Power Electronics

## Speed Controller, 1-phase
SX 9240.01

DOLD ®

SX 9240.01/01005; 5 A   SX 9240.01/02005; 11,5 A

- According to IEC/EN 60 947-1, IEC/EN 60 947-4-2
- For speed control of 3-phase asynchronous motors up to 5.5 kW
- Speed adjustment by potentiometer on the front
- Additional galvanic separated control input for external speed control 0 ... 10 V
- U_{min} and U_{max} setting accessable behind screw cover
- Large motor voltage range
- Integrated temperature monitoring
- Fullfills the EMC requirement according to IEC/EN 61 000-6-4 limit class B, therefore **screened wires are not necessary** between motor and controller
- 2 changeover monitoring contacts
- LED indicators for alarm and status
- Connection for thermistor to monitor temperature
- 100 mm and 122 mm width

Function Diagram

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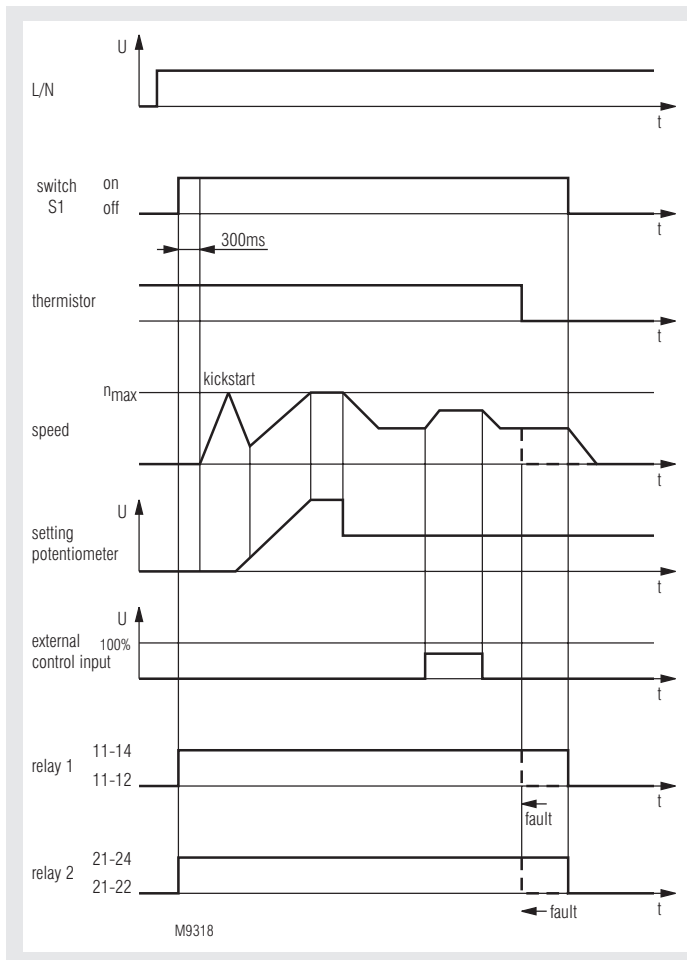
Approvals and marking

CE

Application

- Speed control of fans and pumps.

Speed control only works if the torque of the driven load rises with a quadratic function relative to the speed. Usually this is given with fans and pumps.

Function

Speed controllers are electronic devices designed to enable the speed control of 3-phase induction motors. The SX 9240 is a phase chopper device based on a thyristor circuit. The control input "Kickstart", bridge X7-X8, allows to ramp up the motor voltage to nominal value after start. After that the voltage is ramped down again to the required value with corresponding speed. The speed adjustment is made by a potentiometer on the front or by an external 0 ... 10 V input. The adjustment with the higher setting will take the control of the voltage/speed.

Temperature sensing
The temperature of the power semiconductors are monitored. If the permitted highest temperature is exceeded, motor, relay 1 and relay 2 are switched off. The red LED flashes code 1. This Alarm can only be reset after cooling down the device and temporarily cutting the auxiliary supply of the unit.

Motor temperature monitoring
A thermistor can be connected to terminals X 9 - X 10. If the permitted motor temperature is exceeded the motor, relay 1 and relay 2 are switched off. The red LED flashes code 4. The unit remains in fault status until the failure is removed and the power supply is switched off and on again. If no thermistor is connected, X 9 - X 10 must be bridged.

Adjustment of U_{min} and U_{max}
With the potentiometers U_{min} and U_{max} the speed setting can be limited to a certain minimum and a maximum speed. The potentiometers are accessible behind a screw cover on the front of the unit.
On 230 V units the minimum voltage can be adjusted between 25 V_{rms} and 140 V_{rms} and the maximum voltage between 140 V_{rms} and 230 V_{rms}.

All technical data in this list relate to the state at the moment of edition. We reserve the right for technical improvements and changes at any time.

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Function

ON-OFF switch
The ON-OFF switch is not edge triggered. If the switch is in position ON, the motor will start after the voltage is connected.

Frequency test
When the unit is connected to voltage, the frequency is measured. If the frequency is out of the permitted limits 50/60 Hz ± 10 %, relay 1 and relay 2 are switched off. The red LED flashes code 2. The unit remains in fault status until the failure is removed and the power supply is switched off and on again.
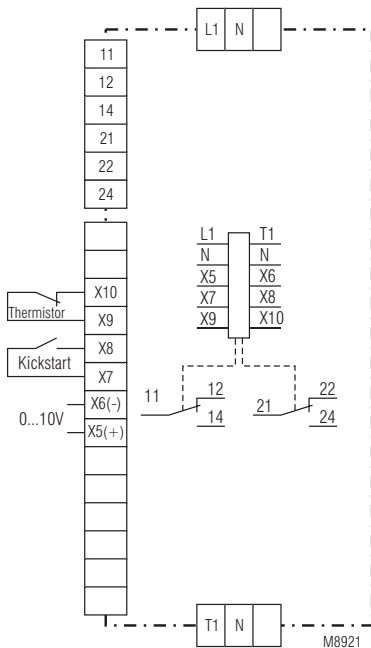
Relay function
Relay 1 (11-12-14): Energises when the unit is switched on and de-energises when the unit is switched off or goes into failure mode.
Relay 2 (21-22-24): Energises when the unit is switched on and de-energises when the unit is switched off or goes into failure mode.
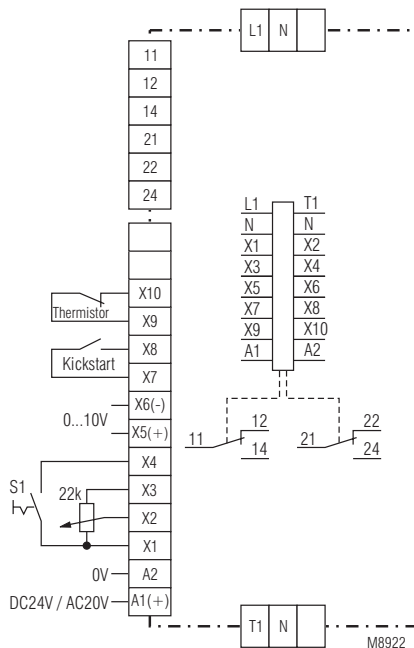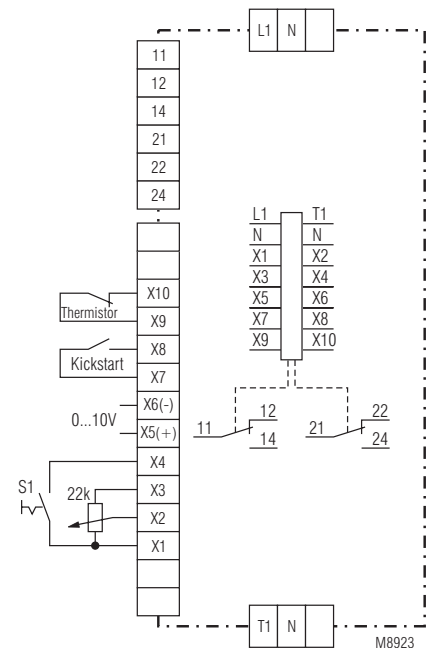
Block Diagram

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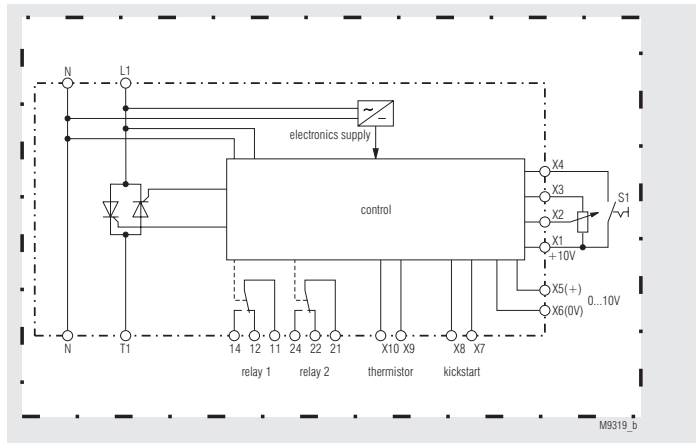
Connection Diagrams

SX 9240.01/0_005

SX 9240.01/2_ 015

SX 9240.01/2_ 005

Indication

green LED: On, when supply connected
yellow LED: On, when motor connected to supply voltage
flashing code 1: voltage is ramping up
red LED: flashing code 1: power semiconductors overheated
flashing code 2: wrong mains frequency
flashing code 4: motor overtemperature

Notes

Motor noise
When the motor is running on low speed resonance can cause noise that may be disturbing.

Notes

Protection against short circuit
It is recommended to use superfast semiconductor fuses to protect the speed controller in the case of short circuits on the output side.

Thermal protection
The speed controllers are designed to operate motors up to the nominal load. To protect the motor against thermal overload a thermal overload device, a motor protection device or thermistor motor protection is required.

To select the right motor the following instructions must be observed:
Between 0.6 and 1.0 of the nominal speed the current could be rise up to 50 % higher than the nominal current. This effect is caused by the voltage control. To avoid overheating of the motor it must be declassified. I.e. a 3.3 kW motor can only loaded up to 2.2 kW. In spite of this measure a higher temperature cannot be avoided. Because of this the motor should be of isolation class F or H. In addition the windings should be monitored by means of a thermal contact or thermistor for overtemperature.

Technical Data

Phase / motor voltage:
L - N: AC 230 V ± 10 %
Nominal frequency: 50 / 60 Hz
Motor power

Type	SX 9240.01/01005	SX 9240.01/02005
heat sink	without	22,5 mm
power loss	5 W	12 W
Nominal current at ϑu = 40 °C:	5,0 A	11,5 A
switching cycle	continuous operation	continuous operation

Min. motor power: 0.2 A
Ramp up time after Kickstart: 7.5 s
Hold time after Kickstart: 1 s
Ramp down time after Kickstart: max. 7.5 s
Kickstart voltage: AC 230 V
Power consumption: 1.2 W

Relay contacts

Thermal continuous current I_{th}:	5 A	
Switching capacity to AC 15		
NO contacts:	3 A / 230 V	IEC/EN 60 947-5-1
NC contacts:	1 A / 230 V	IEC/EN 60 947-5-1
Semiconductor fuse:	1800 A² s	
External control input:	0 ... + 10 V	
Input impedance:	20 kΩ	
Reference voltage:	10 V / 15 mA	
Setting potentiometer:	22 kΩ	
Input impedance:	20 kΩ	
Thermistor input		
NC contact, switching voltage:	24 V	
Input inpedance:	50 kΩ	
Ramp time:	approx. 5 sec from min. speed to max. speed or max. speed to min. speed	
Variation of motor voltage		
at AC 230 V:	25 V_{eff} ... 230 V_{eff}	

General Data

Temperature range:	0 ... + 40°C	

(If the temperature (20 ... 60°C) exceeds the a. m. range the nominal current can be increased by 2 % / °C on lower temperature or must be decreased by 2 % / °C on higher temperature.)

Storage temperature:	- 25 ... + 75°C	
Clearance and creepage distances rated impuls voltage / pollution degree		
Control voltage to motor voltage:	4 kV / 2	IEC 60 664-1
Auxiliary voltage to motor voltage:	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		
wire for power supply:	1 kV	IEC/EN 61 000-4-5
Interference suppression:	Limit value class B	EN 55 011
Radiated interference:	Limit value class B	EN 55 011
Degree of protection:	IP 65	IEC/EN 60 529
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		
Load terminals:	4 mm² solid, or 2.5 mm² stranded	
Control terminals:	1.5 mm² stranded	
Relay terminals:	2.5 mm² stranded	
Net weight:		
5.0 A:	1280 g	
11.5 A:	1500 g	

Dimensions

Width x height x depth:		
5 A:	100 x 160 x 165 mm	
11.5 A:	122 x 160 x 165 mm	

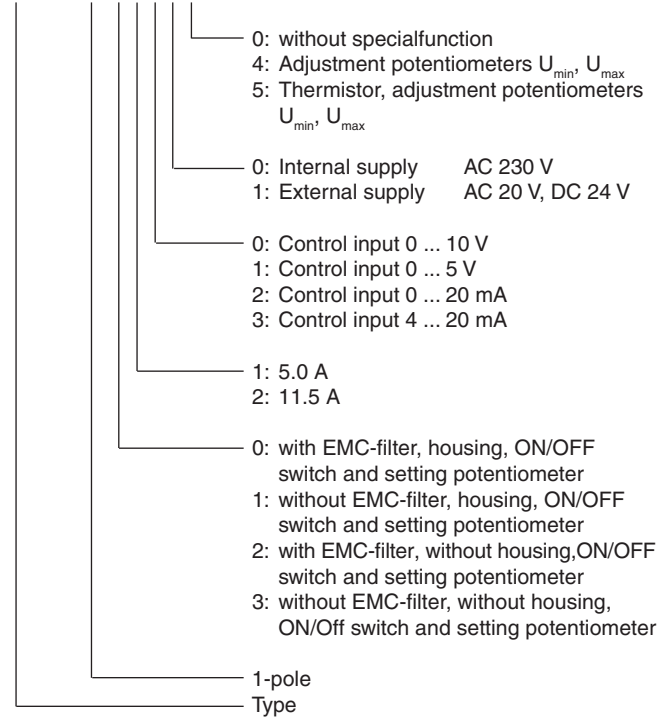SX 9240.01/01005

Article number	0058991

- 1-pole
- for motor currents up to 5 A
- with EMC-filter, Housing, ON/OFF switch and setting potentiometer
- without heat sink
- Control input for 0 ... 10 V
- Thermistor input
- with internal transformer
- 100 mm width

Ordering example for variants

SX 9240 .01 / _ _ _ _ _

0: without specialfunction
4: Adjustment potentiometers U_{min}, U_{max}
5: Thermistor, adjustment potentiometers U_{min}, U_{max}

0: Internal supply   AC 230 V
1: External supply   AC 20 V, DC 24 V

0: Control input 0 ... 10 V
1: Control input 0 ... 5 V
2: Control input 0 ... 20 mA
3: Control input 4 ... 20 mA

1: 5.0 A
2: 11.5 A

0: with EMC-filter, housing, ON/OFF switch and setting potentiometer
1: without EMC-filter, housing, ON/OFF switch and setting potentiometer
2: with EMC-filter, without housing, ON/OFF switch and setting potentiometer
3: without EMC-filter, without housing, ON/Off switch and setting potentiometer

1-pole
Type

1.) Open enclosure. Connect device and motor according to circuit diagram.
2.) Remove bridge X8 / X7 when "Kickstart" is not required.
3.) Close enclosure and apply auxiliary voltage.
4.) Start unit with ON/OFF switch.
5.) Turn speed setting potentiometer fully anticlockwise. Adjust U_{min} potentiometer high enough, so that the motor starts. A humming motor at standstill should be avoided inorder not to heat up the motor unnecesarily. Turn speed setting potentiometer fully clockwise. Adjust U_{max} potentiometer until the required max. speed is reached. The motor temperature should be checked on low and medium speed. If necessary the motor must be cooled.

- Never clear fault when the device is switched on.

Attention: This device can be started by potential-free contact, while connected directly to the mains without contactor (see application example). Please note, that even if the motor is at rest, it is not physically separated from the mains. Because of this the motor **must** be disconnected from the mains via the corresponding manual motor starter.

- 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, e.g. adjustment of U_{min}, U_{max} may only be carried out by qualified specialist staff and the applicable safety rules must be observed. Wiring and disconnection work must only be made when the unit is isolated from the mains.
- After disconnection of the device dangerous voltages may be sensed for several minutes on the connection terminals caused by filter capacitors.

Application Example

L1
N

Q1

kickstart

thermistor

L1 N X7 X8 X9 X10

SX9240

T1 N X5 X6 14 12 11 24 22 21
        0...10V relay 1 relay 2

M
1~

M9320

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