up to 160 inputs
- Open circuit inputs / closed circuit inputs selectable via bridges X1-X2
- Delayed inputs up to 10 s
- Acknowledgement push button QH for external buzzer built in
- Accessories: Buzzer IK 8832, SK 8832
- Devices available in 2 enclosure versions:
  I-model: depth 61 mm, with terminals at the bottom for installations systems and industrial distribution systems according to DIN 43 880
  S-model: depth 100 mm, with terminals at the top for cabinets with mounting plate and cable duct
- Width 35 mm

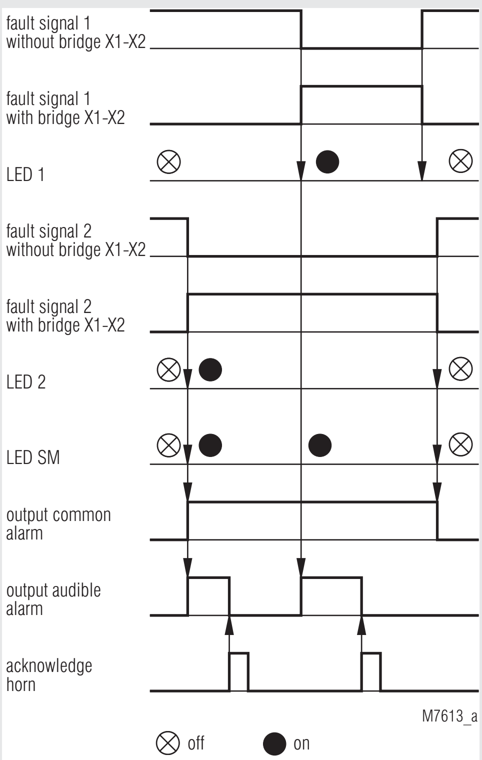
Fault annunciator IL 5990, SL 5990:
- 4 inputs with LED on control unit
- 1 output for common signal and 1 output for audible alarm

Extension unit IL 5991, SL 5991:
- 4 inputs with LED on control unit

Approvals and Markings

CE

Function Diagram



Application

For monitoring of industrial plants and buildings

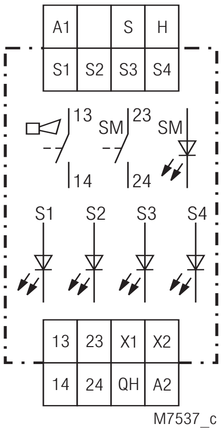
Notes

The terminals A1, inputs S1 - S4 and the acknowledgement input Q_H have to be connected at the same phase. The NO contacts 13 - 14 , 23 - 24 have to be connected to to the same phase.
The bus-circuits H and S have a low voltage and are not allowed to be connected to any external voltage. If inductive or capacitive superimposed voltages are expected from power cables, it is recommended, to use screened cables for these lines. The screen is to be connected to ground.

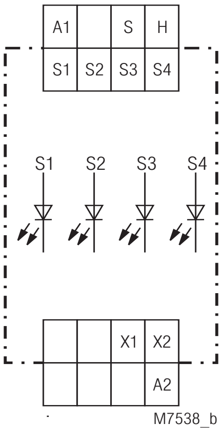
Bridge X1 - X2 = open circuit operation

A different setting of the fault annunciator IL 5990 and the extension unit IL 5991 is possible.

Circuit Diagrams



IL 5990, SL 5990



IL 5991, SL 5991

Connection Terminals

Terminal designation	Signal designation
A1	+ / L
A2	- / N
S1, S2, S3, S4	Measuring input for alarm
X1, X2	Control input for closed - / open circuit operation
QH	Control input for acknowledgement audible alarm
13, 14	Relay output for audible alarm
23, 24	Relay output for common alarm
H	Bus leads audible alarm
S	Bus leads common signal

Technical Data

Input

Nominal voltage A1-A2 and inputs S1-S4: AC 230 V, AC/DC 24 V
Voltage range: 0,8 ... 1,1 U_N
Nominal consumption: 8 VA
Nominal frequency: 50 / 60 Hz
Min. time for input signal: ≥ 100 ms
Min. time for acknowledgement: ≥ 200 ms
Operate delay: 1 s, 3 s, 10 s

Output

Contacts: 1 NO contact for common signal and audible alarm
Thermal current I_{th}: 5 A
Switching capacity
to AC 15: 1 A / 230 V IEC/EN 60 947-5-1
Electrical life IEC/EN 60 947-5-1
to AC 15 at 1 A, AC 230 V: ≥ 1,5 x 10^5 switching cycles
Short circuit strength
max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 switching cycles

General Data

Operating mode: Continuous operation
Temperature range: - 20 ... + 60°C
Clearance and creepage distances
rated impulse voltage / pollution degree: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 8 kV (air) IEC/EN 61 000-4-2
HF-irradiation
80 MHz ... 1 GHz: 10 V / m IEC/EN 61 000-4-3
1 GHz ... 2.7 GHz: 3 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages
between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Degree of protection
Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplast with V0 behaviour according to UL subject 94
Vibration resistance: 0,35 mm Amplitude, frequency 10 ... 55 Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Terminal designation: 2 x 2,5 mm^2 solid or 2 x 1,5 mm^2 stranded ferruled DIN 46 228-1/-2/-3/-4
Wire connection: Flat terminals with self-lifting clamping piece IEC/EN 60 999-1
Fixing torque: 0,8 Nm IEC/EN 60 999-1
Mounting: DIN rail IEC/EN 60 715
Weight
IL 5990: approx. 140 g
IL 5991: approx. 120 g
SL 5990: approx. 170 g
SL 5991: approx. 150 g

Dimensions

Width x height x depth
IL 5990, IL 5991: 35 x 90 x 61 mm
SL 5990, SL 5991: 35 x 90 x 100 mm

Standard Types

IL 5990 AC 230 V 50 / 60 Hz 1 s
Article number: 0049188
SL 5990 AC 230 V 50 / 60 Hz 1 s
Article number: 0051721
- Nominal voltage U_N: AC 230 V
- Operate delay: 1 s
- Width: 35 mm

IL 5991 AC 230 V 50 / 60 Hz 1 s
Article number: 0049189
SL 5991 AC 230 V 50 / 60 Hz 1 s
Article number: 0050615
- Nominal voltage U_N: AC 230 V
- Operate delay: 1 s
- Width: 35 mm

Ordering example

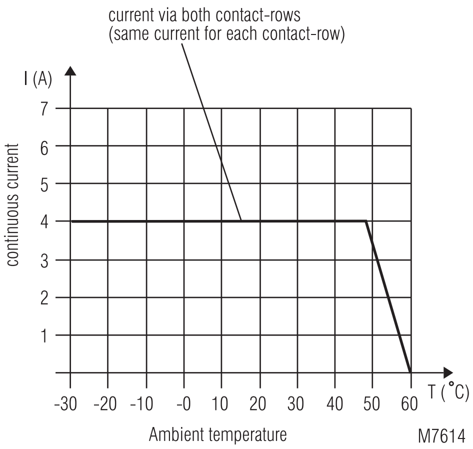
IL 5990 AC 230 V 50 / 60 Hz 1 s

Operate delay
Nominal frequency
Nominal voltage
Type

Accessories

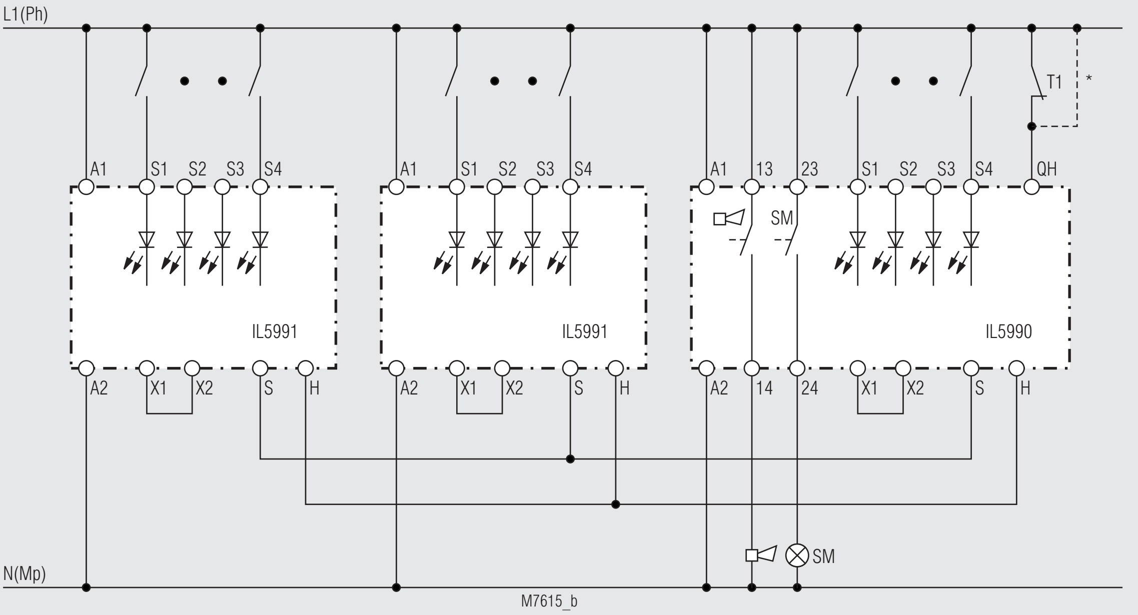
Buzzer IK 8832, SK 8832: Article number: 0049528

Characteristics



Continuous current-limit curve

Connection Example



with bridge X1/X2 open circuit operation
without bridge X1/X2 closed circuit operation

T1 external acknowledgement push button for audible alarm
* without external acknowledgement push button has to be replaced by a bridge

INFOMASTER B
Fault Monitoring System, Bus
System Overview

DOLD

0262640

Compact fault monitoring system with bus
for intelligent, fast and cost saving failure diagnostics.

Available as **common alarm system** or system with programmable function **new signal -, first signal -, and common alarm annunciator**

Your Advantage
- **cost saving:** Reduction of standstill times in production
- **expandable:** up to 88 inputs decentralised via bus
- **flexible:** usage as new- / first- / common signal annunciator
- **all in one:** external buzzer and display units are available as accessoires
- **Far away but easy to reach:** with the GSM-Module you receive fault messages and acknowledge them by SMS using your mobile phone.

Additional Information about this topic

- Informations about the additional Base module, Extension module and Display unit see datasheet RP 5990, RP 5991 and RP 5994, RP 5995
- Information about the additional text display unit see data sheet EH 5996
- Informations about the additional GSM-module for alarm and reset via SMS see datasheet RP 5810

Approvals and Markings

Application

- In building applications, e.g. heating, air conditioning, elevators, escalators, doors, Gates, etc.
- In machines and plants, e.g. process monitoring, emergency power supplies, pumping stations, water treatment, sewage water treatment

Description

The main feature of the modular fault annunciator system INFOMASTER B is the bus structure. It allows easy expansion of the system and adoption to new application requirements.

If INFOMASTER B is used only as common alarm annunciator system the RP 5990 is the base unit.
For flexible use with first-, new signal or common alarm monitoring the RP 5994 is the base unit.

On both modules the number of inputs can be expanded by adding up to 10 extension modules and up to 10 indicator modules.

When using the base module RP 5994 4 text display modules EH5996 can be integrated.

The EH 5996 includes a RS232 interface to connect a GSM module RP 5810. This allows to communicate coming and going fault signal messages to predefined receivers.

System with RP 5994 as Base Module

for new- /first- and common alarm

Base Module RP 5994
adjustable as new- /first- or
common alarm

Extension Module RP 5995
max. 10 units per system

Display Unit EH 5994
with reset push-buttons or
EH 5995 without reset push-buttons
max. 10 units per system

Text Display Unit EH 5996
max. 4 units per system

GSM Module RP 5810
for alarm and reset via SMS

System with RP 5990 as Base Module

only for common alarm

Base Module RP 5990

Extension Module RP 5991
max. 10 units per system

Display Unit EH 5990
with reset push-buttons or
EH 5991 without reset push-buttons
max. 10 units per system

INFOMASTER B Common Alarm Aystem, Bus Connection
Common Alarm Annunciator
RP 5990, RP 5991

DOLD

0255004

RP 5990 EH 5990

RP 5991 EH 5991

Common Alarm Annunciator RP 5990, RP 5991

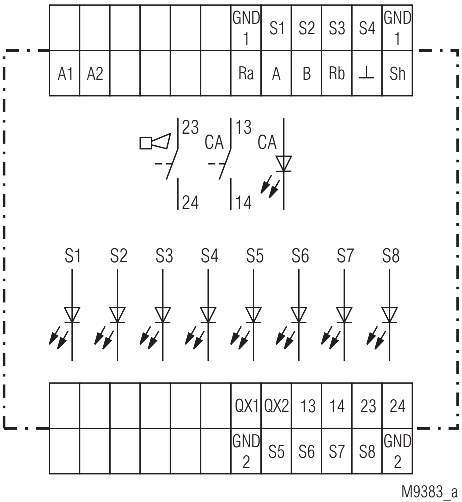
- Fast localisation of failures and their causes
- Reduction of standstill times in production
- Common alarm annunciator with manual or auto reset of faults
- Expandable from 8 to 88 fault signals
- Open or closed circuit operation settable with rotational switch on base unit and with link X1/X2 on extension units
- Adjustable on delay for input signals 0 to 10 sec
- Reset buttons for audible alarm and common alarm on front side
- Connection for external reset of audible alarm
- Galvanic separation to bus RS485 (optional)
- Accessories: buzzer RK 8832, display unit EH 5990, EH 5991
- Width: 70 mm

- **Base Module RP 5990:**
  - 8 fault signal inputs with indicator LED on the unit
  - One relay output each for audible alarm and common alarm
  - Reset buttons for audible alarm and common alarm
  - Connection for external reset of audible alarm
- **Extension Module RP 5991:**
  - 8 fault signal inputs with indicator LED on the unit
  - As option one relay output each for audible alarm and common alarm
  - As option reset buttons for audible alarm and common alarm

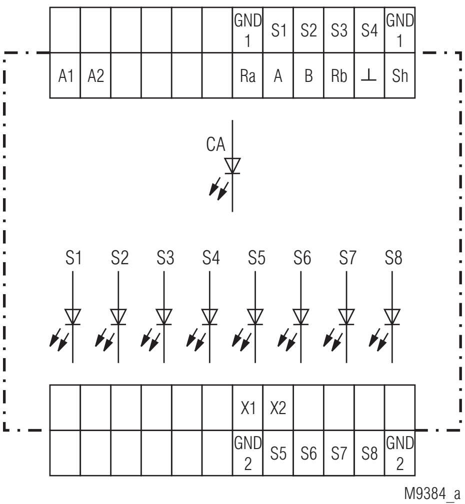
Display Unit EH 5990, EH 5991

- Exchangable front label for individual legending
- As option galvanic separated RS458 bus
- Protection degree for front side IP64
- Enclosure for flush mounting 96 x 96 mm
- **Display Unit EH 5990:**
  - 8 fault signal LEDs on the unit
  - Reset buttons for audible alarm and common alarm
- **Display Unit EH 5991:**
  - 8 fault signal LEDs on the unit
  - Without reset buttons

Circuit Diagrams



RP 5990



RP 5991

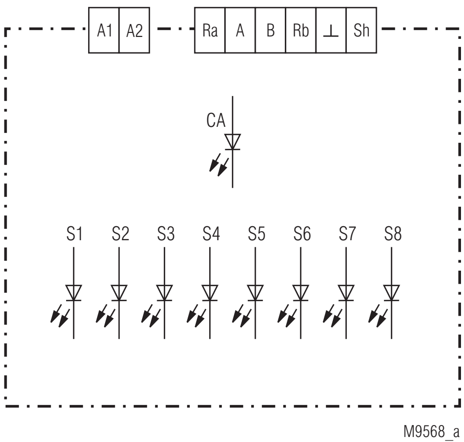
Additional Information about this topic

General Information for INFOMASTER B see data sheet INFOMASTER B, Systemoverview

Approvals and Markings

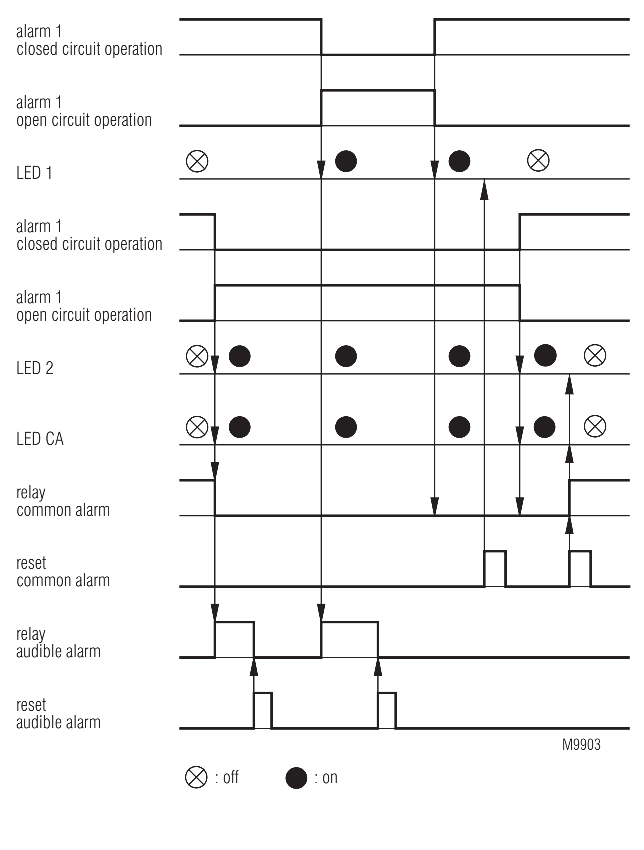
CE

Circuit Diagram

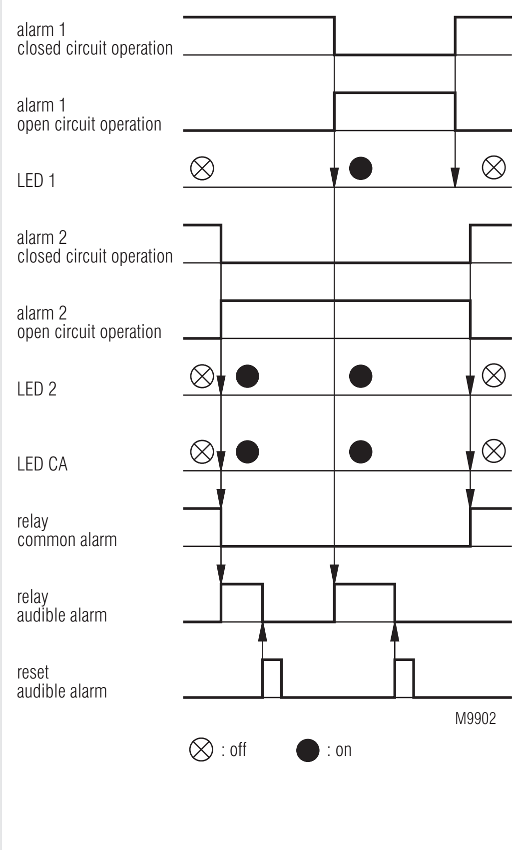


EH 5990, EH 5991

Function Diagram (Faults with Manual Reset)



Function Diagram (Faults with Auto Reset)



Indication

LED green „ON“:	on when supply connected
LED red „CA“:	on when output common alarm active
LED yellow „BUS“:	on when bus active
LEDs red S1 ... S8	on when fault annunciator active

Setting and Adjustment

Wiring
Devices with DC 24V auxiliary supply have to be operated on a galvanic separated power supply.

Configuration Cycle
1.) Wire the system
2.) Adjust module address on extension modules with switch “ADR” (different addresses for all modules)
2.1) When display units are integrated into the annunciator system the address setting of each display unit has to be done as follows
- if the display unit should display the state of the base module (RP 5990) set “MODE” switch on back of the unit to position “Basismodul” and adjust an address that is not used by any other display unit.
- if the display unit should display the state of an extension module (RP 5991) set “MODE” switch on back of the unit to position “Erw.modul” and adjust the same address as on the extension module (RP 5991) of which the status should be displayed.

3.) Set “MODE” switch on base module to position “Config”
4.) Choose input mode on extension modules:
Terminals X1/X2 open = open circuit operation
Terminals X1/X2 linked = closed circuit operation
5.) Set delay on switch, „td“ 0 ... 10 s
6.) Power up the system
7.) Fault signal LEDs of the base module are flashing for some time
8.) On the detected extension modules the fault signal LEDs are now flashing
9.) Fault signal LEDs change to continuous state and indicate number of detected extension modules in binary code
10.) The detected modules are stored no voltage safe in the base module memory. The fault annunciator only works with the detected modules. If a new module is added, the configuration cycle has to be run again.
11.) Select the required alarm function with switch “MODE” on the base module
12.) Press push buttons QH and QHC to leave the configuration mode.

Setting and Adjustment

Functions of Switch „MODE“

switch „MODE“	description
0	Common alarm annunciator alarm manual reset, inputs open circuit operation
1	Common alarm annunciator alarm auto reset, inputs open circuit operation
2	Common alarm annunciator alarm manual reset, inputs closed circuit operation
3	Common alarm annunciator alarm auto reset, inputs closed circuit operation
Configuration	Configuration

Lamp Test

Pressing the pushbuttons QH and QCA simultaneously during normal operation will force a lamp test function (LT). During lamp test all fault signal LEDs are switched on.

Fault Diagnostics

To indicate failures of the system the unit generates a flash code on the Bus LED. When a failure code 1 to 3 is displayed, the contacts of the common alarm relay switch off.

LED continuously on:	System has no failure
Failure 1 :	Configuration failure. One ore more extension modules, that have been detected during configuration do not exist anymore. The address of the first missing extension module is displayed as binary code on the fault signal LEDs.
Failure 2 :	The base module cannot communicate with the extension modules. The address of the first extension module that cannot communicate with the base module is displayed as binary code on the fault signal LEDs.
Failure 3 :	The bus wire is interrupted or the bus is not terminated correctly. The base module does not find any extension modules to communicate with.
Failure 4 :	In normal operation: the configuration data has been found faulty. A new configuration cycles has to be run. During configuration: the detected configuration data could not be stored.
Failure 5 :	New modules unknown to the device software of the base module have to be implemented by a firmware update of the base module.

Remark: Different types of devices (device classes) can be connected to the annunciator bus e.g. extension modules RP 5990, display units EH 5990, EH 5991 etc. The base module detects the different module types and adds a device specific number to the adjusted bus module address (address offset). In the case of failure this added number is indicated as binary code on the LEDs of the base module.

Device class	address offset	modules
Extension modules	+ 0	RP 5991
Display unit	+ 10	EH 5990, EH 5991

Technical Data

Input

Nominal voltage A1-A2:	AC 230 V, DC 24 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption A1-A2		
at AC 230 V:	3.4 VA	
at DC 24 V:	1.1 W	
Nominal frequency A1-A2		
at AC 230 V:	50 Hz	

Fault Signal Inputs (only for RP 5990, RP 5991)

Fault signal inputs S1...S8:	AC/DC 24 ... 230 V
Min. time for input signal:	≥ 70 ms
Min. time for acknowledgement:	≥ 70 ms
Operate delay	setting with potentiometer 0 ... 10 s

Output (only for RP 5990, RP 5991)

Contacts:	1 NO contact each for output common alarm and horn	
Thermal current I_{th}:	2 A	
Switching capacity		
according to AC 15:	3 A / AC 230 V	IEC/EN 60 947-5-1
Electrical life		
to AC 15 at 1 A, AC 230 V:	≥ 1.5 x 10^5 sw. cycles	IEC/EN 60 947-5-1
Short circuit strength		
Max. fuse rating:	4 A gL	IEC/EN 60 947-5-1
Mechanical life:	≥ 30 x 10^6 switching cycles	

RS485 Bus

RP 599_, EH 599_:	not isolated
RP 599_/1_ _, EH 599/1_ _:	isolated (1KV)
Bus wire:	screened twisted pair
Data transmission rate:	115.2 KB/s
	Attention: both ends of the twisted pair have to be terminated by inserting the links A/Ra and B/Rb!

General Data

Nominal operating mode:	continuous operation	
Temperature range:	- 20 ... + 55°C	
clearance and creepage distance		
rated impulse voltage / pollution degree		
relay output:	4 kV / 2	IEC 60 664-1
input:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection RP 5990, RP 5991		IEC/EN 60 529
Housing		
Cover:	IP 40	
Base:	IP 30	
Terminals:	IP 20	
Degree of protection EH 5990, EH 5991		IEC/EN 60 529
Front:	IP 67	
Enclosure:	IP 20	
Enclosure:	thermoplastic with VO behaviour according to UL Subjekt 94	
Vibration resistance:	0.35 mm amplitude, frequency 10 ... 55 Hz,	IEC/EN 60 068-2-6
Climate resistance:	20 / 055 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	

Technical Data

Wire connection	DIN 46 228/1-/-2/-3/-4
fixed screw terminal (S):	0.2 ... 4 mm² solid or 0.2 ... 1.5 mm² stranded wire with sleeve
plug-in screw terminal (PS):	0.1 ... 2.5 mm² solid or 0.1 ... 1.5 mm² stranded wire with sleeve
plug-in cage clamp terminals (PC):	0.2 ... 2.5 mm² solid or 0.2 ... 1.5 mm² stranded wire with sleeve
Wire fixing	
fixed screw terminals (S), plug-in screw terminals (PS):	Captive plus-minus-terminal screws M2.5 with self raising terminal box
plug-in cage clamp terminals (PC):	cage clamp terminals for directely plug-in of conductors Screwdriver 0.6 x 3.5 for removing of the cage-clamp
Mounting:	DIN-rail IEC/EN 60 715
Weight	
RP 5990 S:	260 g
RP 5991 S:	240 g
EH 5990, EH 5991	
AC 230 V-version:	285 g
DC 24 V-version:	210 g

Dimensions

Width x height x depth:	
RP 5990, RP 5991:	70 x 90 x 71 mm
EH 5990, EH 5991:	96 x 96 x 60.5 mm

Standard Types

RP 5990 S AC 230 V 50 Hz
Article number: 0059452
RP 5991 S AC 230 V 50 Hz
Article number: 0059456
- Nominal voltage U_N: AC 230 V
- fixed screw terminals
- Width: 70 mm

EH 5990 AC 230 V 50 Hz
Article number: 0060581
- Nominal voltage U_N: AC 230 V
- Reset buttons for audible alarm and common alarmon front side
- Width: 96 mm

EH 5991 AC 230 V 50 Hz
Article number: 0060585
- Nominal voltage U_N: AC 230 V
- Without reset buttons
- Width: 96 mm

Odering Example for RP 599_

RP 599 _ S/ _ 00 AC 230 V 50 Hz

Nominal frequency
Nominal voltage
RS485 Bus
0 = not isolated (standard)
1 = isolated
Terminals
S = fixed screw terminal
PS = plug-in screw terminal
PC = plug-in cage-terminals
Type
0 = Basis module
1 = Extension module

Odering Example for EH 599_

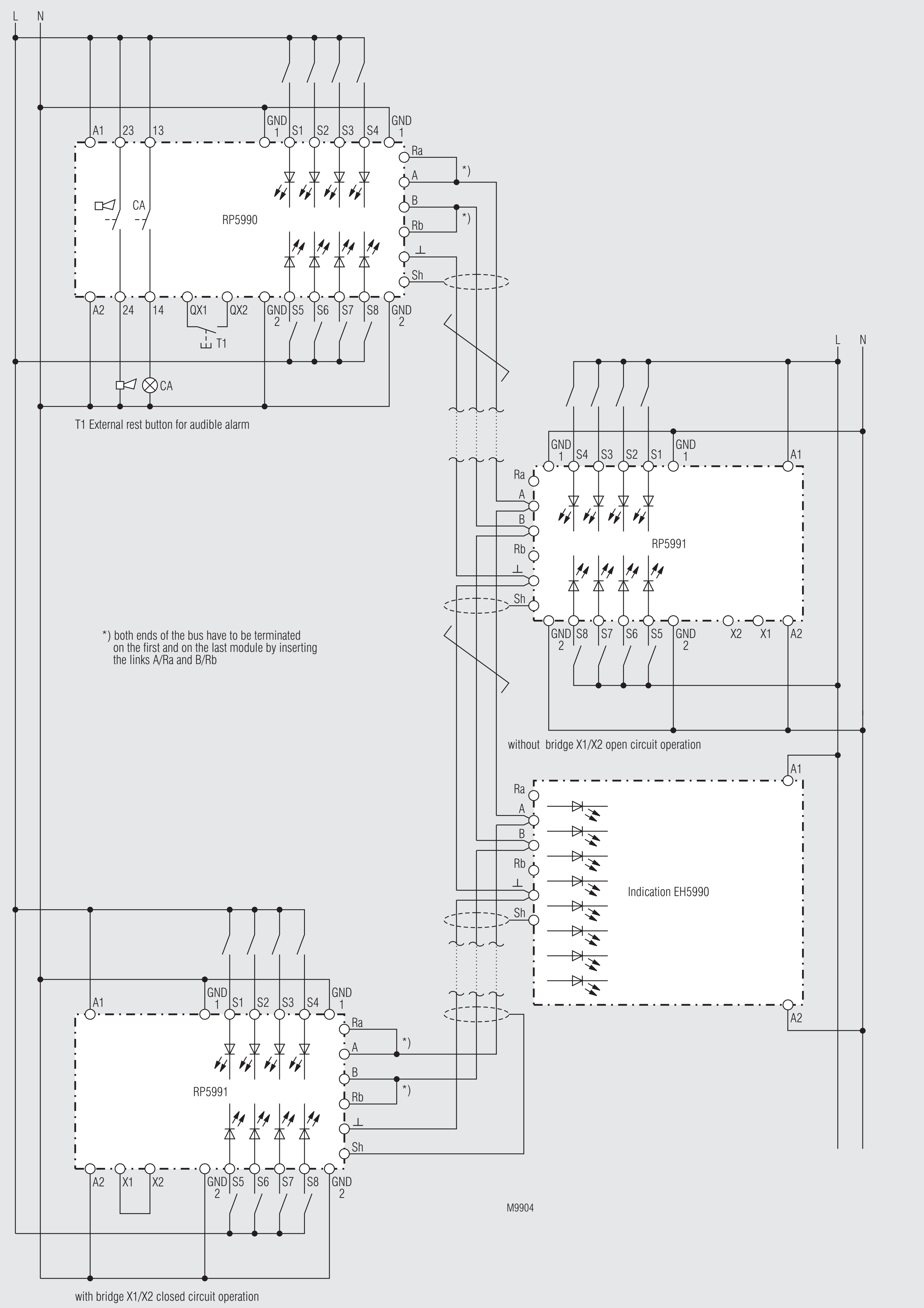
EH 599 _ /_ 00 AC 230 V 50 Hz

Nominal frequency
Nominal voltage
RS485 Bus
0 = not isolated (standard)
1 = isolated
Type
0 = with reset buttons on front
1 = without reset buttons

Accessories

Buzzer RK 8832 Article number: 0059906

Connection Example



INFOMASTER B Common Alarm System, Bus Connection
New- / First- /Common Signal Annunciator
RP 5994, RP 5995

0255005

RP 5994 EH 5994

RP 5995 EH 5995

New- / First- /Common Signal Annunciator RP 5994, RP 5995

- Fast localisation of failures and their causes
- Reduction of standstill times in production
- Adjustable operating modes:
  New- / First signal annunciator according to DIN 19 235,
  common alarm annunciator manual reset / auto reset settable
- Expandable from 8 to 88 fault signals
- Open or closed circuit operation settable
- Adjustable on delay for input signals 0 to 10 sec
- Reset buttons for audible alarm and common alarm on front side
- Connection for external reset of audible alarm, common alarm and single alarm according to setting
- Galvanic separation to bus RS485 (optional)
- Accessories: buzzer RK 8832, display unit EH 5994, EH 5995
  text display unit EH 5996, GMS-module RP 5810
- Width: 70 mm

Base module RP 5994:
- 8 fault signal inputs with indicator LED on the unit
- One relay output each for audible alarm and common alarm
- Reset buttons for audible alarm, common alarm, and single alarm
- Connection of remote reset button. Function according to setting

Extension module RP 5995:
- 8 fault signal inputs with indicator LED on the unit
- One relay output each for audible alarm and common alarm (on request)
- Reset buttons for audible alarm, common alarm, and single alarm
- Connection of remote reset button. Function according to setting

Display unit EH 5994, EH 5995
- Exchangable front label for individual legending
- As option galvanic separated RS458 bus
- Protection degree for front side IP 64
- Enclosure for flush mounting 96 x 96 mm
- **Display unit EH 5994:**
  - 8 fault signal LEDs on the unit
  - Reset buttons for audible alarm, common alarm and alarm signal
- **Display unit EH 5995:**
  - 8 fault signal LEDs on the unit
  - Without reset buttons

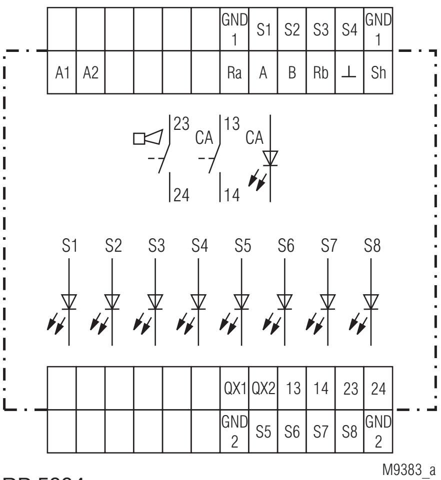
Additional Information about this topic

- General information for INFOMASTER B see data sheet INFOMASTER B, System overview
- Information about the additional text display unit see data sheet EH 5996
- Information about the additional GSM-module for alarm and acknowledgement per SMS see data sheet RP 5810

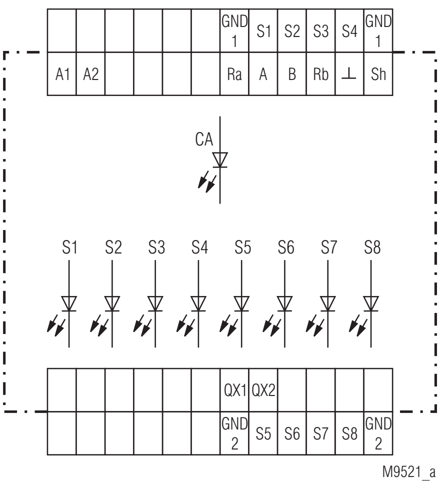
Approvals and Markings

CE

Circuit Diagrams

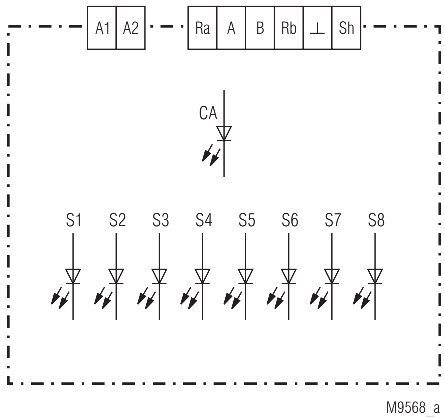


RP 5994



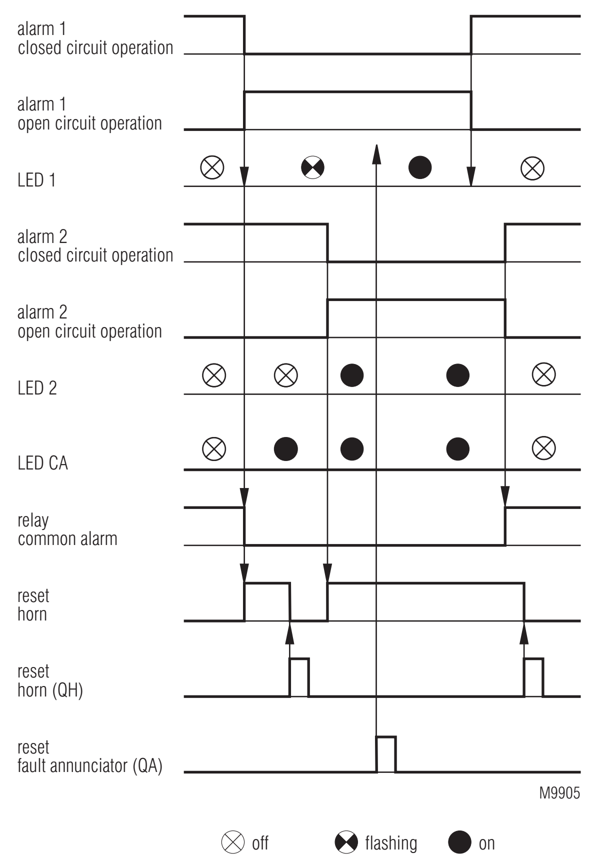
RP 5995

Circuit Diagram

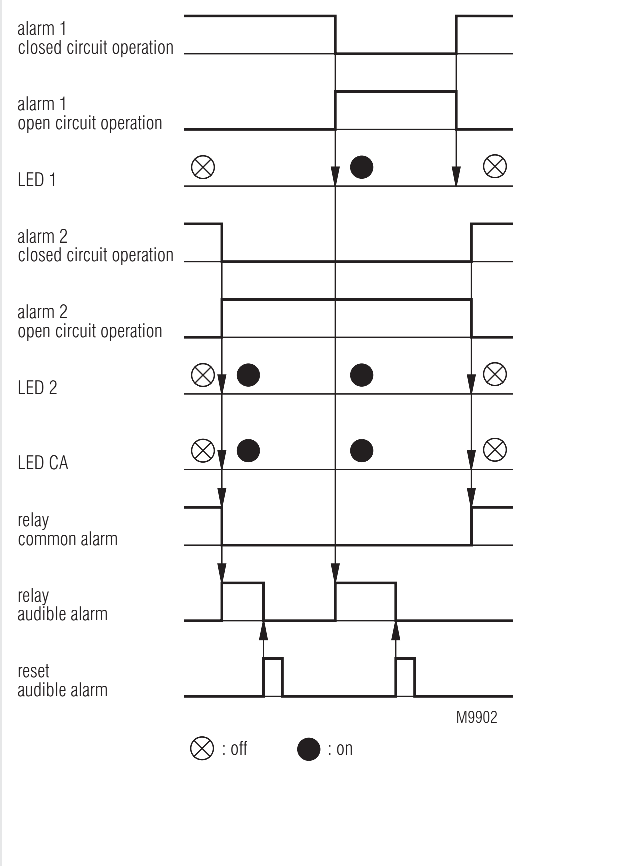


EH 5994, EH 5995

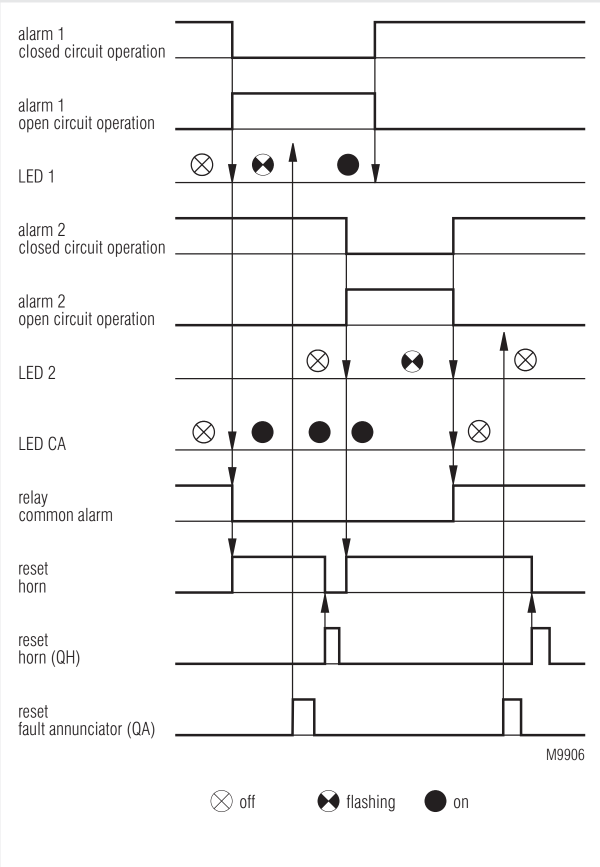
Function Diagram (First Signal Annunciator)



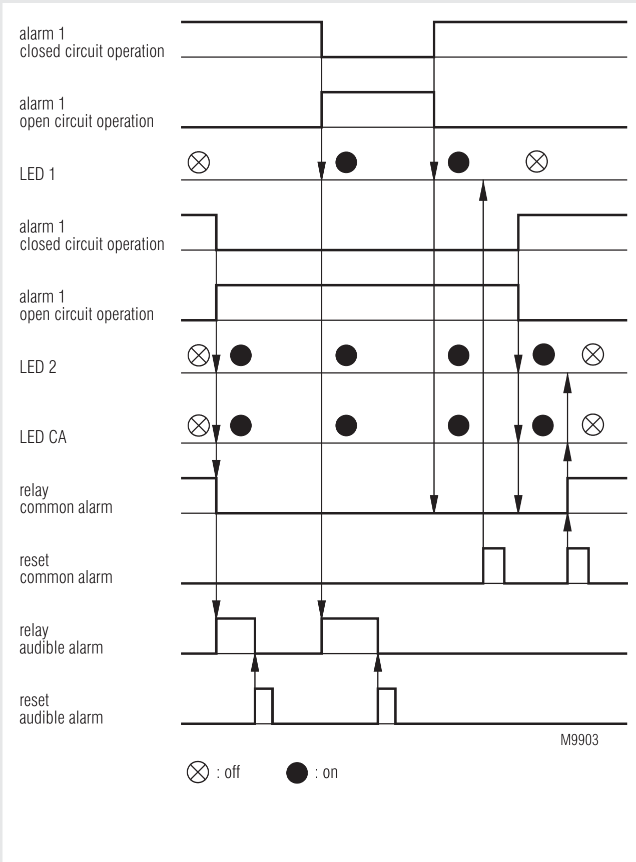
Function Diagram (Common Alarm Annunciator, Auto Reset)



Function Diagram (New Signal Alarm Annunciator)



Function Diagram (Common Alarm Annunciator Manual Reset)



Wiring
Devices with DC 24V auxiliary supply have to be operated on a galvanic separated power supply.

Configuration Cycle

1.) Wire the system
2.) Adjust module address on extension modules with switch “ADR” (different addresses for all modules)
2.1) When display units are integrated into the annunciator system the address setting of each display unit has to be done as follows
- if the display unit should display the state of the base module (RP 5994) set “MODE” switch on back of the unit to position “Basismodul” and adjust an address that is not used by any other display unit.
- if the display unit should display the state of an extension module (RP 5995) set “MODE” switch on back of the unit to position “Erw.modul” and adjust the same address as on the extension module (RP 5995) of which the status should be displayed.

3.) Set “MODE” switch on base module to position “Config”
4.) Choose input mode on extension modules:
Terminals X1/X2 open = open circuit operation
Terminals X1/X2 linked = closed circuit operation
5.) Set delay on switch, „td“ 0 ... 10 s
6.) Power up the system
7.) Fault signal LEDs of the base module are flashing for some time
8.) On the detected extension modules the fault signal LEDs are now flashing
9.) Fault signal LEDs change to continuous state and indicate number of detected extension modules in binary code
10.) The detected modules are stored no voltage safe in the base module memory. The fault annunciator only works with the detected modules. If a new module is added, the configuration cycle has to be run again.
11.) Select the required alarm function with switch “MODE” on the base module
12.) Press push buttons QH and QHC to leave the configuration mode.

Function Switch „MODE“

switch „MODE“	description
0	First fault signal
1	New fault signal
2	Common alarm manual reset
3	Common alarm auto reset
Config.	Configuration

Function Switch „Set“

	Function of QX1 / QX2				Function principle of fault signal inputs	
Switch „Set“	Alarm reset QA	Audible alarm reset QH	Common alarm reset QCA	Lamp test LT	open circuit operation	closed circuit operation
0	✔	-	-	-	✔	-
1	-	✔	-	-	✔	-
2	-	-	✔	-	✔	-
3	-	-	-	✔	✔	-
4	✔	-	-	-	-	✔
5	-	✔	-	-	-	✔
6	-	-	✔	-	-	✔
7	-	-	-	✔	-	✔

Setting and Adjustment

Possible Alarm Modes:

Alarm annunciator	Alarm reset QA	Audible alarm reset QH	Common alarm reset QCA
New signal alarm annunciator	✔	✔	-
First signal annunciator	✔	✔	-
Common alarm annunciator manual reset	✔	✔	✔
Common alarm annunciator auto reset	-	✔	-

- : this setting ist not supported by the module

Lamp Test
Pressing the pushbuttons QH and QCA simultaneously during normal operation will force a lamp test function (LT). During lamp test all fault signal LEDs are switched on.
The lamp test function can also be operated by bridging the terminal QX1/QX2 (connection remote reset) if this function is selected on switch “Set” for QX1/QX2

Fault Diagnostics
To indicate failures of the system the unit generates a flash code on the Bus LED. When a failure code 1 to 3 is displayed, the contacts of the common alarm relay switch off.

LED continuously on:	System has no failure
Failure 1 :	Configuration failure. One ore more extension modules, that have been detected during configuration do not exist anymore. The address of the first missing extension module is displayed as binary code on the fault signal LEDs.
Failure 2 :	The base module cannot communicate with the extension modules. The address of the first extension module that cannot communicate with the base module is displayed as binary code on the fault signal LEDs.
Failure 3 :	The bus wire is interrupted or the bus is not terminated correctly. The base module does not find any extension modules to communicate with.
Failure 4 :	In normal operation: the configuration data has been found faulty. A new configuration cycles has to be run. During configuration: the detected configuration data could not be stored.
Failure 5 :	New modules unknown to the device software of the base module have to be implemented by a firmware update of the base module.

Remark: Different types of devices (device classes) can be connected to the annunciator bus e.g. extension modules RP 5995, display units EH 5994, EH 5995 etc. The base module detects the different module types and adds a device specific number to the adjusted bus module address (address offset). In the case of failure this added number is indicated as binary code on the LEDs of the base module.
Max. 4 text display units EH 5996 can be connected to the Base module RP 5994.
These 4 units has to be designation by adresse 0 up to 3

Device class	adress offset	modules
Extension modules	+ 0	RP 5995
Display unit	+ 10	EH 5994, EH 5995
Textdisplay unit	+ 20	EH 5996

Technical Data

Input

Nominal voltage A1-A2: AC 230 V, DC 24 V
Voltage range: 0.8 ... 1.1 U_N
Nominal consumption A1-A2
at AC 230 V: 3.4 VA
at DC 24 V: 1.1 W
Nominal frequency A1-A2
at AC 230 V: 50 Hz

Fault Signal Inputs (only for RP 5994, RP 5995)

Fault signal inputs S1...S8: AC/DC 24 ... 230 V
Min. time for input signal: ≥ 70 ms
Min. time for acknowledgement: ≥ 70 ms
Operate delay setting with poti 0 ... 10 s

Output (only for RP 5994, RP 5995)

Contacts: 1 NO contact each for output common alarm and horn
Thermal current I_{th}: 2 A
Switching capacity
according to AC 15: 3 A / AC 230 V IEC/EN 60 947-5-1
Electrical life
to AC 15 at 1 A, AC 230 V: ≥ 1.5 x 10^5 sw. cycles IEC/EN 60 947-5-1
Short circuit strength
Max. fuse rating: 4 A gL IEC/EN 60 947-5-1
Mechanical life: ≥ 30 x 10^6 switching cycles

RS485 Bus

RP 599_, EH 599_: not isolated
RP 599_/1_ _, EH 599/1_ _: isolated (1KV)
Bus wire: screened twisted pair
Data transmission rate: 115.2 KB/s
Attention: both ends of the twisted pair have to be terminated by inserting the links A/Ra and B/Rb!

General Data

Nominal operating mode: continuous operation
Temperature range: - 20 ... + 55°C
clearance and creepage distance
rated impulse voltage / pollution degree
relay output: 4 kV / 2 IEC 60 664-1
input: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge (ESD): 8 kV (air) IEC/EN 61 000-4-2
HF irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltage between
wires for power supply: 1 kV IEC/EN 61 000-4-5
between wire and ground: 2 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Degree of protection RP 5994, RP 5995: IEC/EN 60 529
Housing
Cover: IP 40
Base: IP 30
Terminals: IP 20
Degree of protection EH 5994, EH 5995: IEC/EN 60 529
Front: IP 64
Enclosure: IP 20
Enclosure: thermoplastic with VO behaviour according to UL Subjekt 94
Vibration resistance: 0.35 mm amplitude, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance: 20 / 055 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection DIN 46 228/1-/-2/-3/-4
fixed screw terminal (S): 0.2 ... 4 mm² solid or 0.2 ... 1.5 mm² stranded wire with sleeve
plug-in screw terminal (PS): 0,1 ... 2.5 mm² solid or 0.1 ... 1.5 mm² stranded wire with sleeve
plug-in cage clamp terminals (PC): 0.2 ... 2.5 mm² solid or 0.2 ... 1.5 mm² stranded wire with sleeve
Wire fixing
fixed screw terminals (S), plug-in screw terminals (PS): Captive plus-minus-terminal screws M2.5 with self raising terminal box

Technical Data

plug-in cage clamp terminals (PC): cage clamp terminals for directely plug-in of conductors Screwdriver 0.6 x 3.5 for removing of the cage-clamp
Mounting: DIN-rail IEC/EN 60 715
Weight
RP 5994 S: 260 g
RP 5995 S: 240 g
EH 5994, EH 5995
AC 230 V-versions: 285 g
DC 24 V-versions: 210 g

Dimensions

Width x height x depth:
RP 5994, RP 5995: 70 x 90 x 71 mm
EH 5994, EH 5995: 96 x 96 x 60.5 mm

Standard Types

RP 5994 S AC 230 V 50 Hz
Article number: 0060029
RP 5995 S AC 230 V 50 Hz
Artikelnummer: 0060034
- Nominal voltage U_N: AC 230 V
- fixed screw terminals
- Width: 70 mm

EH 5994 AC 230 V 50 Hz
Article number: 0060589
- Nominal voltage U_N: AC 230 V
- Reset buttons for audible alarm and common alarmon front side
- Width: 96 mm

EH 5995 AC 230 V 50 Hz
Article number: 0060593
- Nominal voltage U_N: AC 230 V
- Without reset buttons
- Width: 96 mm

Odering Example for RP 599_

RP 599 _ S/_ 00 AC 230 V 50 Hz

Nominal frequency
Nominal voltage
RS485 Bus
0 = not isolated (standard)
1 = isolated
Terminals
S = fixed screw terminal
PS = plug-in screw terminal
PC = plug-in cage-terminals
Type
4 = Basis module
5 = Extension module

Odering Example for EH 599_

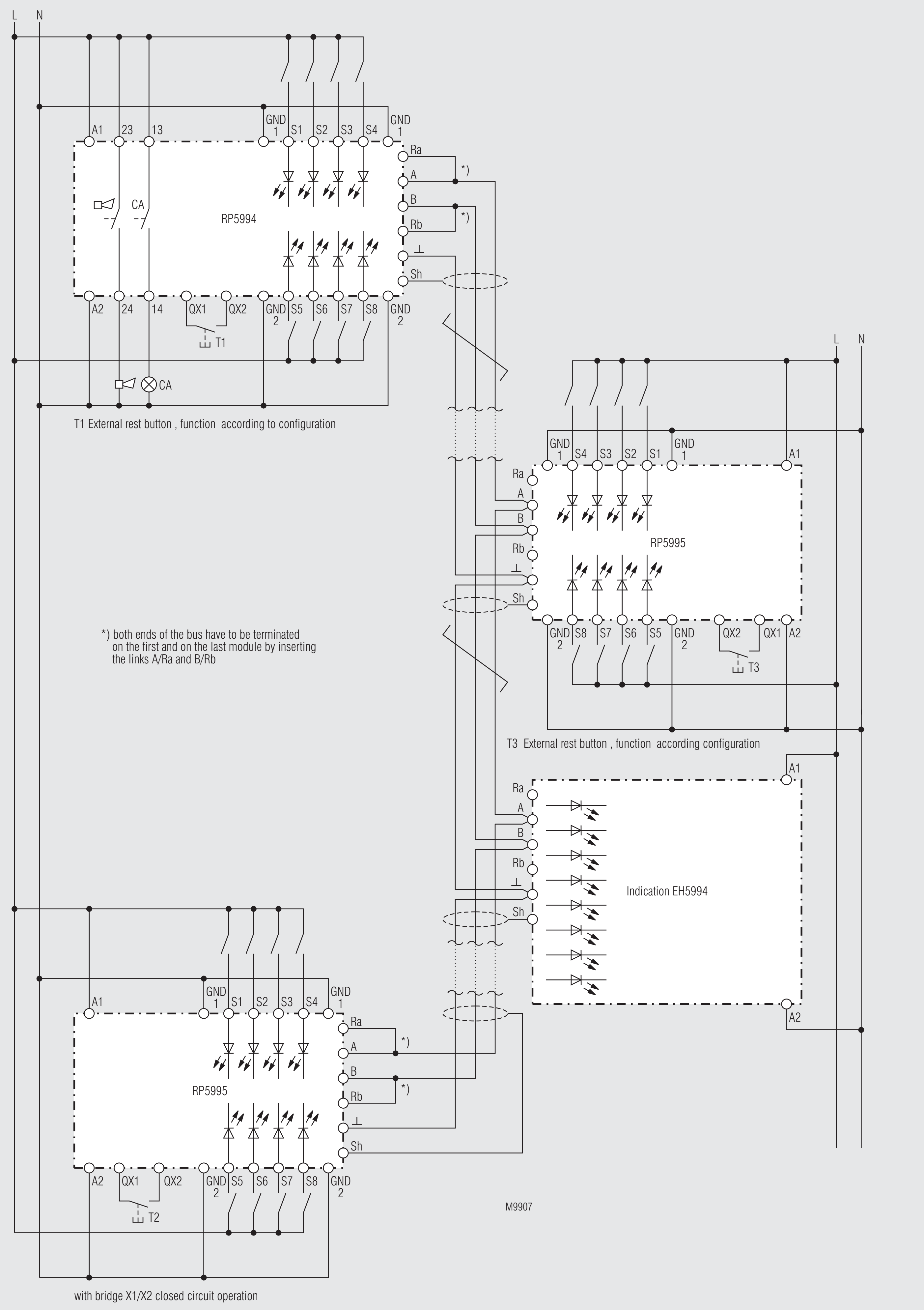
EH 599 _ /_ 00 AC 230 V 50 Hz

Nominal frequency
Nominal voltage
RS485 Bus
0 = not isolated (standard)
1 = isolated
Type
4 = with reset buttons on front
5 = without reset buttons

Accessories

Buzzer RK 8832: Article number: 0059906
Text Display Unit EH 5996 Article number: 0061784

Connection Example

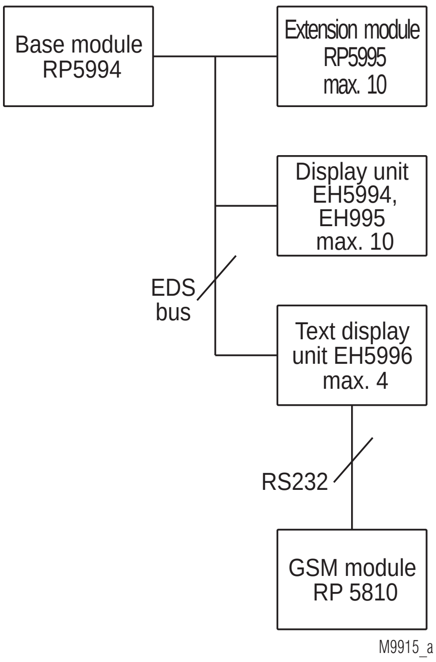


INFOMASTER B Fault Monitoring System with Bus Connection
Text display Unit
EH 5996


0258314

System Overview

In one fault monitoring system INFOMASTER B with one base module RP 5994 up to 4 text displays EH 5996 can be operated. In addition it is possible to connect 10 extension modules RP 5995 and 10 Display units EH 5994 or EH 5995. Via the RS230 interface on EH 5996 a GSM Module RP 5810 can be controlled, that transfers SMS on coming or going fault signals to pre-defined receivers.



Your Advantages
- Easy to extend up to 10 displays because of bus connection
- Easy to change the operating language for menus and failure text

Features
- Text display for DOLD fault annunciator system INFOMASTER B with base module RP 5994
- To display up to 88 fault messages with 80, 40 or 20 characters each
- Operating mode adjustable on base module RP 5994 for new, first or common alarm
- Reset buttons for individual alarm signal, audible alarm and common alarm on front side
- RS 485 bus connection, as option with galvanic separation
- Alarms and resets can be transmitted by SMS via GSM module RP 5810
- SMS communication is possible with up to 16 receivers
- Configuration of the text display via USB-Stick (acceccories OA 5996 Article-No. 0065659), therefore no laptop on site is necessary
- Real time clock
- Operating language for menus and failure text in English, German and French
- Up to 3 variable parameters in one message text
- 2 password levels for device configuration

Approvals and Markings

Additional Information about this topic

- General information for INFOMASTER B see datasheet INFOMASTER B, systemoverview
- Informations about the additional Base module, Extension module and Display unit see datasheet RP 5994, RP 5995
- Informations about the additional GSM-module for alarm and reset via SMS see datasheet RP 5810

Application

- To monitor industrial plants and buildings
- For fast localisation of failures and their causes
- For reduction of standstill times in production

Indication

green LED „ON“:	on when supply connected
red LED „CA“:	on, when output common alarm is active
yellow LED „BUS“:	on, when bus is active

Setting and Adjustment

Wiring

Devices with DC 24V auxiliary supply have to be operated on a galvanic separated power supply.

Configuration cycle

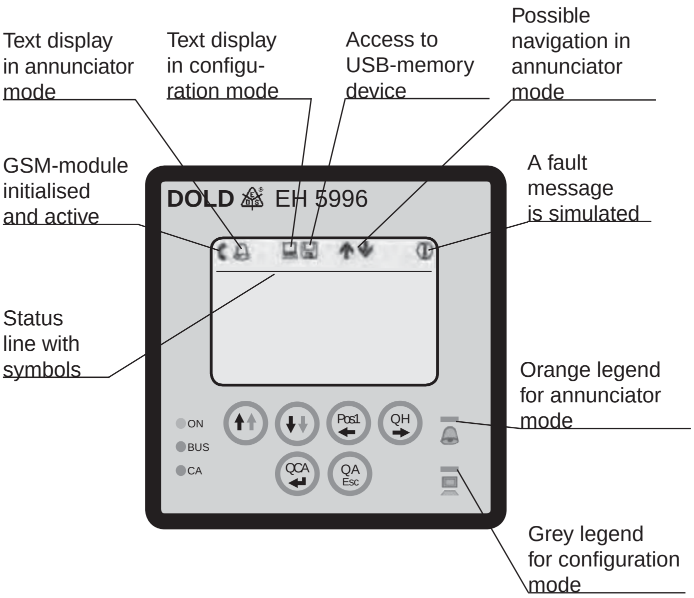
1.) Wire the system
2.) Adjust module address on all connected modules with switch “ADR” (different addresses for all modules)
3.) Set “MODE” switch on base module to position “Config”
4.) Power up the system
5.) While fault signal LEDs of the base module are flashing
6.) the text display Eh 5996 detected by the base module RP 5994 shows the following text: „**System is in configuration mode module has been detected on bus**“
7.) Fault signal LEDs change to continuous state and indicate number of detected extension modules in binary code
8.) The detected modules are stored no voltage safe in the base module memory. The fault annunciator only works with the detected modules. If a new module is added, the configuration cycle has to be run again.
9.) Configuration of the text display unit (see user manual)

Operation of Text Display Unit

The text display is either in annunciator or configuration mode. A symbol in the status line of the display indicates the mode (see table and drawing and picture below). Depending on the actual mode the pushbuttons on the front have a different function. In annunciator mode the orange legend is valid and in configuration the grey legend.

	Symbols in status line
	GSM module is initialised and ready
	Annunciator mode
	Configuration mode
	Reading from or writing to USB-memory device
	Simulation mode

Description text display unit EH 5996



Operation of Text Display Unit

Function of Push Buttons

	Annunciator mode	Configuration mode
↑↑	Previous active fault message	one menu item up or increase value in data entry field
↓↓	Next active fault message	one menu item down or decrease value in data entry field
Pos1 ←	Beginning of active messages list	one character to the left in data entry field
QH →	Acknowledging the audible alarm	one character to the right in data entry field
QCA ↵	Acknowledging the common alarm	select menu item or confirm entered data
QA Esc	Acknowledging alarm message	cancel changes and leave data entry field
QCA + QA Esc	Change into configuration mode	

SMS Function

In conjunction with the GSM module RP 5810 the text display can transmit SMS on coming and going alarm messages. For each alarm message an SMS text each for coming and going can be defined together with max. 16 possible receivers. Also it is possible to enable receivers out of the possible 16 to acknowledge alarms.

Technical Data

Input

Nominal voltage A1-A2:	AC 230 V, DC 24 V	
Voltage range:	0.8 ... 1.1 U_N	
Nominal consumption A1-A2		
at AC 230 V:	2.5 VA	
at DC 24 V:	1.9 W	
Nominal frequency A1-A2		
at AC 230 V:	50 Hz	

Output

RS485 Bus	
EH 5996:	not isolated
EH 5996/1_ _:	isolated (1KV)
Bus wire:	screened twisted pair
Data transmission rate:	115.2 KB/s
	Attention: both ends of the twisted pair have to be terminated by inserting the links A/Ra and B/Rb!

General Data

Nominal operating mode:	continuous operation	
Temperature range:	- 20 ... + 55°C	
Clearance and creepage distance		
rated impulse voltage / pollution degree	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge (ESD):	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltage between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
between wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection:		IEC/EN 60 529
Front:	IP 64	
Enclosure:	IP 20	
Enclosure:	thermoplastic with VO behaviour according to UL Subjekt 94	

Technical Data

Vibration resistance:	0.35 mm amplitude, frequency 10 ... 55 Hz, IEC/EN 60 068-2-6
Climate resistance:	20 / 055 / 04 IEC/EN 60 068-1
Terminal designation:	EN 50 005
Wire connection	DIN 46 228/1-/-2/-3/-4
plug-in screw terminal:	0.1 ... 2.5 mm² solid or 0.1 ... 1.5 mm² stranded wire with sleeve
Wire fixing:	Captive plus-minus-terminal screws M2.5 with self raising terminal box
Mounting:	DIN-rail IEC/EN 60 715
Weight:	260 g

Dimensions

Width x height x depth:	96 x 96 x 123 mm

Standard Types

EH 5996 AC 230 V 50 Hz
Article number: 0061784
EH 5996 DC 24 V
Article number: 0061813

- Nominal voltage U_N: AC 230 V or DC 24 V
- fixed screw terminals
- Width: 96 mm

Odering example

EH 5996 /_ 00 AC 230 V 50 Hz

Nominal frequency
Nominal voltage
RS485 Bus
0 = not isolated (standard)
1 = isolated
Type

Accessories

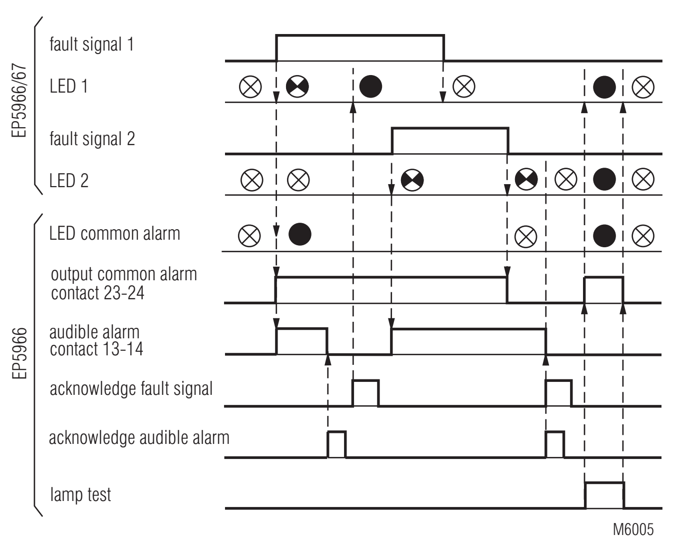
Base module RP 5994	Article number: 0060029
Extension module RP 5995	Article number: 0060034
Display unit EH 5994	Article number: 0060589
Display unit EH 5995	Article number: 0060593
Buzzer RK 8832	Article number: 0059906
GSM-Module RP 5810	Article number: 0065146
USB-Stick OA 5996 (FAT 16 formated):	Article number: 0065659

INFOMASTER
Fault Annunciator System
EP 5966, EP 5967

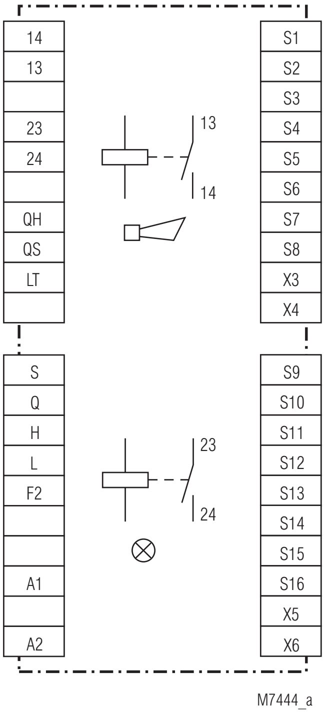
- New fault annunciation with single frequency flashlight according to DIN 19 235
- Expandable from 16 up to 160 inputs
- in 2 groups of 8 inputs selectable:
  - open circuit operation
  - closed circuit operation
- Input voltage up to max. AC/DC 240 V
- Delayed inputs
- Exchangable front for individual scale
- Removable terminals
- Flush mounting
- Frame 72 x 144 mm

EP 5966:
- 16 inputs in control unit
- Output relay for common signal and audible alarm
- Built in and external connected pushbuttons for lamp test (LT), acknowledgement of horn (QH) and of alarm (QS)
- Extension module with 16 inputs

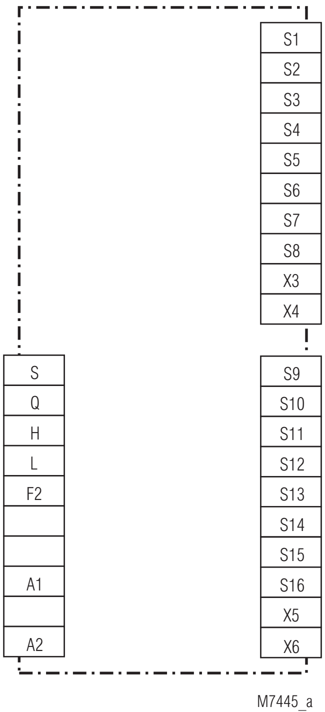
Function Diagram



Circuit Diagrams



EP 5966



EP 5967

Approvals and Markings

Applications

Monitoring of industrial plants and buildings

Function

The unit EP 5966 controls the system and includes the common alarm output for all connected extension modules EP 5967.
For audible alarm as well as for common alarm 2 relay outputs (NO) are available. The acknowledgement (QH and QS), as well as the lamp test (LT) can be effected through built in and external pushbuttons. The pushbutton lamp test (LT) is for the checking of the LED´s in the control unit and the supsequent extension modules. The associated common alarm output contact 23-24 will be closed.

On EP 5966 and 5967 open circuit operation or closed circuit operation can be selected by bridging terminals X3/X4 or X5/X6 for 2 groups of 8 inputs.
To avoid unnecessary fault signalling an operate delay of 1 s, 3 s or 10 s to the inputs is available.
The fault annunciator lamps can be marked by the customer on an attached label. Spare labels for EP 5966 and EP 5967 are available.
Extension modules can be mounted in neighbour cabinets. The distances of the panels should not be bigger than 10 m. In this case the connection cable must be screened. The screen has to be grounded on both sides.

Indication

One LED for each signal
EP 5966 with additional LED for common alarm

Notes

The inputs for the control signals as well as the inputs for programming (open circuit / closed circuit) are **not** protected against false connection to mains voltage.
The inputs are not galvanic separated from the supply voltage. At DC units 0 V must always be connected to A2.
When configured for NC signal inputs, the inputs not used, must be connected to high level.

Technical Data

Input

Auxiliary voltage U_H (A1, A2):	AC 24, 42, 110, 127, 230 V DC 24 V	
Special voltages[1]:	EP 5966	EP 5967
DC 48 V:	270 Ω / 8 W	330 Ω / 8 W
DC 60 V:	390 Ω / 8 W	510 Ω / 8 W
DC 110 V:	1.0 kΩ / 20 W	1.2 kΩ / 20 W
DC 127 V:	1.2 kΩ / 20 W	1.5 kΩ / 20 W
DC 220 V:	2.4 kΩ / 35 W	2.7 kΩ / 35 W

[1] Special voltages with series dropresistor (5%) on terminal A1. The fault annunciators are made for the special voltage and cannot be adapted to other voltages by changing series resistors.

Voltage range:	0.8 ... 1.1 U_N
Nominal consumptions	
EP 5966:	approx. 5 VA
EP 5967:	approx. 5 VA
Nominal frequency:	50 / 60 Hz
Min. time for input signal:	≥ 100 ms + operate delay
Min. time for acknowlegement:	≥ 200 ms
Input voltage (S1 ... S16):	AC/DC 24 ... 60 V AC/DC 110 ... 240 V AC/DC 12 ... 30 V (only at U_H = DC 12 V)

Output

Operate delay t_V:	1 s, 3 s, 10 s	
Thermal current I_{th}:	3 A	
Switching capacity		
to AC 15:	3 A; AC 230 V	IEC/EN 60 947-5-1
Electrical life		IEC/EN 60 947-5-1
to AC 15 at 3 A, AC 230 V:	5 x 10^5 switching cycles	

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 50°C	
Clearance and creepage distances		
rated impulse voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	4 kV (air)	IEC/EN 61 000-4-2
HF-irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge voltages between		
wires for power supply:	2 kV	IEC/EN 61 000-4-5
between wire and ground:	4 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0-behaviour according to UL subject 94	
Vibration resistance:	Amplitude 0.35 mm frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 050 / 04	IEC/EN 60 068-1
Wire connection:	2 x 1.5 mm^2 solid DIN 46 228-1/-2/-3/-4 1 x 1.5 mm^2 or 2 x 0.75 mm^2 stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Box terminals with self-lifting wire protection, removable	
Mounting:	flush mounting	
Weight		
EP 5966:	520 g	
EP 5967:	approx. 480 g	

Dimensions

Width x heigth x depth:	72 x 144 x 134 mm
Front panel cut-out:	$66^{+0.7}$ x 138^{+1} mm

Standard Types

EP 5966 AC/DC 24 ... 60 V U_H DC 24 V 1 s

Article number:	0041660
• Input voltage:	AC/DC 24 ... 60 V
• Auxiliary voltage U_H:	DC 24 V
• Operate delay:	1 s
• Frame:	72 x 144 mm

EP 5967 AC/DC 24 ... 60 V U_H DC 24 V 1 s

Article number:	0041662
• Input voltage:	AC/DC 24 ... 60 V
• Auxiliary voltage U_H:	DC 24 V
• Operate delay:	1 s
• Frame:	72 x 144 mm

Ordering examples

EP 5966 AC/DC 110 ... 240 V U_H AC 230 V 1 s

- 1 s – Operate delay
- U_H AC 230 V – Auxiliary voltage
- AC/DC 110 ... 240 V – Input voltage
- EP 5966 – Type

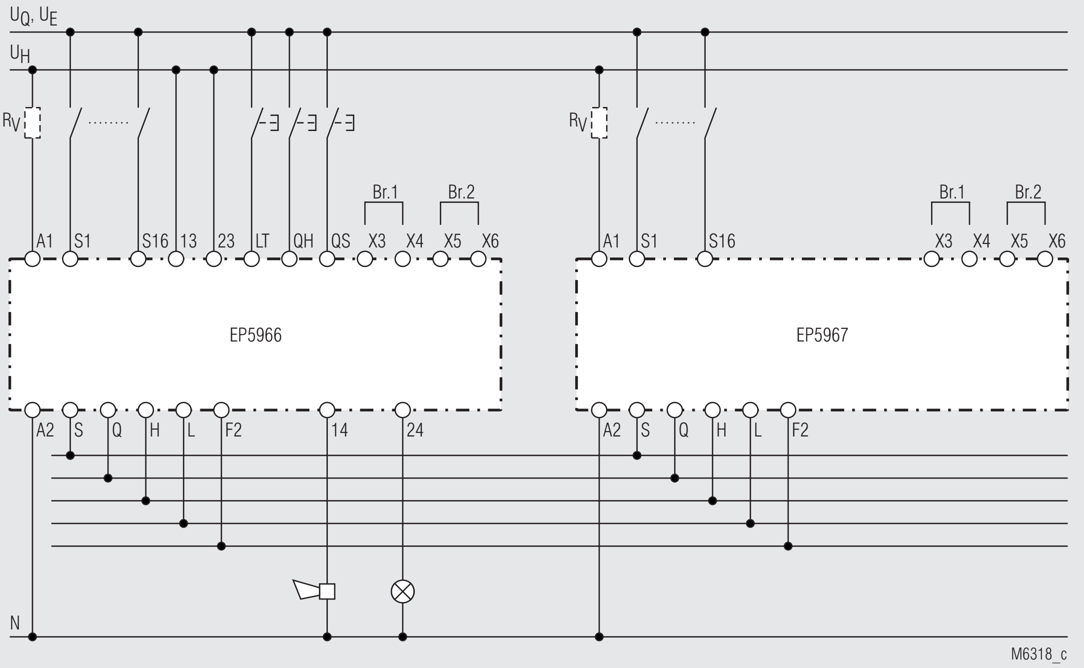
EP 5967 AC/DC 110 ... 240 V U_H AC 230 V 1 s

- 1 s – Operate delay
- U_H AC 230 V – Auxiliary voltage
- AC/DC 110 ... 240 V – Input voltage
- EP 5967 – Type

Accessories

Spare indication label:	EP 5966-0-1,	Art.-No.: 0048909
	EP 5967-0-1,	Art.-No.: 0050771
Spare transparent front sheet:	EP 5966-10,	Art.-No.: 0048738

Connection Example



S1 - S16	Inputs
LT	Lamp test
QH	Acknowledge audible alarm
QS	Acknowledge fault signal
13/14	Relay contact audible alarm
23/24	Relay contact common alarm
UQ	Control voltage of the acknowledge inputs
UE	Control voltage of the inputs

with bridge X3 / X4 or X5 / X6 n.o. circuit operation
without bridge X3 / X4 or X5 / X6 n.c. circuit operation

INFOMASTER
Fault Annunciator System
AD 5998, AD 5992

0221533

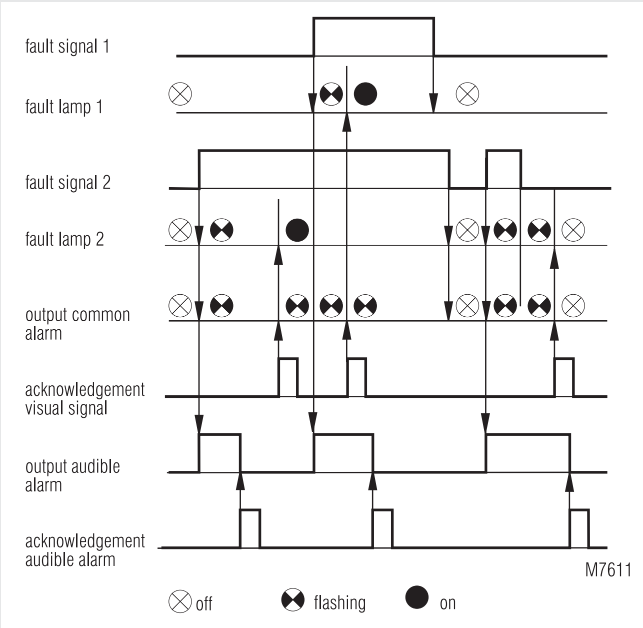
AD 5998 AD 5992

- New fault annunciation according to DIN 19235
- Expandable from 3 up to 303 inputs
- Width 45 mm

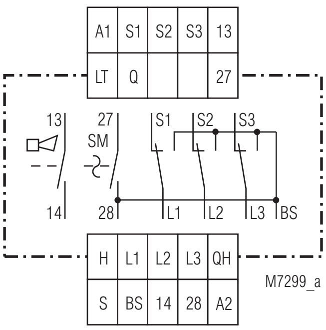
Fault annunciator AD 5998:
- 3 inputs
- Pushbutton connection possible for light signal acknowledgement, horn acknowledgement and lamp test
- 1 relay for common alarm and 1 for horn

Extension unit AD 5992:
- 6 inputs

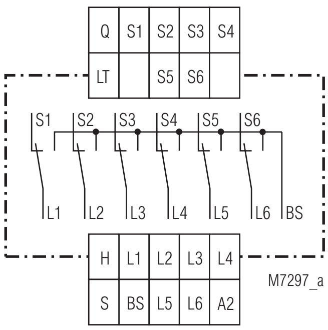
Function Diagram



Circuit Diagrams



AD 5998



AD 5992

Approvals and Markings

CE

Application

Monitoring of industrial plants and buildings

Notes

The connections A1, inputs S1-S3 and S1-S6, lampt test input LT and acknowledgement input Q have to be connected to the same phase.

Even if no common signal light will be connected, the nominal voltage is to be connected to terminal 27.

The bus-lines H and S have a low voltage and are not allowed to be connected to any external voltage. If inductive or capacitive superimposed voltages are expected, it is recommened to use screened cables for these lines.

The flash impulse via flash line BS will be generated by an internal contact. The maximum load of this contact must be observed (technical data).

It is not allowed to connect lamps with transformers on the outputs. This would cause unintentional fault signals at the lamp test.

In case of units with AC-voltage, the signal lights during the lamp test are lighting dim, as the test will be effected only with a half-wave. The half-wave voltage is also applied at terminals S1-S3 and S1-S6 during the lamp test.

If other lamps, except for the fault signal lamps, should be tested via the lamp test pushbutton T1, it is necessary to use a lamp tester, whose diode configuration is identically to the diode configuration of the fault annunciator. In case of AC-voltage operation this ist the lamp tester AI 990/04, in case of DC-voltage operation the lamp tester AI 990 or AI 990.10.

Technical Data

Input

Nominal voltage U_N: AC 24, 230, 240 V,
DC 24 V with polarity protection
AC 42, 110, 127 V on demand

Special voltages: with additional resistors
(see connection example)

	AD 5998		AD 5992
	RV	R1	R2
DC 48 V:	ZWS 8 sl 390 Ω	ZWS 8 sl 2.7 kΩ	ZWS 8 sl 430 Ω
DC 60 V:	ZWS 8 sl 640 Ω	ZWS 20 sl 4.7 kΩ	ZWS 8 sl 640 Ω
DC 110 V:	ZWS 20 sl 1.5 kΩ	ZWS 20 sl 10 kΩ	ZWS 20 sl 1.5 kΩ
DC 125 V:	ZWS 20 sl 1.8 kΩ	ZWS 20 sl 12 kΩ	ZWS 20 sl 1.8 kΩ
DC 230 V:	ZWS 20 sl 3.3 kΩ	ZWS 20 sl 24 kΩ	ZWS 20 sl 3.3 kΩ

Voltage range: 0.8 ... 1.1 U_N
Nominal consumption: AC 230 V 6 VA; DC 24 V 1.5 W
Nominal frequency: 50 / 60 Hz
Fault impulse time: ≥ 100 ms
Acknowledgement impulse time: > 200 ms

Output

Loading:
AD 5992 / AD 5998
signal light each:
(terminals L1, L2, L3, L4, L5, L6 bzw. L1, L2, L3): AC 230 V 1 A max.

AD 5998
Audible-alarm output
(terminal 14): AC 230 V 3 A max.
Common alarm output
(terminal 28) and lamp signal
via flash line BS totally: AC 230 V 3 A max.
DC 24 V 2 A max.
for higher switching capacity
a contactor is to be inserted
Lamp test (pushbutton 1): Sum of the currents of all lamp signals L

General Data

Operation mode: Continuous operation
Temperature range: - 20 ... + 60°C
Clearance and creepage distances
rated impulse voltage /
pollution degree: 4 kV / 2 IEC 60 664-1
EMC
Electrostatic discharge: 6 kV (contact) IEC/EN 61 000-4-2
HF-irradiation: 10 V / m IEC/EN 61 000-4-3
Fast transients: 2 kV IEC/EN 61 000-4-4
Surge voltages: 1 kV IEC/EN 61 000-4-5
Interference suppression: Limit value class B EN 55 011
Degree of protection: Housing: IP 40 IEC/EN 60 529
Terminals: IP 20 IEC/EN 60 529
Housing: Thermoplast with V0 behaviour
according to UL subject 94
Vibration resistance: Amplitude 0.35 mm,
frequency 10...55Hz IEC/EN 60 068-2-6
Climate resistance: 20 / 060 / 04 IEC/EN 60 068-1
Terminal designation: EN 50 005
Wire connection: 2 x 2.5 mm² solid or
2 x 1.5 mm² stranded wire with sleeve
DIN 46 228
Wire fixing: Flat terminals with self lifting
clamping piede IEC/EN 60 999-1
Mounting: DIN rail IEC/EN 60 715

Weight	AC 230 V	DC 24 V
AD 5998:	380 g	250 g
AD 5992:	360 g	220 g

Dimensions

Width x height x depth: 45 x 77 x 127 mm

Standard Types

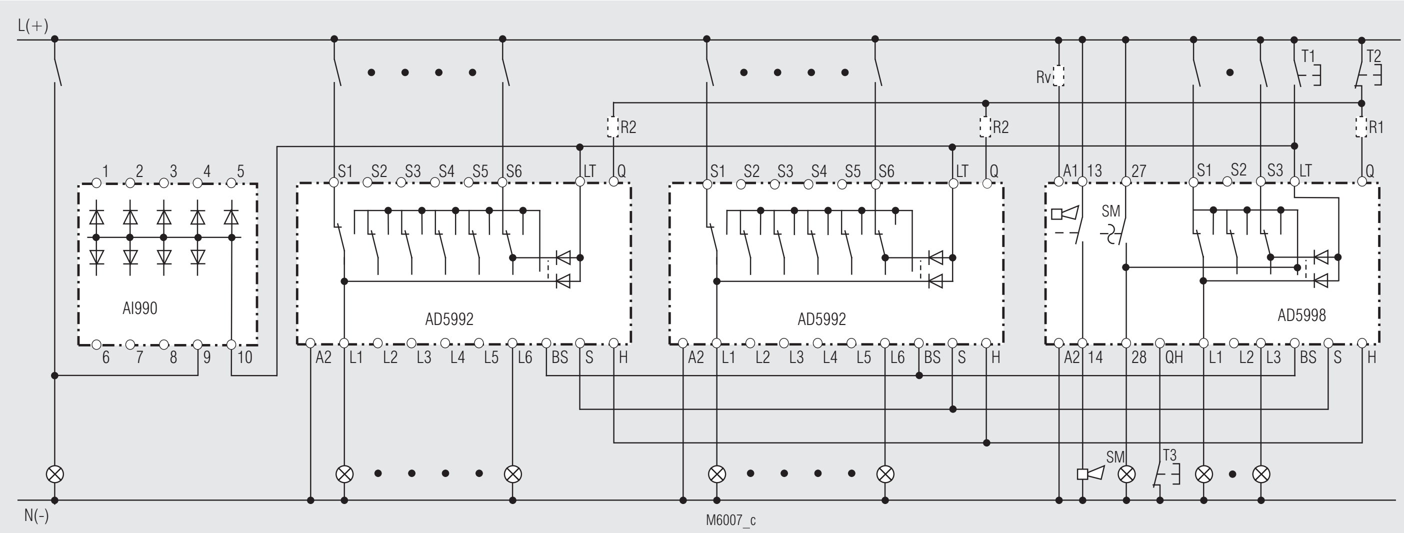
AD 5998 AC 230 V 50/60 Hz
Article number: 0032367 stock item
- Nominal voltage U_N: AC 230 V
- Width: 45 mm

AD 5992 AC 230 V 50/60 Hz
Article number: 0032361 stock item
- Nominal voltage U_N: AC 230 V
- Width: 45 mm

Ordering Example

AD 5998 AC 230 V 50/60 Hz
- 50/60 Hz — Nominal frequency
- AC 230 V — Nominal voltage
- AD 5998 — Type

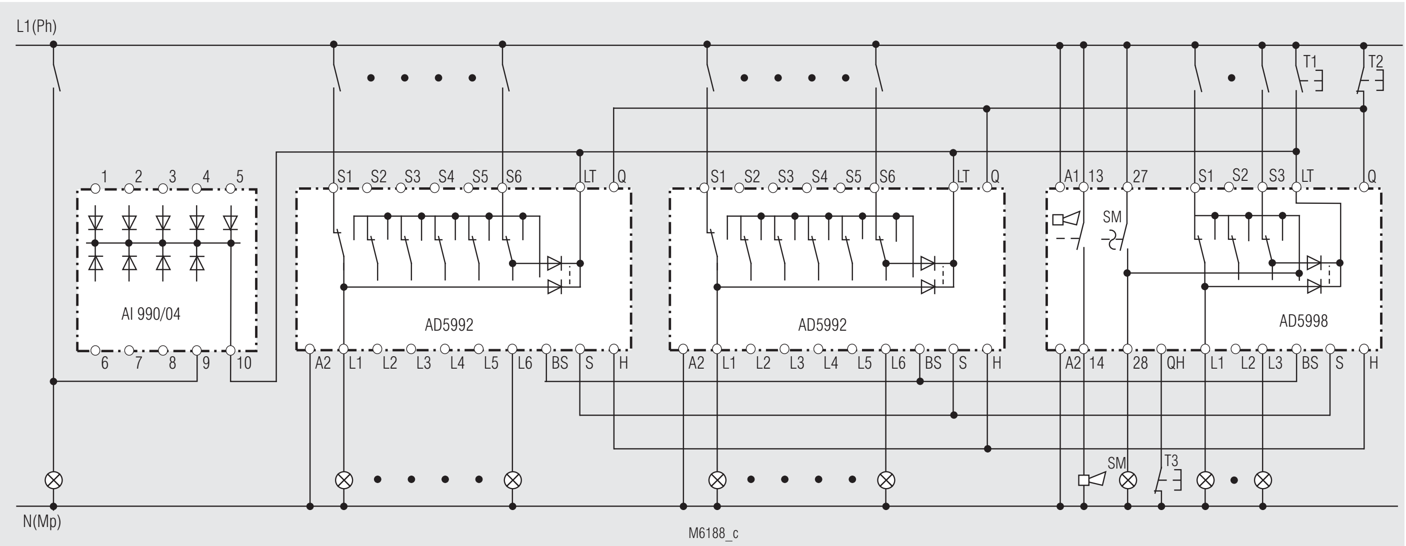
Connection Examples



T1 external pushbutton for lamp test
T2 external acknowledgement pushbutton for lamp signal
T3 external acknowledgement pushbutton for audible alarm
R_v, R1, R2 > DC 30 V

Connection diagram AD 5998 - AD 5992 for operation at DC-voltage with additional almp tester AI 990 or AI 990.10
Lamp tester AI 990 is only required if additional lamps in the system need to be tested.

Connection Examples



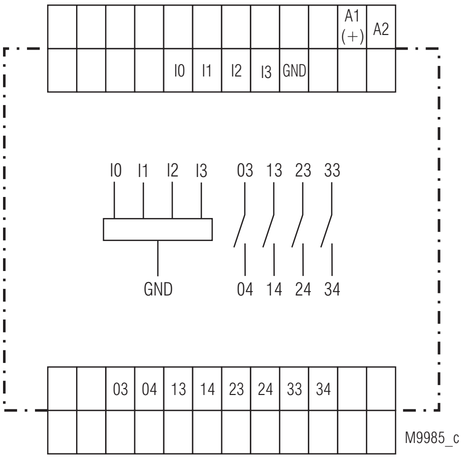
T1 external pushbutton for lamp test
T2 external acknowledgement pushbutton for lamp signal
T3 external acknowledgement pushbutton for audible alarm

Connection diagram AD 5998 - AD 5992 for operation at AC-voltage with additional lamp texter AI 990.04 or AI 990.12
Lamp tester AI 990 is only required if additional lamps in the system need to be tested.

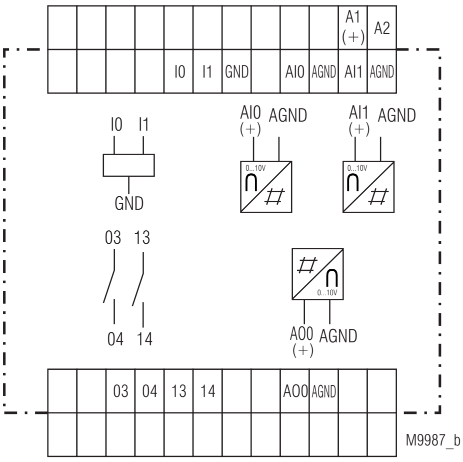
INFOMASTER SMS
SMS-Telecontrol Module
RP 5812

0265719

Circuit Diagrams



RP 5812S, RP 5812PS, RP 5812PC



RP 5812S/001, RP 5812PS/001, RP 5812PC/001

Your Advantage
- Easy remote control of unit via mobile phone
- Easy configuration of unit via mobile phone
- SMS-status request of all i/p's - and o/p's via configurable shortcuts
- SMS text messages via customers SIM card
- Cyclic SMS message with configurable time interval (watchdog function)

Features
- According to directive 1999/5/EC (RTTE) for radio equipment and telecommunications terminal equipment
- 4 digital inputs and 4 relay outputs
- Variant RP 5812/001 with 2 digital and 2 analogue inputs and 1 analogue - and 2 relay outputs
- Auxiliary voltage DC 24 V
- DC 24 V digital inputs
- Automatic SMS messages for status changes
- Quad-Band GSM-Module for 850, 900, 1800 and 1900 MHz (GSM = Global System for Mobile)
- Pin protection of SIM card
- Caller password protection against unauthorised access
- User Dialogue language for: German, English or French
- Configurable authorization levels for up to 16 users
- Assignment of different I/O's to different users
- Automatic sending of SMS when digital inputs change state I.e. come on or go off or both (on rising edge or falling edge)
- Automatic sending of SMS when analogue inputs
  - exceed preset lower and upper limits or
  - when signal is within the preset window
  - and when the signal returns to good state
- Adjustable
  - Hysteresis for analogue inputs
  - Time delay for each input
  - Repeat time for SMS-transmitting
  - Time delay for output status after starting the unit
  - Time delay for activation of the output
- SMS for device status to the system administrators
- SMS-counter to monitor the remaining account
- No interruption of operation after Voltage failure due to integrated Li-Ion battery backup 24Hours
- Compact width: 70 mm

Approvals and Markings

CE

Application
- Remote monitoring control and operation of
  - Machinery and installations for industry and building automation.
  - Small power plants
  - Remote buildings
  - Unmanned production plants
  - Air-conditioning and refrigeration systems
  - Heating systems
  - Elevators and escalators
  - Alarm systems, burglar alarms
  - Smoke, fire and gas warning systems
  - Doors, gates and windows
  - Flood warning systems
- Level alarm in pumping stations
- Remote shut down of rental equipment when payment overdue
- Level monitoring in silos, tanks, etc.

Indication

green LED „U_H“:	on when supply connected
yellow LED „GSM“	
off:	SMS-Telecontrol module is off
flashes 600ms on / 600 ms off:	SMS-Telecontrol module searches for available network and logs on
flashes 75ms on / 3s off:	SMS-Telecontrol module is registered on GSM network.
on:	Data transmission in GSM network is taking place
yellow LED „Status“	
off:	Configuration correct, SMS-Telecontrol module is working correctly
flashes:	Indication of failure code, see table “Fault indication by flashing code”
on:	SMS transmission take place

Settings

Safety remarks

- The SMS-Telecontrol module must not be used for safety relevant control functions due to signal availability.
- The use of the SMS-Telecontrol module in medical rooms must be evaluated thoroughly as medical equipment such as pacemakers etc may react to the radiofrequency of the SMS-Telecontrol module. Also be aware that the radio frequency of the SMS-Telecontrol module may disturb the function of insufficiently protected PCs, monitors and other electronic equipment.
- Delays in the transmission of I/O status may take place due to network problems.

General settings

- If the SMS-Telecontrol module is disconnected for a long period, (e.g. as when delivered) the battery must be charged. To do this the SMS-Telecontrol module needs to be connected to the supply Voltage for up to 6 h. Only after this time is correct operation is possible.

Attention
On delivery the battery is disconnected. Before the batteries can be charged the connection has to be made by changing the slide switch at the bottom edge of the unit to the ON position.

- On first activation a SIM card with a pin code of 1234 has to be inserted. This pin can then be changed by an SMS command. After pin change only the SIM card with the changed pin can to be used. If the pin number on the SIM card is different to the one in the configuration the SIM card may be locked when connecting to the GSM network. A locked SIM card can be unlocked by placing it in a mobile Phone and entering the PUK or Master pin.

- If the Reset/Default Konf. button on the front of the unit is pressed for 3-4 seconds while the unit is powered up, the SMS-Telecontrol module is reset. This means, that the any connection to an SMS network is disconnected and reconnected. If the reset button is pressed for more than 5 sec the configuration is reset to default and the unit makes a factory reset.

- Due to the internal battery back up, the function of the SMS-Telecontrol module is still available even if the power supply is disconnected for up to 24 hours.

Attention
It is your responsibility as an end user to dispose old batteries correctly. Of course, you may return replaced batteries to us.

Settings

Set up procedure of SMS-Telecontrol module

- Wire the i/p’s- o/p’s and the auxiliary supply connections
- Press the SIM eject button (use pen tip), insert the SIM-card with the Preconfigured pin 1234 into the SMS-Telecontrol module
- Power up the SMS-Telecontrol module
- Send the necessary configuration commands via text to the SMS-Telecontrol module (see manual)

Examples for configuration and communication of the SMS module via SMS:

Demand:
The SMS module located in the pump station, should be named “Pump station“ and then answer with this name.
The following SMS is created and sent:
CFGDN§Pump station#

Demand:
Input I0 shall send an SMS on the negative edge (turning off) of the input signal
The following SMS is created and sent:

DISEND§0§FE#

Demand:
Input I0 shall be named „ Pump“
The following SMS is created and sent:
DISYMB§0§Pump#

Demand:
The status „0“ of input I0 shall be named „ Pump stopped“
The following SMS is created and sent:
DITXTLO§0§Pump stopped#

An SMS is generated and sent by the SMS module caused by a defective Pump,it appears as follows:
Answer: „Pump station:Pump stopped“

Demand:
The current status of the (2 or 4) digital inputs can be called up.
The following SMS is created and sent:
?DIALL#
Answer: „Pump station:Pump stopped; Level to high“
and for the 2 analogue inputs:
and to call up the 2 analogue inputs if previously configured for level and motor temperature
?AIALL#
Answer: „Pump station: Level:180cm; pump temp: 85°C“

Safety notes

Attention:

- It is important, that the connected voltage of the analogue inputs and tha analogue outputs of the variant /001 are no larger that are spezified in the Technical Data.
- The Li-Ion battery can not be changed by the user.
  Is there a need to replaced the battery please send the device back to the manufacturer.
- Please note, before using, the other safety instructions of the manual INFOMASTER SMS-Telecontrol module RP 5812.

Technical Data

Input

Auxiliary Voltage A1-A2 (U_H):	DC 24 V,
Nominal consumption A1-A2:	max. 4.5 W at DC 24V
Inputs (digital)	
RP 5812:	4 x i/p; I0 ... I3 DC 24 V with galvanic separation
RP 5812/001:	2 x i/p; I0 ... I1 DC 24 V with galvanic separation
Inputs (analogue)	
RP 5812/001:	2 x i/p; AI0 ... AI1 DC 0 .. 10 V resolution 100 mV

Technial Data

Outputs

Contacts:		
RP 5812:	4 N/O contacts	
RP 5812/001:	2 N/O contacts	
Thermal current I_{th} :	2A	
Switching capacity		IEC/EN 60947-5-1
to AC 15:	3 A / AC 230 V (secondary voltage)	
Electrical life		
to AC15 at 1A / 230V:	$\geq$ 1,5 x 10^6 switch. cycl.	IEC/EN 60 947-5-1
Max. fuse rating:	4A gL	IEC/EN 60947-5-1
Mechanical life:	$\geq$ 30 x 10^6 switching cycles	
Output (analogue)		
RP 5812/001:	AO0 DC 0..10V resolution 100 mV	

GSM

Frequency band:	850 / 900 / 1800 / 1900 MHz
Power class:	GSM 850 / 900 MHz: 4 (2 W) GSM 1800 / 1900 MHz: 1 (1 W)
SIM-card:	1.8V and 3 V SIM cards are supported
Aerial jack:	SMA (male)

General Data

Nominal operating mode:	continuous operation	
Temperature range:	0 ... + 40°C	
Clearance and creepage distance:		
Rated impulse Voltage / pollution degree:	4 kV / 2	IEC 60 664-1
EMC		
Electrostatic discharge:	8 kV (air)	IEC/EN 61 000-4-2
HF irradiation:	10 V / m	IEC/EN 61 000-4-3
Fast transients:	2 kV	IEC/EN 61 000-4-4
Surge between		
wires for power supply:	1 kV	IEC/EN 61 000-4-5
wire and ground:	2 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55011
Degree of protection:		
Housing, Cover	IP 30	IEC/EN 60 529
Terminals	IP 20	IEC/EN 60 529
Housing:	thermoplastic with VO behaviour acc. to UL subject 94	
Vibration resistance:	Amplitude 0,35 mm Frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	00 / 040 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	DIN 46 228/-1/-2/-3/-4	
fixed screw terminal (S):	0,2 ... 4 mm² solid or 0,2 ... 1,5 mm² stranded wire with sleeve	
plug in screw terminal (PS) :	0,1 .. 2,5 mm² solid or 0,1 .. 1,5 mm² stranded wire with sleeve	
plug in cage clamp terminals (PC):	0,2 .. 2,5 mm² solid or 0,2 .. 1,5 mm² stranded wire with sleeve	
Wire fixing:		
fixed screw terminal (S), plug in screw terminal (PS):	Captive plus-minus-terminal screws M2,5 with self raising terminal box	
plug in cage clamp terminals (PC):	spring terminal for direct plug in of wires, screw driver 0,6 x 3,5 for spring releasing	
Mounting:	DIN rail	IEC/EN 60175
Weight:	216 g	

Dimensions

Width x height x depth:	70 x 95 x 80 mm

Standard Types

RP 5812S DC 24 V

Article number:	0065147
• Auxiliary Voltage U_H:	DC 24 V
• Inputs:	4 digital inputs DC 24 V
• Outputs:	4 relay outputs N/O contacts
• Width:	70 mm

RP 5812S/001 DC 24 V

Article number:	0065148
• Auxiliary voltage U_H:	DC 24 V
• Inputs:	2 digital inputs DC 24 V 2 analogue inputs 0 ... 10 V
• Outputs:	2 relay outputs N/O contacts 1 analogue output 0 ... 10 V
• Width:	70 mm

Ordering Example

RP 5812 _ _ / 0 0 _ AC/DC 19 ... 30 V

Auxiliary Voltage
Inputs / Outputs
0: 4 digital inputs, 4 relay outputs
1: 2 digital inputs, 2 analogue inputs 2 relay outputs, 1 analogue outputs
Type of Terminals
S: Terminal blocks fixed, with screw terminals
PC (plug in cage clamp): Plug in terminal blocks with cage clamp terminals
PS (plug in screw): Plug in terminal blocks with screw terminals
Type

Accessories

OA 5810/900:	GSM-aerial, 90° angle Article number: 0062212
OA 5810/901:	GSM magnetic foot areal with 2,5 m connecting lead Article number: 0062213

Fault indicated by Flashing Code

The current state of the SMS-Telecontrol module is indicated by the flashing code on the status LED. The number of flashing pulses followed by a longer space relates to the failure code in the following table. After the longer space the flashing cycle is repeated until the state on the unit changes.

State LED	Description
OFF	No status for indication, normal operation
ON	SMS transmission
2 * flashes	Internal system failure, please contact the manufacturer
3 * flashes	Invalid configuration. When this failure occurs, the unit tries to reset the configuration to factory settings followed by a device test. If the failure remains, please contact manufacturer.
4 * flashes	No access on SIM-card **Cause:** no SIM-card inserted or invalid PIN for inserted SIM card
5 * flashes	No GSM network available **Cause:** insufficient radio signal, aerial placed in a poor location.
6 * flashes	In the configuration, the service centre for SMS transmission is not yet defined. **Cause:** The CFGINT command sequence SMS has not been sent to the module
7 * flashes	No administrator for using are defined. No user administrator is defined **Cause:** The CFGINT command sequence SMS has not been sent to the module

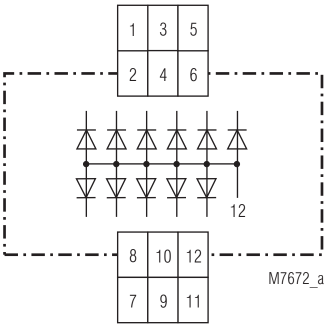
LEDs for each I/O on the front of the unit indicate the status of the in- and outputs.

INFOMASTER
Lamp Tester
MK 9994, MK 9995

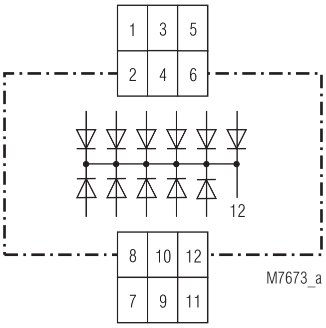
0235659

- For max. 11 indicator lamps
- Width 22.5 mm

Circuit Diagrams



MK 9994



MK 9995

Approvals and Markings

CE

Application

The lamp tester contains a diode group with either common anode or cathode. It blocks one lamp from the other in order to avoid influence. On AC-operation the lamps are only half illuminated.

Standard Types

MK 9994
Article number: 0012938
MK 9995
Article number: 0015889
- Width: 22.5 mm

Ordering example for variants

MK 9994 /_ _
Variant, if required
Type

Technical Data

Nominal voltage:	AC 250 V

Data of diods

Current per output:	0.6 A at 100 % ED 1 A max. 3 min.
Periodical peak reverse voltage:	1 000 V
Peak surge voltage:	1 200 V
Peak surege voltage power dissipation:	1.0 kW for 10 µs
Max. peak current:	50 A for 10 ms
Periodical peak voltage:	1 100 V

General Data

Operating mode:	Continuous operation	
Temperature range:	- 20 ... + 60°C	
Degree of protection		
Housing:	IP 40	IEC/EN 60 529
Terminals:	IP 20	IEC/EN 60 529
Housing:	Thermoplastic with V0 behaviour to UL subject 94	
Vibration resistance:	0,35 mm Amplitude, frequency 10 ... 55 Hz	IEC/EN 60 068-2-6
Climate resistance:	20 / 060 / 04	IEC/EN 60 068-1
Terminal designation:	EN 50 005	
Wire connection:	2 x 1.5 mm² solid or 2 x 1.0 mm² stranded wire with sleeve DIN 46 228-1/-2/-3/-4	
Wire fixing:	Flat terminals with self lifting clamping piece	IEC/EN 60 999-1
Mounting:	DIN rail	IEC/EN 60 715
Weight:	80 g	

Dimensions

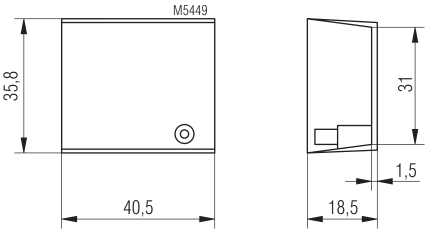
Width x heigth x depth:	22.5 x 82 x 99 mm

Accessories

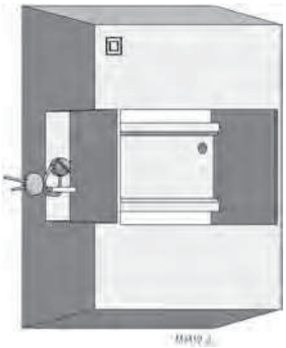
DOLD

Cover K 70-34

For Timers: AA 9943, AA 9050, AI 942,



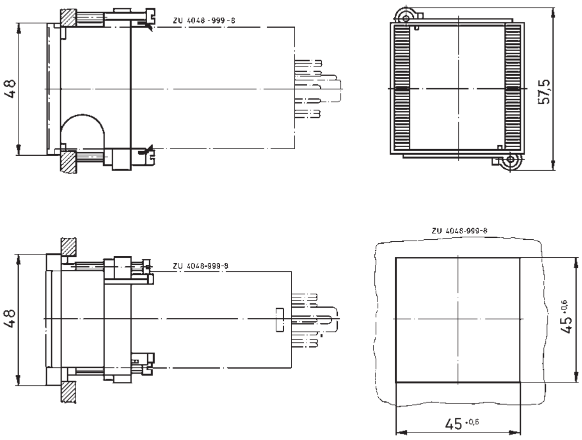
Mounting kit for surface mounting KU 4087-100



Types of I-series	Width (mm)	Order reference
IK	17,5	KU4087-100/56763
IL	35,0	KU4088-100/56764
IN	52,5	KU4084-100/56765
IP	70,0	KU4089-100/56766
IR	105,0	KU4090-100/56767

Front frame ET 4048-3

48 x 48 with clamp screws.

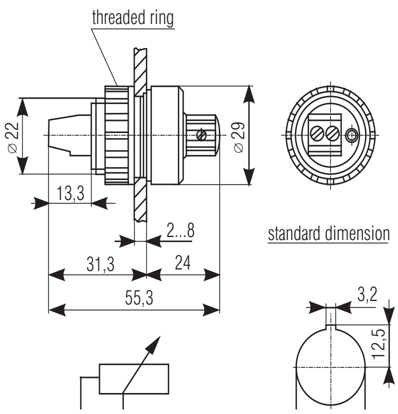


front panel cut-out

External potentiometer AD 3

The external potentiometer is used for remote setting of the time delay. The internal potentiometer of the timer must be set to min. time delay.

Degree of protection front side: IP 60



Test and indicator panel UP 5862

For insulation monitors in medically used rooms according to IEC 60 364-7-710, DIN VDE 0100-710

- to mount in flush device boxes ø 60 mm, 35 mm deep;
- test button to check the function of the device
- with green LED to indicate operation
- reset button for audible alarm
- with yellow LED to monitor insulation failure

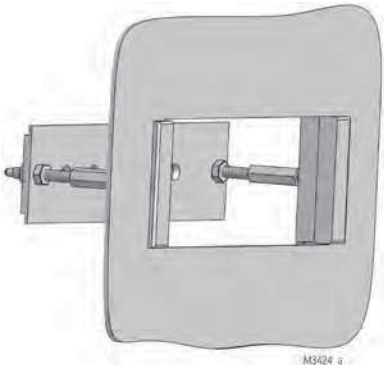
Max. wire length to IN / IP 5880
at wire cross section A = 0.5 mm²: 500 m
at wire cross section A = 1.5 mm²: 1000 m

Dimensions (width x height): 80 x 80 mm
Article number: 0041706

Accessories

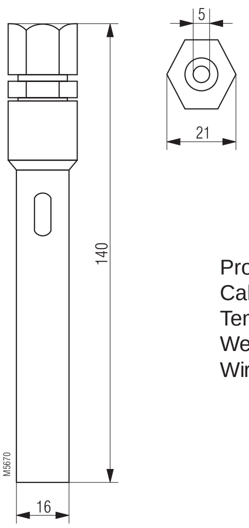
Flush mounting kit

Order reference: KU 4087-150/0056598



For universal use with:
- I-series devices of 17.5 to 105 mm width
- easy mounting

Standard probe OA 5640

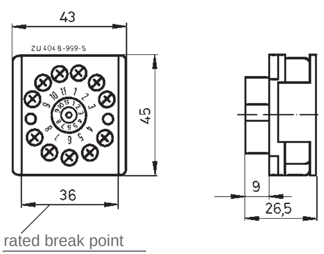


Probe made of stainless steel,
Cable entry PG 9,
Temperature range 0 ... +60°C,
Weight approx. 0.1 kg
Wire connection 2.5 mm² stranded wire with sleeve

Plug in adaptor ET 4048-13

11-pole, from PC

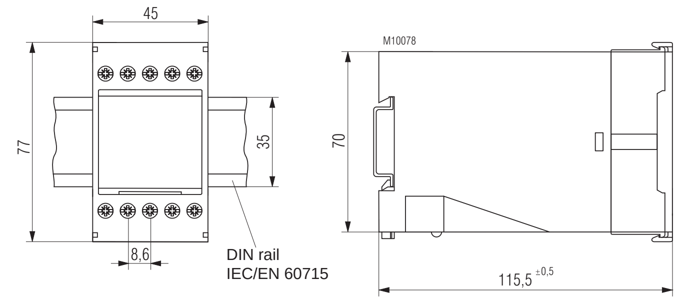
For installation into control panel.



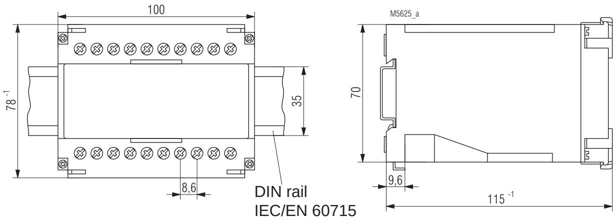
Version with flat-pin plug on request.

DOLD

AA / AI - Enclosure



AN - Enclosure



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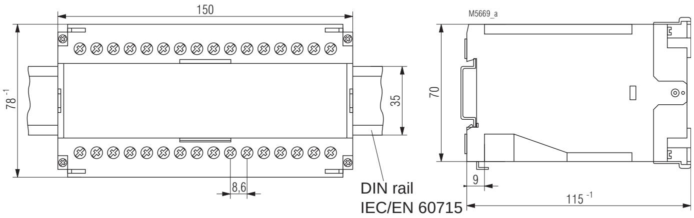
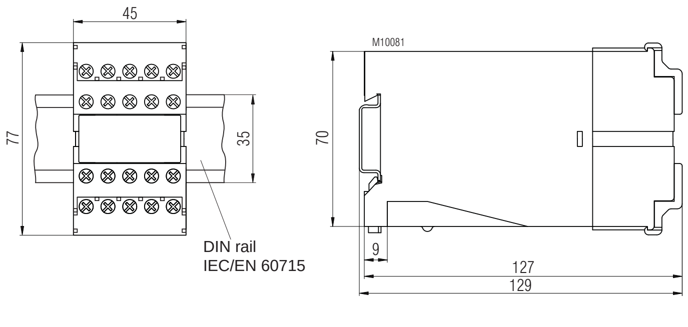
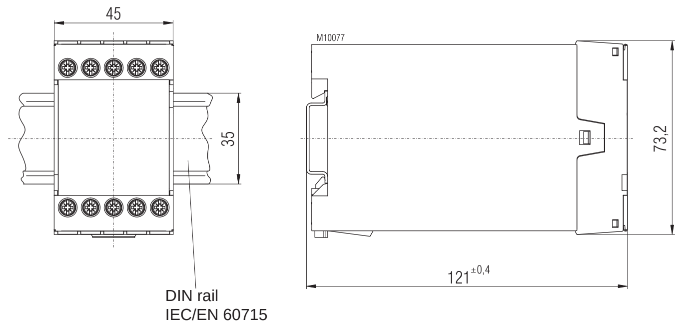


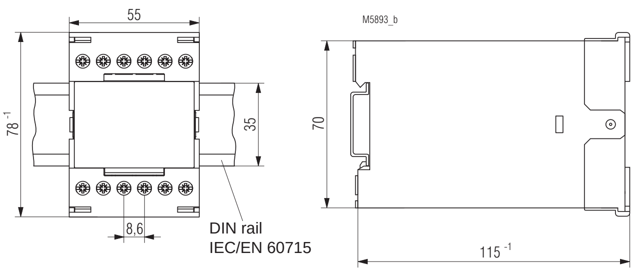
AD - Enclosure



BA - Enclosure



AG - Enclosure



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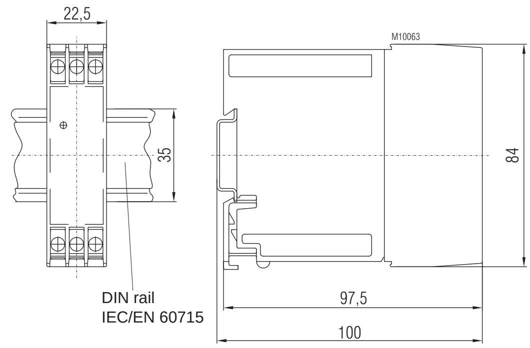
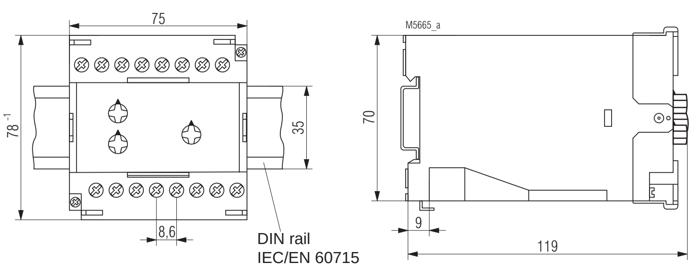
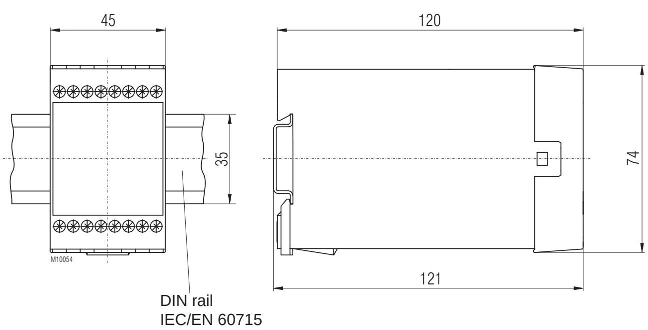


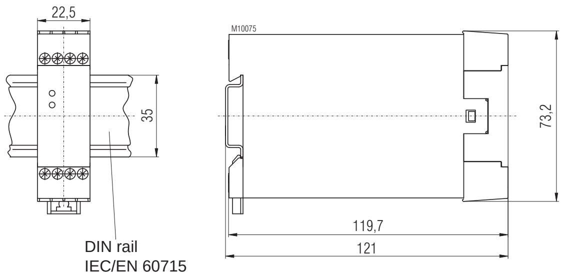
AK - Enclosure



BD - Enclosure



BE - Enclosure



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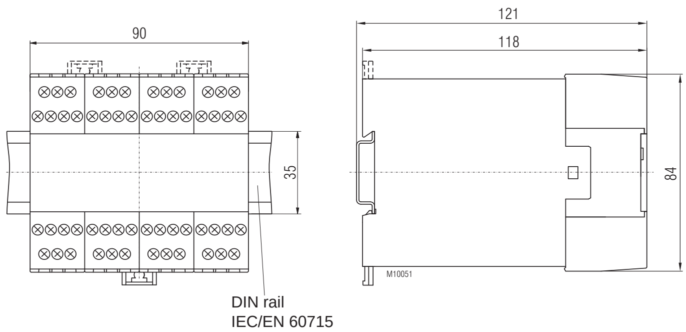
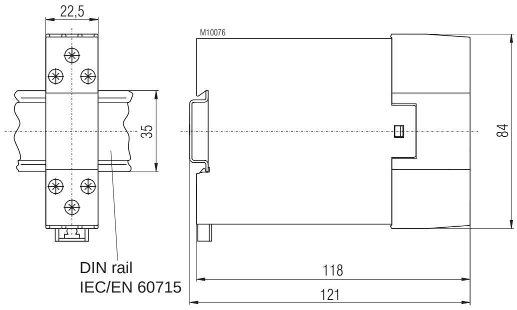
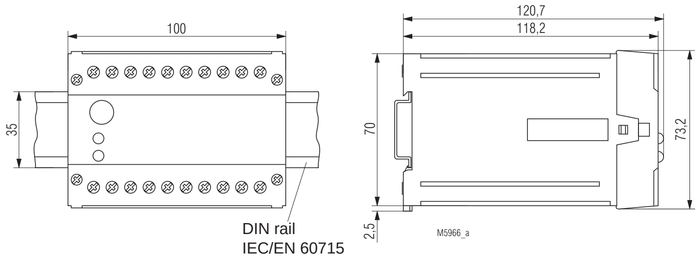


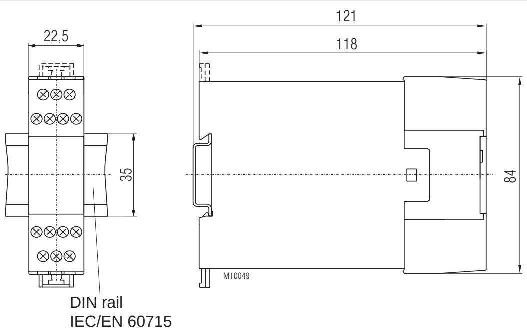
BF - Enclosure



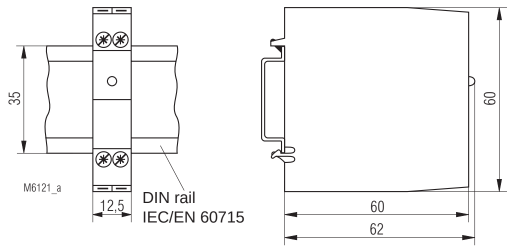
BN / BO - Enclosure



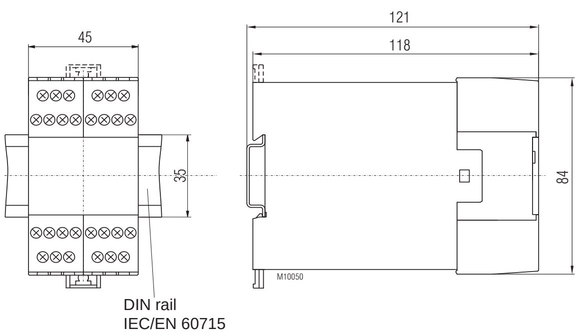
BG - Enclosure BA - Enclosure



CA - Enclosure BA - Enclosure



BH - Enclosure



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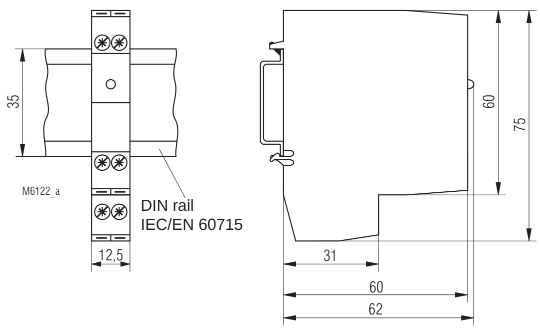

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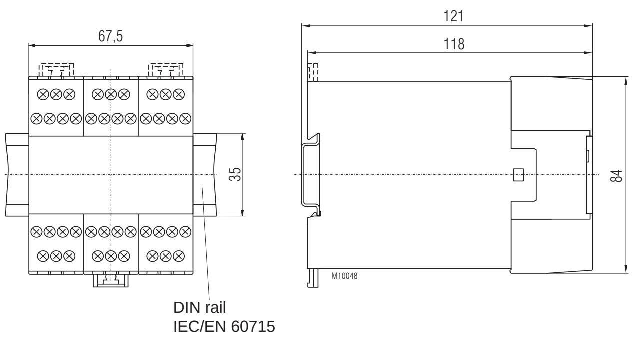
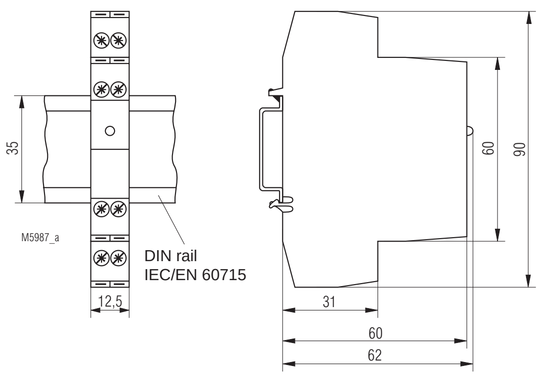
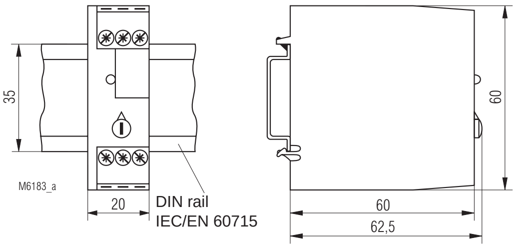


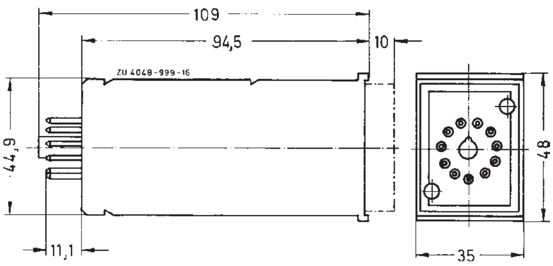
CC - Enclosure



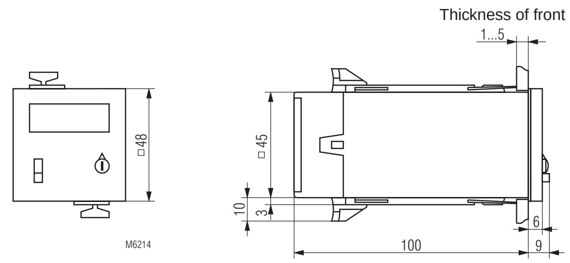
CD - Enclosure



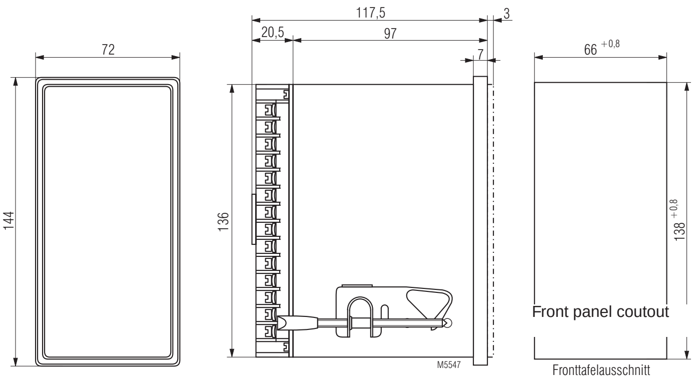
EO - Enclosure



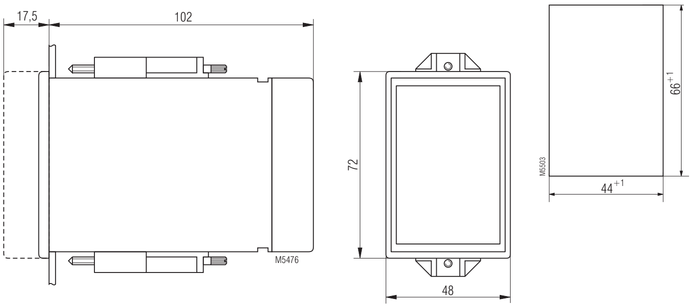
EB - Enclosure



EP - Enclosure



EC - Enclosure BA - Enclosure



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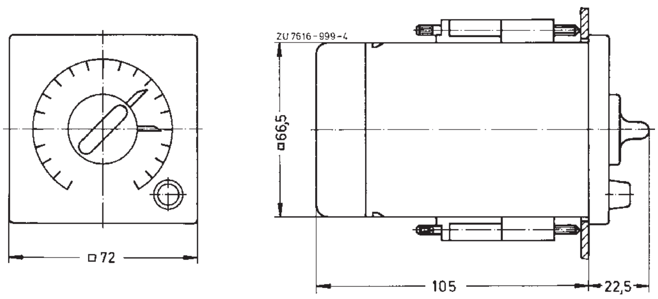

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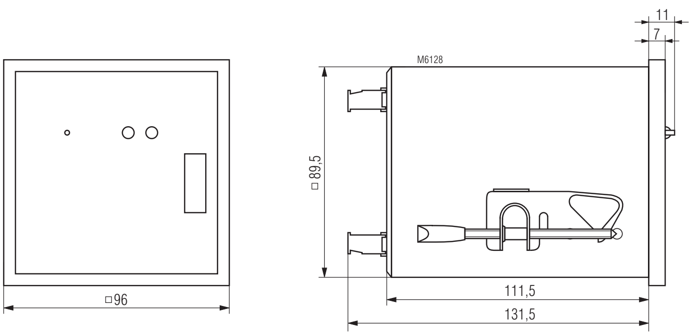
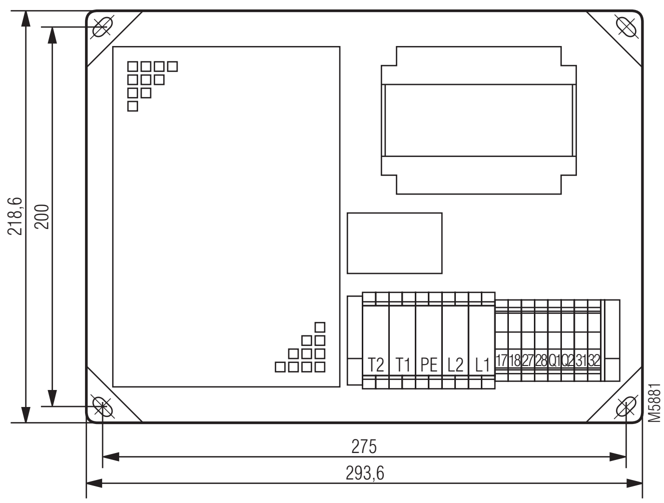
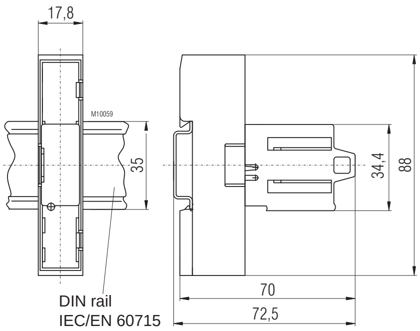


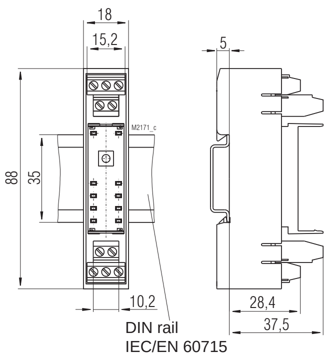
GA - Enclosure



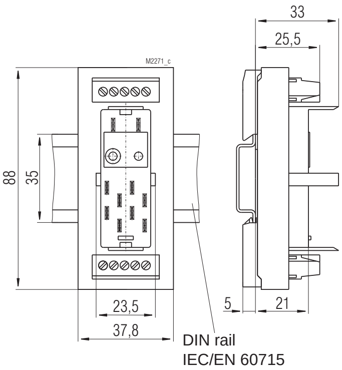
HA / HC - Enclosure



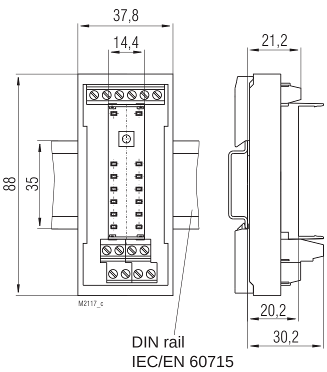
HC - Enclosure



HL - Plug-in base

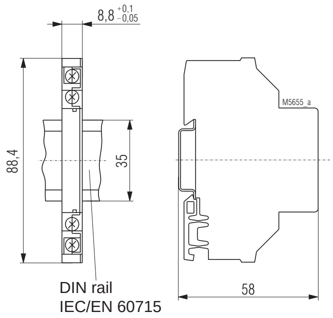


HL 3094 - Plug-in base

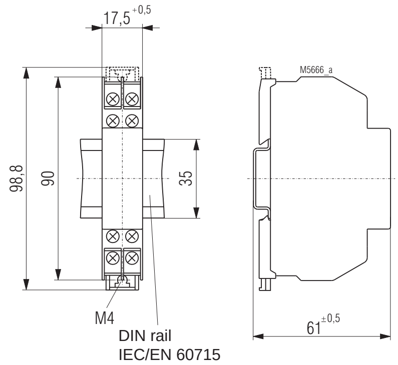


HL 3096 - Plug-in base

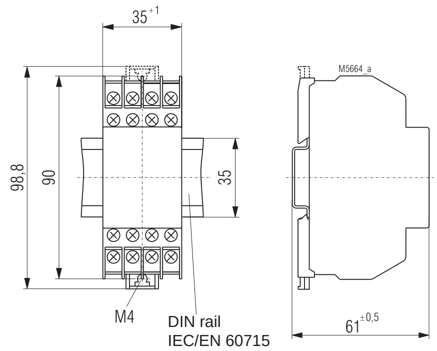
IG - Enclosure



IK - Enclosure



IL - Enclosure



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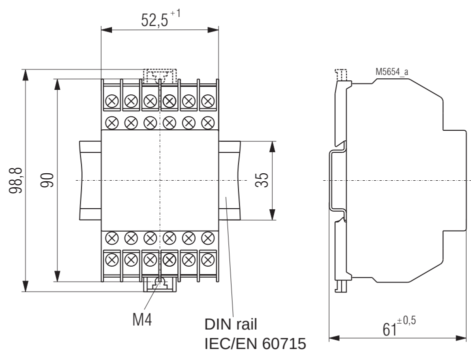
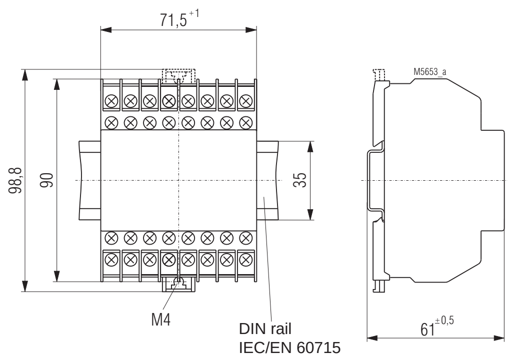
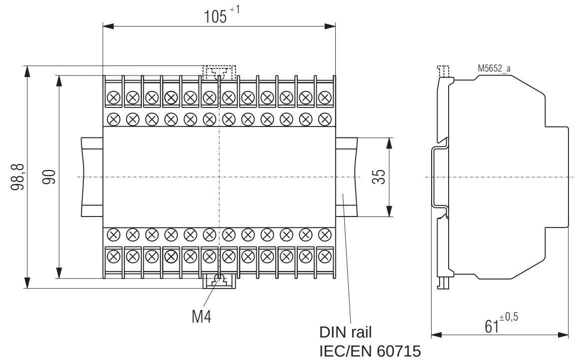


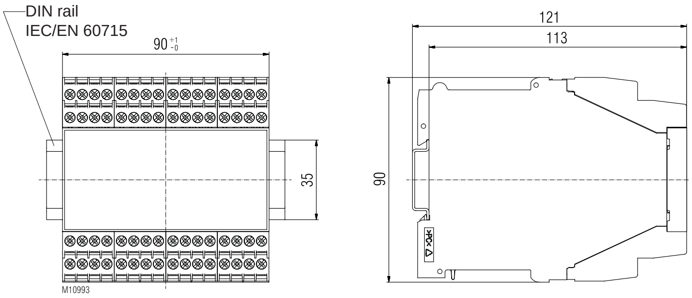
IP - Enclosure



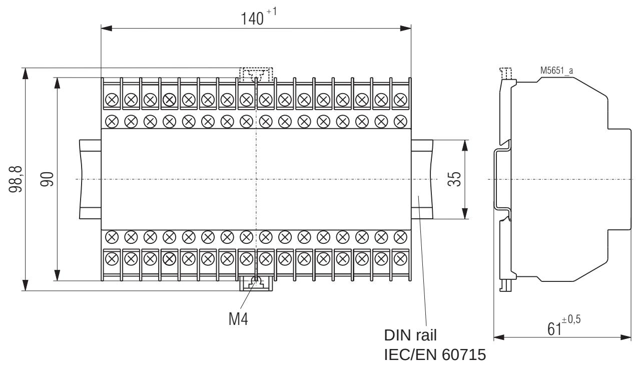
IR - Enclosure



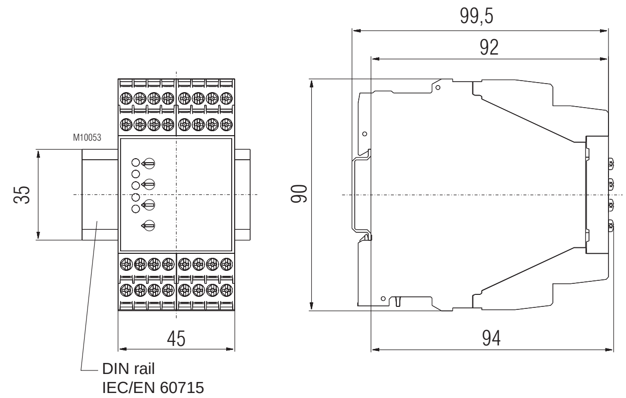
LK - Enclosure



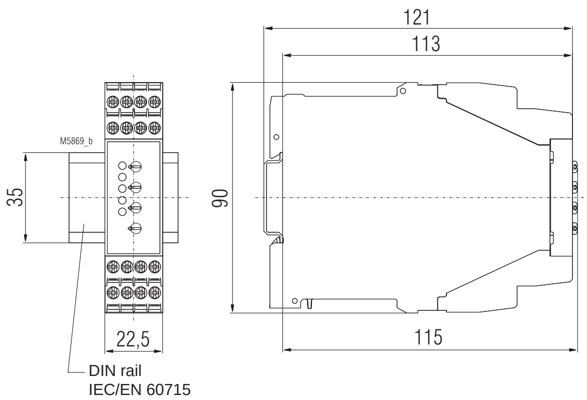
IS - Enclosure



MH - Enclosure



LG - Enclosure



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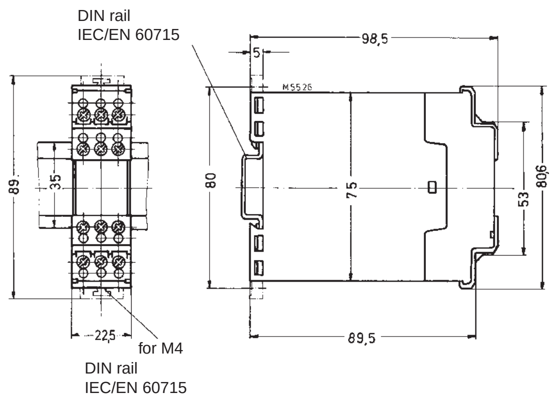

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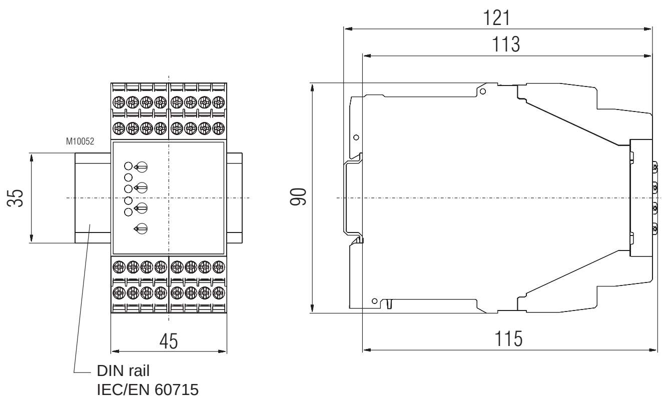

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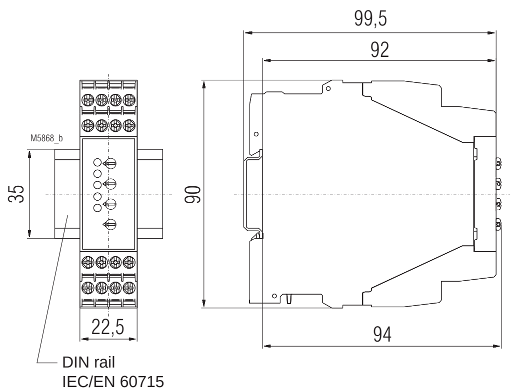

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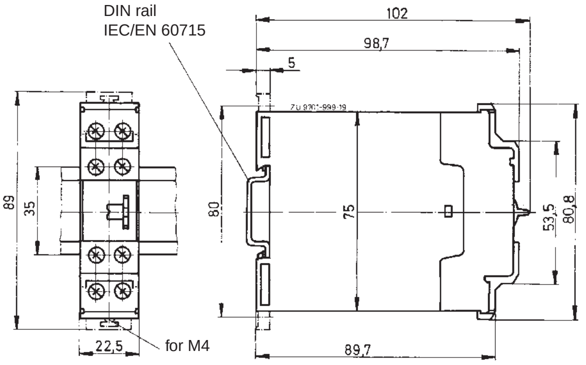

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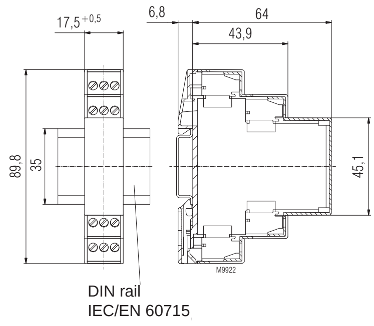
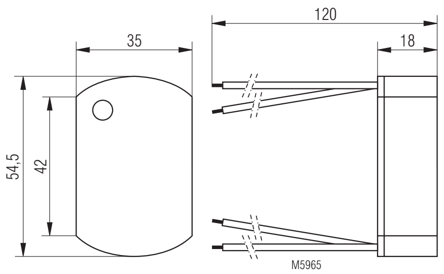
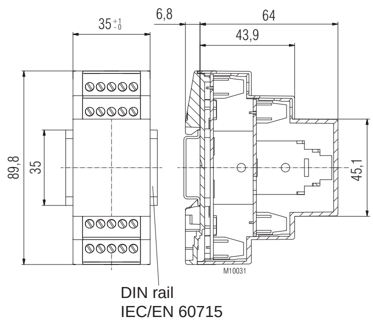


OA - Enclosure

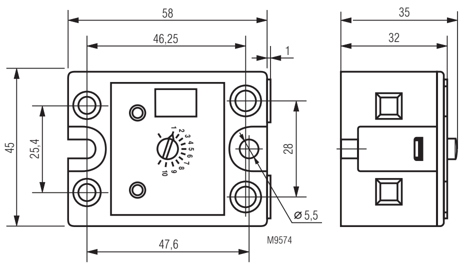


Enclosure OA 8823 / 8824

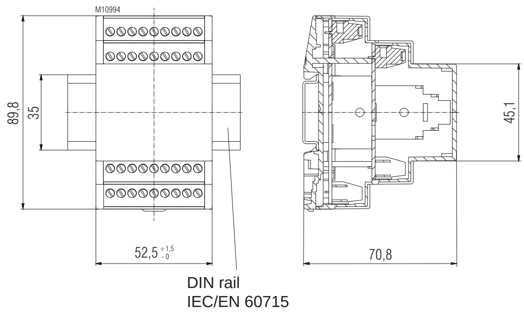
RL - Enclosure



PH - Enclosure



RN - Enclosure



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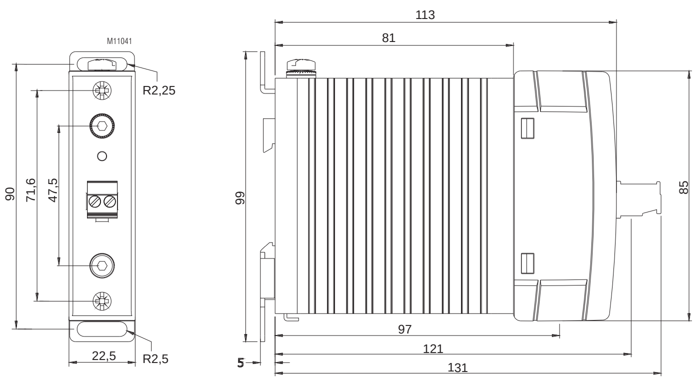
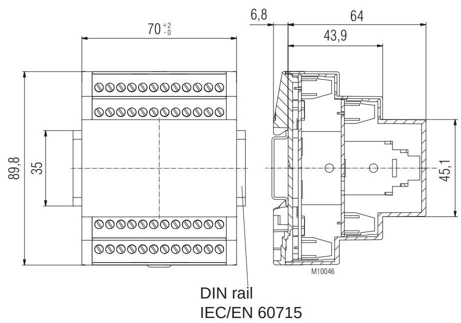


RP - Enclosure



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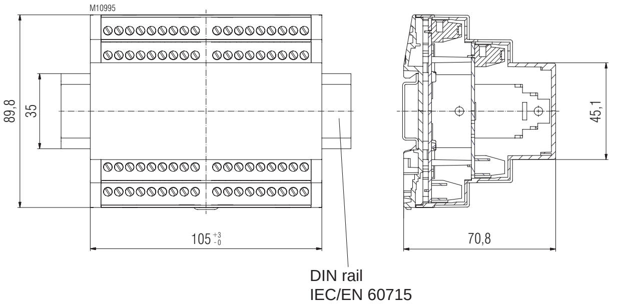
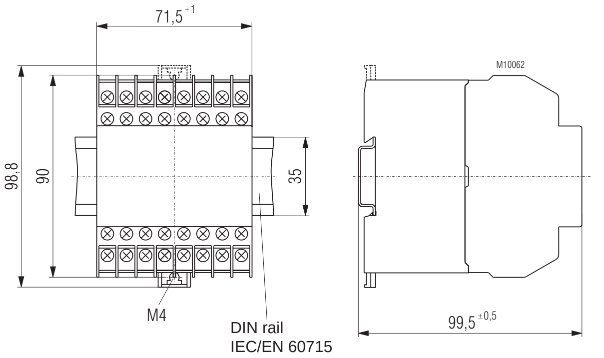


SP - Enclosure



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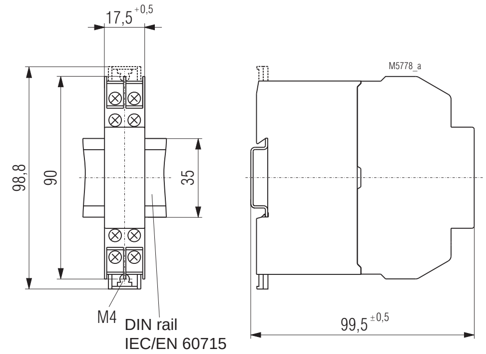
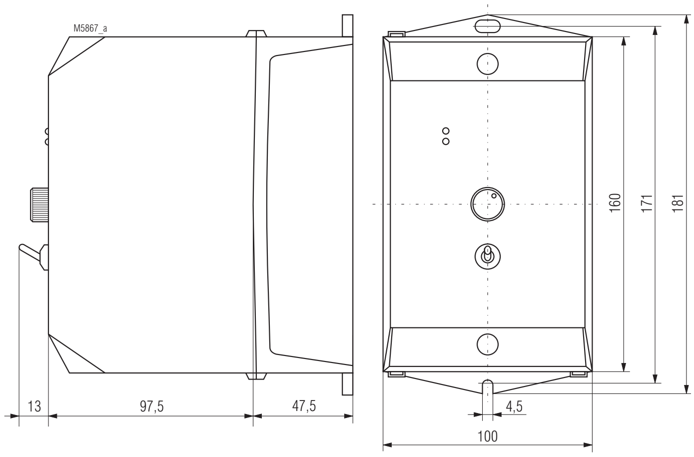


SX - Enclosure



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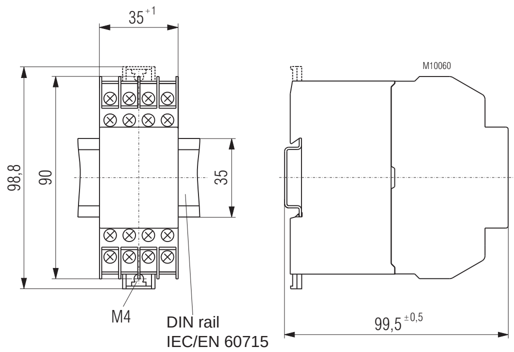
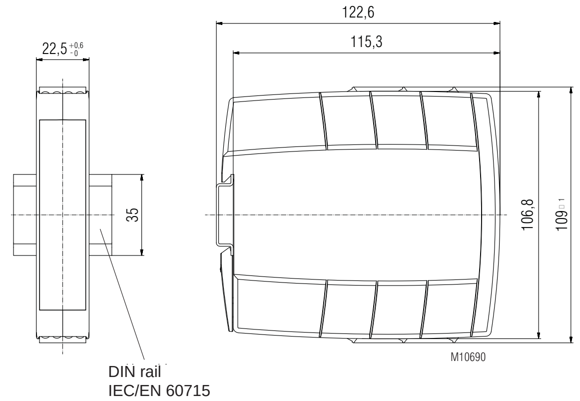


UG - Enclosure



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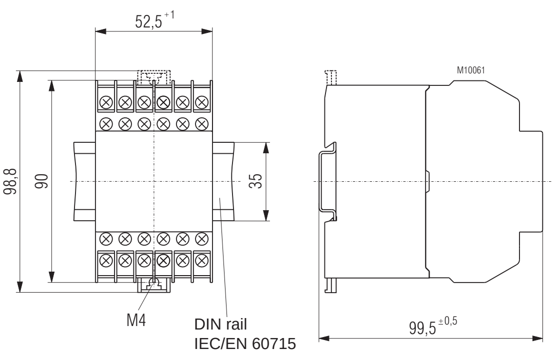

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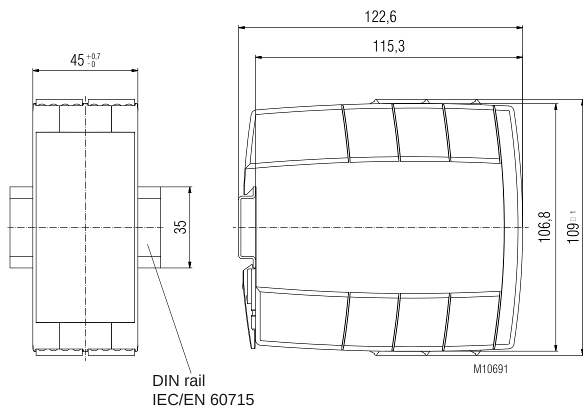

General technical definitions

Open-circuit mode (normally de-energized mode)
Contact switches to operated condition when the operate condition is met.

Limiting continuous current I_{th}
This is the current that a relay contact may permanently carry without exceeding its permissible heating related to defined environmental conditions.

Accuracy (repeat accuracy)
This is the difference between the smallest and largest measured values of constant influence quantities related to the max. value (full scale value).

Equipment service life
Mechanical service life indicating the permissible number of operations for de-energized relay contacts.

Hysteresis
Hysteresis is generally known as maintaining an effect although the physical quantity that has caused it is no longer effective. For relays, magnetic hysteresis causes the difference between pick-up and drop-out values. In case of measuring relays the drop-out value is determined by an adjustable hysteresis.

Climate resistance / humidity class
Electromechanical equipment:
The standard DIN EN 60068-2-78 describes the tests for the environmental conditions of steady state damp heat, for example.

Electronic equipment:
The indication of climate resistance for electronic equipment is given as follows:
Climate resistance: 15 / 55 / 04 IEC/EN 60068-1

-15 °C   +55 °C   4 days at 93 % rel. humidity of air 40 °C

Contact service life
Electrical service life indicating the number of operating cycles to be expected at a defined load, e.g. AC 15 (see the definition for switching capacity).

Creeping distance
This is the shortest distance along the surface of an insulating material between two conductive parts.

Clearance in air
This is the shortest distance in air between two conductive parts.

Nominal voltage
The nominal voltage of a relay is that voltage for which the winding including additional built-in components is designed and to which other characteristics are related to.

Devices that are rated for 230 V ± 10 % can only be operated on a 220 V or 240 V system with restricted tolerances. For these devices, the restricted tolerance is indicated on the nameplate.

240 / 230 V
+ 10 %
– 10 %
253 V
207 V
+ 5.4 %
– 13.8 %

220 / 230 V
+ 10 %
– 10 %
253 V
207 V
+ 15 %
– 6 %

Protective separation
A protective separation of circuits is present when a single fault does not cause the voltage from being transferred to another circuit. The definition of "protective separation" is based on the standards DIN EN 61140, DIN EN 60947-1 in conjunction with the standard DIN EN 60664-1 and is specified as rated impulse withstand voltage related to the pollution severity. The rated impulse withstand voltage is the voltage level according to which clearance and creeping distances are rated. It is determined as a function of the overvoltage category to which the electrical equipment is to be assigned to.

A specification of 4 kV/2 means: Rated impulse withstand voltage 4 kV related to the pollution severity 2.

Test voltage
The test voltage specifies the dielectric strength between coil and contact, e.g. 4 kV.

Closed-circuit mode (normally energized mode)
With the closed-circuit principle, the contact falls back in its normal position when the operate condition is met.

Degree of protection
Standardized classification of the protection of equipment against accidental contact, foreign bodies and water. According to IEC/EN 60529, the degree of protection is indicated by the code letters IP and two code numbers. The first code number describes the protection against accidental contact and foreign bodies, the second number the protection against water.

Degrees of protection against solid foreign bodies designated by the first code number.

First code no.	Degree of protection: Short description	Definition
0	Not protected	–
1	Protected against solid foreign objects, diameter 50 mm and larger	The object probe, a ball with a diameter of 50 mm, must not enter fully.*)
2	Protected against solid foreign objects, diameter 12.5 mm and larger	The object probe, a ball with a diameter of 12.5 mm, must not enter fully.*)
3	Protected against solid foreign objects, diameter 2.5 mm and larger	The object probe with a diameter of 2.5 mm must not penetrate at all.*)
4	Protected against solid foreign objects, diameter 1.0 mm and larger	The object probe with a diameter of 1.0 mm must not penetrate at all.*)
5	Protected against dust	The penetration of dust is not completely prevented, but dust must not enter in an amount that impairs the satisfactory functioning of the equipment or the safety.
6	Dust-proof	No penetration of dust is allowed.

*) Note: The full diameter of the object probe must not fit through any opening of the enclosure.

Degrees of protection against water designated by the second code number

Second code no.	Degree of protection: Short description	Definition
0	Not protected	–
1	Protected from drip water.	Drops which fall vertically must not have any harmful effect.
2	Protected against drip water when the enclosure is inclined at an angle up to 15 %.	Drops which fall vertically must not have any harmful effect when the enclosure is inclined at an angle up to 15 % of either side of the vertical.
3	Protected against spray water.	Water which is sprayed at an angle of up to 60 % of either side of the perpendicular must not have any harmful effects.
4	Protected against spray water	Water splashing against the enclosure from all directions must not have any harmful effects.
5	Protected against water jets.	Water jets against the enclosure from all directions must not have any harmful effects.
6	Protected against strong jets of water.	Strong water jets against the enclosure from all directions must not have any harmful effects.
7	Protected against the effects of temporary flooding.	Water must not enter the enclosure in any harmful quantity when the enclosure is temporarily submerged in water under standard conditions of pressure and time.
8	Protected against the effects of permanent flooding.	Water must not enter the enclosure in any harmful quantity when the enclosure is permanently submerged in water under conditions to be agreed between manufacturer and user. However, the conditions must be more stringent than those for code number 7.

General technical definitions

Switching capacity

Unaffected electric current a switching device or fuse can make/interrupt at a defined voltage under specified conditions.

Extract from IEC/EN 60 947-5-1

Table 1: Utilization categories for switching elements

Type of current	Utilization category	Typical applications
Alternating voltage	AC-12	Control of ohmic and semicoductor loads in input circuits of optocouplers
	AC-13	Control of semiconductor loads with transformer separation
	AC-14	Control of small electromagnetic loads (max. 72 VA)
	AC-15	Control of electromagnetic loads (larger than 72 VA)
Direct voltage	DC-12	Control of ohmic and semiconductor loads in input circuits of optocouplers
	DC-13	Control of electromagnetic loads
	DC-14	Control of electromagnetic loads with auto-resistors in the circuit

The rated operational current and the rated operational voltage are determined according to the values defined in the tables 2 and 3 for usual and unusual conditions depending on the utilization category.

Table 2: Proof of the making and breaking capacity of switching elements under usual conditions by utilization categories

Utilization category	Making			Breaking			Min. ON-duration
	I / Ie	U / Ue		I / Ie	U / Ue		
AC			cos φ			cos φ	Cycles (at 50 Hz or 60 Hz)
AC-12	1	1	0,9	1	1	0,9	2
AC-13	2	1	0,65	1	1	0,65	2[3])
AC-14	6	1	0,3	1	1	0,3	2[3])
AC-15	10	1	0,3	1	1	0,3	2[3])
DC			T0,95 ms			T0,95 ms	Time ms
DC-12	1	1	1	1	1	1	25
DC-13	1	1	6xP[6])	1	1	6xP[6])	T0,95
DC-14	10	1	15	1	1	15	25[3])

Number of making and breaking operations and switching rate		
Sequence[7])	Number	Cycles per min.
1	50[4])	6
2	10	fast[5])
3	990	60
4	5000	6

Ie	Rated operational current	I	Making or breaking current
Ue	Rated operational voltage	U	Voltage before making
P = Ue x Ie	Steady-state power in Watt	T0.95	Time until 95 % of the steady-state current is reached

3) Both ON-duration values (for Imaking and for Ibreaking) must be at least 2 cycles (or 25 ms for DC-14).
4) The first 50 switching cycles must be carried out with test voltage Ue x 1.1, with the test current Ie is firstly set at Ue.
5) As fast as possible, but full closing and opening of the contacts must be ensured.
6) The value "6 x P" results from an empirical ratio that corresponds to most d.c. magnet loads up to an upper limit P = 50 W, with 6 x P = 300 ms. Loads with a rated power above 50 W are composed from small paralle loads. Therefore, 300 ms is an upper limit independent of the power magnitude.
7) For all utilization categories the test sequences must be performed in the specified order.

Table 3: Proof of the making and breaking capacity of switching elements under unusual conditions by utilization categories[1])

Utilization category	Making			Breaking			Min. ON-duration	Making and breaking	
	I / I_e	U / U_e		I / I_e	U / U_e			Number	switching cycles/min.
AC			cos φ			cos φ	Cycles (at 50 Hz or 60 Hz)		
AC-12	–	–	–	–	–	–	–	–	–
AC-13[3])	10	1,1	0,65	1,1	1,1	0,65	2[4])	10	6
AC-14	6	1,1	0,7	6	1,1	0,7	2	10	6
AC-15	10	1,1	0,3	10	1,1	0,3	2	10	6
DC			T0,95 ms			T0,95 ms	Time ms		
DC-12	–	–	–	–	–	–	–	–	–
DC-13[3])	1,1	1,1	6xP[5])	1,1	1,1	6xP[5])	T0,95	10	6
DC-14	10	1,1	15	10	1,1	15	25[4])	10	6

Ie	Rated operational current	I	Making or breaking current
Ue	Rated operational voltage	U	Voltage before making
P = Ue x Ie	Steady-state power in Watt	T0.95	Time until 95 % of the steady-state current is reached

1) The unusual condition must simulate an electromagnet blocked in open position.
3) For semiconductor switching elements an overload protection specified by the manufacturer should be used for testing under unusual conditions.
4) Both ON-duration values (for Imaking and for Ibreaking) must be at least 2 cycles (or 25 ms for DC-14).
5) The value "6 x P" results from an empirical ratio that corresponds to most d.c. magnet loads up to an upper limit P = 50 W, with 6 x P = 300 ms. Loads having a rated power above 50 W are composed of small parallel loads. Therefore, 300 ms is an upper limit independent of the power magnitude.
For semiconductor switching elements the largest time constant must be 60 ms so that T0.95 = 180 ms (3 x time constant).

Electrical life

The electrical life of a control unit is defined by the number of switching cycles under load that is reached or exceeded by 90 % of all devices under test without any repair or replacement of any part.

Extract from IEC/EN 60 947-5-1

Table 4: Making and breaking capacity for testing the electrical service life

Type of current	Utilization category	Making			Breaking		
Alternating current	AC-15	I	U	cos φ	I	U	cos φ
		10 Ie	Ue	0,7[1])	Ie	Ue	0,4[1])
Direct current	AC-15	I	U	T0,95	I	U	T0,95
		Ie	Ue	6 x *P* [3])	Ie	Ue	6 x *P* [3])

Ie	Rated operational current	I	Making or breaking current
Ue	Rated operational voltage	U	Voltage before making
P = Ue x Ie	Steady-state power in Watt	T0.95	Time until 95 % of the steady-state current is reached (in ms)

1) The indicated power factors are conventional values and are only indicated for test circuits where electrical characteristics of coils are simulated.
It is pointed out that for circuits with a power factor 0.4 shunt resistors are used in the test circuit to simulate the dampening effect by eddy-current losses.
2) In case of magnetic loads for direct current that are equipped with switching devices for starting an auto-resistor the rated operational current must be at least the highest inrush current.
3) The value "6 x P" results from an empirical ratio that corresponds to most d.c. magnet loads up to an upper limit P = 50 W. Loads having a power above 50 W are composed of small parallel loads. Therefore, 300 ms is an upper limit independent of the power.

Further available devices

Function	Type
Current relay	ML 9701
Insulation monitor	AI 897
Insulation monitor	AI 898
Insulation monitor	EH 5878
Lamp tester	AI 990
line breakage relay	AI 940
Overvoltage relay	IL 9070
Test and indication panel	UP 5864

The data sheets are available at **www.dold.com**

Function index

Function index

* Data sheet on request

General Conditions

for the Supply of Products and Services of the Electrical and Electronics Industry ("Grüne Lieferbedingungen" – GL)*

for commercial transactions between businesses

recommended by ZVEI-Zentralverband Elektrotechnik- und Elektronikindustrie e. V.

as of June 2011

Article I: General Provisions

1. Legal relations between Supplier and Purchaser in connection with supplies and/or services of the Supplier (hereinafter referred to as "Supplies") shall be solely governed by the present GL. The Purchaser's general terms and conditions shall apply only if expressly accepted by the Supplier in writing. The scope of delivery shall be determined by the congruent mutual written declarations.

2. The Supplier herewith reserves any industrial property rights and/or copyrights pertaining to its cost estimates, drawings and other documents (hereinafter referred to as "Documents"). The Documents shall not be made accessible to third parties without the Supplier's prior consent and shall, upon request, be returned without undue delay to the Supplier if the contract is not awarded to the Supplier. Sentences 1 and 2 shall apply mutatis mutandis to the Purchaser's Documents; these may, however, be made accessible to those third parties to whom the Supplier has rightfully subcontracted Supplies.

3. The Purchaser has the non-exclusive right to use standard software and firmware, provided that it remains unchanged, is used within the agreed performance parameters, and on the agreed equipment. Without express agreement the Purchaser may make one back-up copy of standard software.

4. Partial deliveries are allowed, unless they are unreasonable to accept for the Purchaser.

5. The term „claim for damages" used in the present GL also includes claims for indemnification for useless expenditure.

Article II: Prices, Terms of Payment, and Set-Off

1. Prices are ex works and excluding packaging; value added tax shall be added at the then applicable rate.

2. If the Supplier is also responsible for assembly or erection and unless otherwise agreed, the Purchaser shall pay the agreed remuneration and any incidental costs required, e. g. for traveling and transport as well as allowances.

3. Payments shall be made free Supplier's paying office.

4. The Purchaser may set off only those claims which are undisputed or non- appealable.

Article III: Retention of Title

1. The items pertaining to the Supplies ("Retained Goods") shall remain the Supplier's property until each and every claim the Supplier has against the Purchaser on account of the business relationship has been fulfilled. If the combined value of the Supplier's security interests exceeds the value of all secured claims by more than 20 %, the Supplier shall release a corresponding part of the security interest if so requested by the Purchaser; the Supplier shall be entitled to choose which security interest it wishes to release.

2. For the duration of the retention of title, the Purchaser may not pledge the Retained Goods or use them as security, and resale shall be possible only for resellers in the ordinary course of their business and only on condition that the reseller receives payment from its customer or makes the transfer of property to the customer dependent upon the customer fulfilling its obligation to effect payment.

3. Should Purchaser resell Retained Goods, it assigns to the Supplier, already today, all claims it will have against its customers out of the resale, including any collateral rights and all balance claims, as security, without any subsequent declarations to this effect being necessary. If the Retained Goods are sold on together with other items and no individual price has been agreed with respect to the Retained Goods, Purchaser shall assign to the Supplier such fraction of the total price claim as is attributable to the price of the Retained Goods invoiced by Supplier.

4. (a) Purchaser may process, amalgamate or combine Retained Goods with other items. Processing is made for Supplier. Purchaser shall store the new item thus created for Supplier, exercising the due care of a diligent business person. The new items are considered as Retained Goods.

   (b) Already today, Supplier and Purchaser agree that if Retained Goods are combined or amalgamated with other items that are not the property of Supplier, Supplier shall acquire co-ownership in the new item in proportion of the value of the Retained Goods combined or amalgamated to the other items at the time of combination or amalgamation. In this respect, the new items are considered as Retained Goods.

   (c) The provisions on the assignment of claims according to No. 3 above shall also apply to the new item. The assignment, however, shall only apply to the amount corresponding to the value invoiced by Supplier for the Retained Goods that have been processed, combined or amalgamated.

   (d) Where Purchaser combines Retained Goods with real estate or movable goods, it shall, without any further declaration being necessary to this effect, also assign to Supplier as security its claim to consideration for the combination, including all collateral rights for the pro-rata amount of the value the combined Retained Goods have on the other combined items at the time of the combination.

5. Until further notice, Purchaser may collect assigned claims relating to the resale. Supplier is entitled to withdraw Purchaser's permission to collect funds for good reason, including, but not limited to delayed payment, suspension of payments, start of insolvency proceedings, protest or justified indications for overindebtedness or pending insolvency of Purchaser. In addition, Supplier may, upon expiry of an adequate period of notice disclose the assignment, realize the claims assigned and demand that Purchaser informs its customer of the assignment.

6. The Purchaser shall inform the Supplier forthwith of any seizure or other act of intervention by third parties. If a reasonable interest can be proven, Purchaser shall, without undue delay, provide Supplier with the information and/or Documents necessary to assert the claims it has against its customers.

*** The original German text shall be the governing version.**

7. Where the Purchaser fails to fulfill its duties, fails to make payment due, or otherwise violates its obligations the Supplier shall be entitled to rescind the contract and take back the Retained Goods in the case of continued failure following expiry of a reasonable remedy period set by the Supplier; the statutory provisions providing that a remedy period is not needed shall be unaffected. The Purchaser shall be obliged to return the Retained Goods. The fact that the Supplier takes back Retained Goods and/or exercises the retention of title, or has the Retained Goods seized, shall not be construed to constitute a rescission of the contract, unless the Supplier so expressly declares.

Article IV: Time for Supplies; Delay

1. Times set for Supplies shall only be binding if all Documents to be furnished by the Purchaser, necessary permits and approvals, especially concerning plans, are received in time and if agreed terms of payment and other obligations of the Purchaser are fulfilled. If these conditions are not fulfilled in time, times set shall be extended reasonably; this shall not apply if the Supplier is responsible for the delay.

2. If non-observance of the times set is due to:

   (a) force majeure, such as mobilization, war, terror attacks, rebellion or similar events (e. g. strike or lockout);

   (b) virus attacks or other attacks on the Supplier’s IT systems occurring despite protective measures were in place that complied with the principles of proper care;

   (c) hindrances attributable to German, US or otherwise applicable national, EU or international rules of foreign trade law or to other circumstances for which Supplier is not responsible; or

   (d) the fact that Supplier does not receive its own supplies in due time or in due form

   such times shall be extended accordingly.

3. If the Supplier is responsible for the delay (hereinafter referred to as "Delay") and the Purchaser has demonstrably suffered a loss therefrom, the Purchaser may claim a compensation as liquidated damages of 0.5 % for every completed week of Delay, but in no case more than a total of 5 % of the price of that part of the Supplies which due to the Delay could not be put to the intended use.

4. Purchaser's claims for damages due to delayed Supplies as well as claims for damages in lieu of performance exceeding the limits specified in No. 3 above are excluded in all cases of delayed Supplies, even upon expiry of a time set to the Supplier to effect the Supplies. This shall not apply in cases of liability based on intent, gross negligence, or due to loss of life, bodily injury or damage to health. Rescission of the contract by the Purchaser based on statute is limited to cases where the Supplier is responsible for the delay. The above provisions do not imply a change in the burden of proof to the detriment of the Purchaser.

5. At the Supplier's request, the Purchaser shall declare within a reasonable period of time whether it, due to the delayed Supplies, rescinds the contract or insists on the delivery of the Supplies.

6. If dispatch or delivery, due to Purchaser's request, is delayed by more than one month after notification of the readiness for dispatch was given, the Purchaser may be charged, for every additional month commenced, storage costs of 0.5 % of the price of the items of the Supplies, but in no case more than a total of 5 %. The parties to the contract may prove that higher or, as the case may be, lower storage costs have been incurred.

Article V: Passing of Risk

1. Even where delivery has been agreed freight free, the risk shall pass to the Purchaser as follows:

   (a) if the delivery does not include assembly or erection, at the time when it is shipped or picked up by the carrier. Upon the Purchaser's request, the Supplier shall insure the delivery against the usual risks of transport at the Purchaser's expense;

   (b) if the delivery includes assembly or erection, at the day of taking over in the Purchaser's own works or, if so agreed, after a successful trial run.

2. The risk shall pass to the Purchaser if dispatch, delivery, the start or performance of assembly or erection, the taking over in the Purchaser's own works, or the trial run is delayed for reasons for which the Purchaser is responsible or if the Purchaser has otherwise failed to accept the Supplies.

Article VI: Assembly and Erection

Unless otherwise agreed in written form, assembly and erection shall be subject to the following provisions:

1. Purchaser shall provide at its own expense and in due time:

   (a) all earth and construction work and other ancillary work outside the Supplier's scope, including the necessary skilled and unskilled labor, construction materials and tools;

   (b) the equipment and materials necessary for assembly and commissioning such as scaffolds, lifting equipment and other devices as well as fuels and lubricants;

   (c) energy and water at the point of use including connections, heating and lighting;

   (d) suitable dry and lockable rooms of sufficient size adjacent to the site for the storage of machine parts, apparatus, materials, tools, etc. and adequate working and recreation rooms for the erection personnel, including sanitary facilities as are appropriate in the specific circumstances; furthermore, the Purchaser shall take all measures it would take for the protection of its own possessions to protect the possessions of the Supplier and of the erection personnel at the site;

   (e) protective clothing and protective devices needed due to particular conditions prevailing on the specific site.

2. Before the erection work starts, the Purchaser shall unsolicitedly make available any information required concerning the location of concealed electric power, gas and water lines or of similar installations as well as the necessary structural data.

3. Prior to assembly or erection, the materials and equipment necessary for the work to start must be available on the site of assembly or erection and any preparatory work must have advanced to such a degree that assembly or erection can be started as agreed and carried out without interruption. Access roads and the site of assembly or erection must be level and clear.

4. If assembly, erection or commissioning is delayed due to circumstances for which the Supplier is not responsible, the Purchaser shall bear the reasonable costs incurred for idle times and any additional traveling expenditure of the Supplier or the erection personnel.

5. The Purchaser shall attest to the hours worked by the erection personnel towards the Supplier at weekly intervals and the Purchaser shall immediately confirm in written form if assembly, erection or commissioning has been completed.

6. If, after completion, the Supplier demands acceptance of the Supplies, the Purchaser shall comply therewith within a period of two weeks. The same consequences as upon acceptance arise if and when the Purchaser lets the two-week period expire or the Supplies are put to use after completion of agreed test phases, if any.

Article VII: Receiving Supplies

The Purchaser shall not refuse to receive Supplies due to minor defects.

Article VIII: Defects as to Quality

The Supplier shall be liable for defects as to quality ("Sachmängel", hereinafter referred to as "Defects",) as follows:

1. Defective parts or defective services shall be, at the Supplier's discretion, repaired, replaced or provided again free of charge, provided that the reason for the Defect had already existed at the time when the risk passed.

2. Claims for repair or replacement are subject to a statute of limitations of 12 months calculated from the start of the statutory statute of limitations; the same shall apply mutatis mutandis in the case of rescission and reduction. This shall not apply where longer periods are prescribed by law according to Sec. 438 para. 1 No. 2 (buildings and things used for a building), Sec. 479 para. 1 (right of recourse), and Sec. 634a para. 1 No. 2 (defects of a building) German Civil Code ("Bürgerliches Gesetzbuch"), in the case of intent, fraudulent concealment of the Defect or non-compliance with guaranteed characteristics ("Beschaffenheitsgarantie"). The legal provisions regarding suspension of the statute of limitations ("Ablaufhemmung", "Hemmung") and recommencement of limitation periods shall be unaffected.

3. Notifications of Defect by the Purchaser shall be given in written form without undue delay.

4. In the case of notification of a Defect, the Purchaser may withhold payments to an amount that is in a reasonable proportion to the Defect. The Purchaser, however, may withhold payments only if the subject-matter of the notification of the Defect involved is justified and incontestable. The Purchaser has no right to withhold payments to the extent that its claim of a Defect is time-barred. Unjustified notifications of Defect shall entitle the Supplier to demand reimbursement of its expenses by the Purchaser.

5. The Supplier shall be given the opportunity to repair or to replace the defective good ("Nacherfüllung") within a reasonable period of time.

6. If repair or replacement is unsuccessful, the Purchaser is entitled to rescind the contract or reduce the remuneration; any claims for damages the Purchaser may have according to No. 10 shall be unaffected.

7. There shall be no claims based on Defect in cases of insignificant deviations from the agreed quality, of only minor impairment of usability, of natural wear and tear, or damage arising after the passing of risk from faulty or negligent handling, excessive strain, unsuitable equipment, defective civil works, inappropriate foundation soil, or claims based on particular external influences not assumed under the contract, or from non-reproducible software errors. Claims based on defects attributable to improper modifications or repair work carried out by the Purchaser or third parties and the consequences thereof are likewise excluded.

8. The Purchaser shall have no claim with respect to expenses incurred in the course of supplementary performance, including costs of travel, transport, labor, and material, to the extent that expenses are increased because the subject-matter of the Supplies has subsequently been brought to another location than the Purchaser's branch office, unless doing so complies with the normal use of the Supplies.

9. The Purchaser's right of recourse against the Supplier pursuant to Sec. 478 BGB is limited to cases where the Purchaser has not concluded an agreement with its customers exceeding the scope of the statutory provisions governing claims based on Defects. Moreover, No. 8 above shall apply mutatis mutandis to the scope of the right of recourse the Purchaser has against the Supplier pursuant to Sec. 478 para. 2 BGB.

10. The Purchaser shall have no claim for damages based on Defects. This shall not apply to the extent that a Defect has been fraudulently concealed, the guaranteed characteristics are not complied with, in the case of loss of life, bodily injury or damage to health, and/or intentionally or grossly negligent breach of contract on the part of the Supplier. The above provisions do not imply a change in the burden of proof to the detriment of the Purchaser. Any other or additional claims of the Purchaser exceeding the claims provided for in this Article VIII, based on a Defect, are excluded.

Article IX: Industrial Property Rights and Copyrights; Defects in Title

1. Unless otherwise agreed, the Supplier shall provide the Supplies free from third parties' industrial property rights and copyrights (hereinafter referred to as "IPR") with respect to the country of the place of delivery only. If a third party asserts a justified claim against the Purchaser based on an infringement of an IPR by the Supplies made by the Supplier and used in conformity with the contract, the Supplier shall be liable to the Purchaser within the time period stipulated in Article VIII No. 2 as follows:

   (a) The Supplier shall choose whether to acquire, at its own expense, the right to use the IPR with respect to the Supplies concerned or whether to modify the Supplies such that they no longer infringe the IPR or replace them. If this would be impossible for the Supplier under reasonable conditions, the Purchaser may rescind the contract or reduce the remuneration pursuant to the applicable statutory provisions;

   (b) The Supplier's liability to pay damages is governed by Article XII;

   (c) The above obligations of the Supplier shall apply only if the Purchaser (i) immediately notifies the Supplier of any such claim asserted by the third party in written form, (ii) does not concede the existence of an infringement and (iii) leaves any protective measures and settlement negotiations to the Supplier's discretion. If the Purchaser stops using the Supplies in order to reduce the damage or for other good reason, it shall be obliged to point out to the third party that no acknowledgement of the alleged infringement may be inferred from the fact that the use has been discontinued.

2. Claims of the Purchaser shall be excluded if it is responsible for the infringement of an IPR.

3. Claims of the Purchaser are also excluded if the infringement of the IPR is caused by specifications made by the Purchaser, by a type of use not foreseeable by the Supplier or by the Supplies being modified by the Purchaser or being used together with products not provided by the Supplier.

4. In addition, with respect to claims by the Purchaser pursuant to No. 1 a) above, Article VIII Nos. 4, 5, and 9 shall apply mutatis mutandis in the event of an infringement of an IPR.

5. Where other defects in title occur, Article VIII shall apply mutatis mutandis.

6. Any other claims of the Purchaser against the Supplier or its agents or any such claims exceeding the claims provided for in this Article IX, based on a defect in title, are excluded.

Article X: Conditional Performance

1. The performance of this contract is conditional upon that no hindrances attributable to German, US or otherwise applicable national, EU or international rules of foreign trade law or any embargos or other sanctions exist.

2. The Purchaser shall provide any information and Documents required for export, transport and import purposes.

Article XI: Impossibility of Performance; Adaptation of Contract

1. To the extent that delivery is impossible, the Purchaser is entitled to claim damages, unless the Supplier is not responsible for the impossibility. The Purchaser's claim for damages is, however, limited to an amount of 10 % of the value of the part of the Supplies which, owing to the impossibility, cannot be put to the intended use. This limitation shall not apply in the case of liability based on intent, gross negligence or loss of life, bodily injury or damage to health; this does not imply a change in the burden of proof to the detriment of the Purchaser. The Purchaser's right to rescind the contract shall be unaffected.

2. Where events within the meaning of Article IV No. 2 (a) to (c) substantially change the economic importance or the contents of the Supplies or considerably affect the Supplier's business, the contract shall be adapted taking into account the principles of reasonableness and good faith. To the extent this is not justifiable for economic reasons, the Supplier shall have the right to rescind the contract. The same applies if required export permits are not granted or cannot be used. If the Supplier intends to exercise its right to rescind the contract, it shall notify the Purchaser thereof without undue delay after having realized the repercussions of the event; this shall also apply even where an extension of the delivery period has previously been agreed with the Purchaser.

Article XII: Other Claims for Damages

1. Unless otherwise provided for in the present GL, the Purchaser has no claim for damages based on whatever legal reason, including infringement of duties arising in connection with the contract or tort.

2. This does not apply if liability is based on:

   (a) the German Product Liability Act ("Produkthaftungsgesetz");

   (b) intent;

   (c) gross negligence on the part of the owners, legal representatives or executives;

   (d) fraud;

   (e) failure to comply with a guarantee granted;

   (f) negligent injury to life, limb or health; or

   (g) negligent breach of a fundamental condition of contract ("wesentliche Vertragspflichten").

   However, claims for damages arising from a breach of a fundamental condition of contract shall be limited to the foreseeable damage which is intrinsic to the contract, provided that no other of the above case applies.

3. The above provision does not imply a change in the burden of proof to the detriment of the Purchaser.

Artikel XIII: Venue and Applicable law

1. If the Purchaser is a businessman, sole venue for all disputes arising directly or indirectly out of the contract shall be the Supplier's place of business. However, the Supplier may also bring an action at the Purchaser's place of business.

2. This contract and its interpretation shall be governed by German law, to the exclusion of the United Nations Convention on contracts for the International Sale of Goods (CISG).

Article XIV: Severability Clause

The legal invalidity of one or more provisions of this Agreement in no way affects the validity of the remaining provisions. This shall not apply if it would be unreasonably onerous for one of the parties to be obligated to continue the contract.

RE 10 / 11.13