A division of the WIKA Group

Tension/compression force transducer
With thin-film technology, 0...1 kN up to 0...100 kN
Models F2301, F23C1, F23S1

Applications

- Crane systems and hoists
- Industrial weighing technology
- Machine building and plant construction, manufacturing automation
- Theatre and stage construction
- Chemistry and petrochemistry

Special features

- Measurement ranges 0...1 kN up to 0...100 kN
- Corrosion-resistant stainless steel design
- Integrated amplifier
- High long-term stability, high shock and vibration resistance
- For static and dynamic measurements
- Good reproducibility, simple installation

Certificates

Description

Tension/compression force transducers are designed for static and dynamic measurement tasks in the direct flux of force. They determine the tension and compression forces in a wide scope of applications.

Tension/compression force transducers of this series are often used in hoist and crane systems, as well as for special machine constructions, in laboratories and stage systems. Appropriate technical and regional approvals are available as an option.

These force transducers are made of high-strength, corrosionresistant stainless steel 1.4542, which is particularly suitable for their application areas. The standard active current and voltage outputs are available as output signals (4...20 mA/0...10 V). Redundant output signals are possible.

This kind of force transducers are part of our certified product ELMS1 overload protection (DIN EN ISO 13849-1 with PL d/Kat. 3 and DIN EN 62061 with SIL 2).

Specifications in accordance with VDI/VDE/DKD 2638

Model series	Symbol	Unit	F2301					F23S1			
Measurement range											
Rated force	F_{nom}	**kN**	1	2	3	5	10	20	30	50	100
Accuracy and stability											
Relative linearity error	d_{lin}	**x%F_{nom}**	± 0.2								
Relative reversibility error	**v**	**x%F_{nom}**	< 0.1								
Relative creep		**x%F_{nom}**	0.1								
Temperature effect on zero signal	TK_0	**%/10 K**	0.2								
Temperature effect on characteristic value	TK_C	**%/10 K**	0.2								
Mechanical characteristics											
Force limit	F_L	**x%F_{nom}**	150								
Breaking force	F_B	**x%F_{nom}**	300								
Permissible oscillation stress	F_{rb}	**x%F_{nom}**	± 50								
Rated displacement	s_{nom}	**mm**	< 10 kN: < 0.02 < 100 kN: < 0.2								
Material of measuring spring			corrosion resistant stainless steel ultrasonic tested 3.1 material / (optionally 3.2)								
Temperature ranges											
Rated temperature range	$B_{T, nom}$	**°C**	-20...80								
Operating temperature range	$B_{T, G}$	**°C**	-30...80					-30...80			
Storage temperature range	$B_{T, S}$	**°C**	-40...85								
Electrical characteristics											
Output signal (rated output)	C_{nom}	**mA**	(4...)20, 2-wire, (4...)20, 3-wire, 2 x (4...)20 redundant					Redundant opposing 4...20/20...4 acc. the requirements for functional safety acc. Machinery Directive 2006/42/EG			
		V	DC (0...)10, 3-wire, DC 2 x (0...)10 redundant								
			CANopen® Configuration of device address and baud rate Sync/Async, Node/Lifeguarding, Heartbeat; Zero point and full scale up to ±10% by entries into object directory [1]								
Current consumption		**mA**	Current output 4...20 2-wire: signal current Current output 4...20 3-wire: < 8 Voltage output: < 8, CANopen®: <1W					Current output 4...20: signal current			
Supply voltage		**V**	DC 10...30 for current output, DC 14...30 for voltage output, DC 12...30 for CANopen®					DC 10...30 for current output			
Burden		**Ohm**	≤ (UB–10 V)/0.024 A for current output > 10 kΩ for voltage output					≤ (UB–10 V)/0.020 A (channel 1) for current output ≤ (UB–7 V)/0.020 A (channel 2) for current output			
Response time		**ms**	≤ 2 (within 10% up to 90% F_{nom})[2]								
General data											
Protection (acc. to EN/IEC 60529)			IP67								
Vibration resistance (acc. to DIN EN 60068-2-6)			20 g, 100 h, 50...150 Hz								
Electrical protection			Reverse voltage, overvoltage and short-circuit protection								
Emission			DIN EN 55011								
Immunity			acc. to DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC ruggedized version)								
Electrical connection			Circular connector M 12x1, 4-pin, CANopen® 5-pin					2-circular connector M 12x1, 4-pin			
Options			Certificates, Strength tests, 3D-CAD data (STEP, IGES) on request								

[1] Protocol acc. CiA DS-301 V.402. Device profile DS-404 V. 1.2.
[2] Other response times are available on request.
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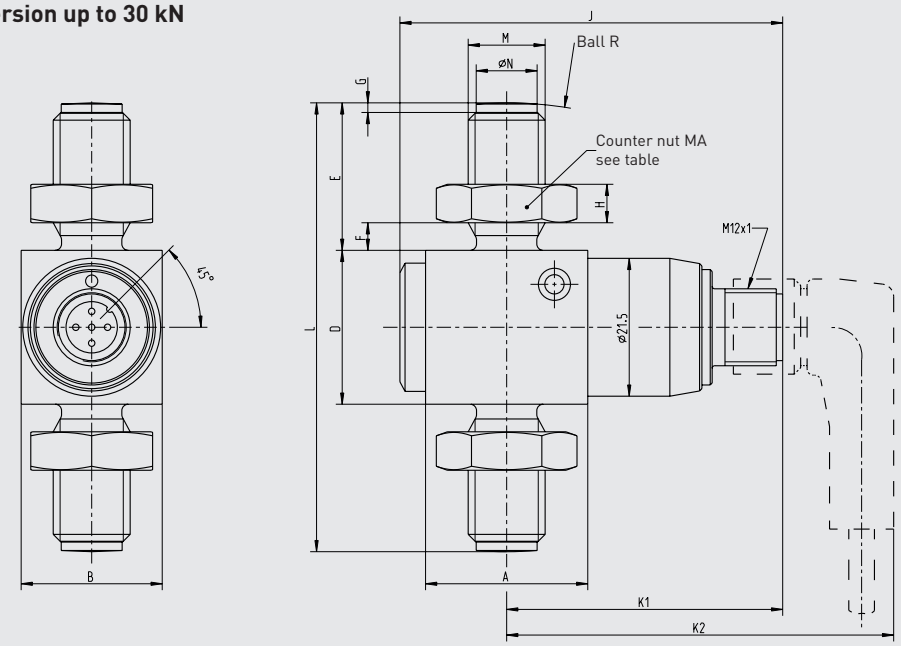
Specifications in accordance with VDI/VDE/DKD 2638

Model series	Symbol	Unit	F23C1 Version ATEX/IECEx Ex ib[1]					F23C1 Version SIL-3 nach EN 62061:2005			
Measurement range											
Rated force	F_{nom}	kN	1	2	3	5	10	20	30	50	100
Accuracy and stability											
Relative linearity error	d_{lin}	$x\%F_{nom}$	± 0.2								
Relative reversibility error	v	$x\%F_{nom}$	< 0.1								
Relative creep		$x\%F_{nom}$	0.1								
Temperature effect on zero signal	TK_0	%/10 K	0.2								
Temperature effect on characteristic value	TK_C	%/10 K	0.2								
Mechanical characteristics											
Force limit	F_L	$x\%F_{nom}$	150								
Breaking force	F_B	$x\%F_{nom}$	300								
Permissible oscillation stress	F_{rb}	$x\%F_{nom}$	± 50								
Rated displacement	s_{nom}	mm	< 10 kN: < 0.02 < 100 kN: < 0.2								
Material of measuring spring			corrosion resistant stainless steel ultrasonic tested 3.1 material / (optionally 3.2)								
Temperature ranges											
Rated temperature range	$B_{T, nom}$	°C	-20...80								
Operating temperature range	$B_{T, G}$	°C	Ex II 2G Ex ib IIC T4 Gb -25°C < Tamb < +85°C Ex II 2G Ex ib IIC T3 Gb -25°C < Tamb < +100°C Ex I M2 Ex ib I Mb -25°C < Tamb < +85°C Ex II 2G Ex ib IIC T4 Gb -40°C < Tamb < +85° Ex I M2 Ex ib I Mb (for cabel connection only)					-30...80			
Storage temperature range	$B_{T, S}$	°C	-40...85								
Electrical characteristics											
Output signal (rated output)	C_{nom}	mA	(4...)20, 2-wire					4...16, 2-wire[2]			
		V	-					DC 2...8, 3-wire[2]			
Current consumption		mA	Current output 4...20 2-wire: signal current					Current output 4...20 2-wire: signal current, Current output 4...20 3-wire: < 8, Voltage output: < 8			
Supply voltage		V	DC 10...30 for current output					DC 10...30 for current output DC14...30 voltage output			
Burden		Ohm	⩽ (UB–10 V)/0,024 A for current output, > 10 kΩ for voltage output								
Responce time		ms	⩽ 2 (within 10% bis 90% F_{nom})[3]								
General data											
Protection (acc. to EN/IEC 60529)			IP67								
Vibration resistance (acc. to DIN EN 60068-2-6)			20 g, 100 h, 50...150 Hz								
Electrical protection			Reverse voltage, overvoltage and short-circuit protection								
Emission			DIN EN 55011								
Immunity			acc. DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC ruggedized version)								
Electrical connection			Circular connector M 12x1, 4-pin					Circular connector M 12x1, 4-pin			
Options			Certificates, Strength tests, 3D-CAD data (STEP, IGES) on request								
Certificates (optional)			**ATEX:** acc. EN 60079-0:2012 and EN 60079-11:2012 (Ex ib) **IECEx:** acc. IEC 60079-0:2011 (Ed.6) and IEC 60079-11:2011 (Ed. 6) (Ex ib) **SIL:** acc. EN 62061:2005 **UL:** acc. UL 61010-1 and CSA C22.2 NO. 61010-1								

[1] The load cells with ignition protection type "ib" must only be supplied using galvanically-isolated power supplies. Suitable supply isolators are also optionally available eg. EZE08X030003.
[2] Other SIL-shifts are available on request. [3] Other response times are available on request.

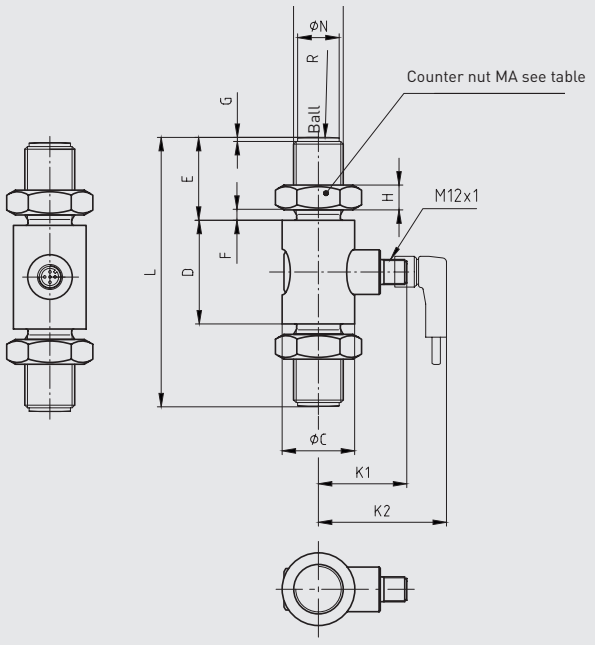
Dimensions in mm

Version up to 30 kN



Rated force in kN	A	B	D	E	F	G	H	J	K1	K2	L	M	N -0.1	Ball R	MA (Nm)	Rated displacement
1, 2, 3	25.3	22	24	23	4.3	1.5	6	59.7	43	63	70	M12	9.5	60	60	< 0.02
5	25.3	22	24	23	4.3	1.5	6	59.7	43	63	70	M12	9.5	60	60	< 0.02
10	25.3	22	31	23	4.3	1.5	6	59.7	43	63	77	M12	9.5	80	60	< 0.02
20	25.3	26	33	34	3.8	2	10	59.7	43	63	101	M20 x 1.5	17	100	300	< 0.2
30	27.6	27.5	40	34	3.8	2	10	61.5	44	64	108	M20 x 1.5	17	120	300	< 0.2

Version from 50 kN



Rated force in kN	C	D	E	F	G	H	K1	K2	L	M	N -0.1	Ball R	MA (Nm)	Rated displace-ment
50	35	50	40	5	2	12	43	62	130	M24 x 2	20	150	500	< 0.2
100	54	54	68	10	3	19.5	44	64	190	M39 x 3	34	200	2,500	< 0.2

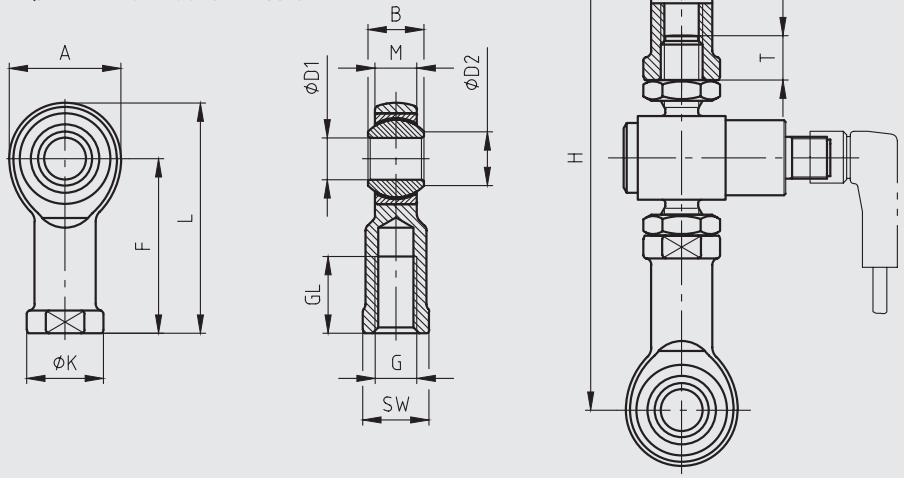
Dimensions in mm

Accessories swivel heads

Swivel heads in accordance with DIN ISO 12240-4

Ø -D1 = 12 ... 25 dim. column K

Ø -D2 = 40 ... 80 dim. column E

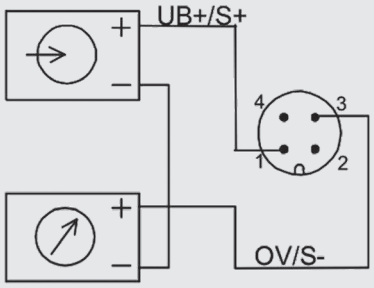


Rated force in kN	H	Minimum screw-in depth T
1, 2, 3, 5	148 ± 3	9.5
10	155 ± 3	9.5
20	219 ± 4	16
30	226 ± 4	16
50	276 ± 4	19.5
100	405 ± 7	31

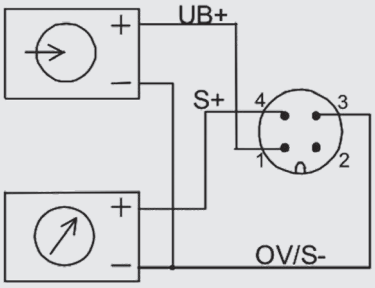
Rated force in kN	Weight in kg	A	B	$ØD_1$	$ØD_2$	F	G	GL	ØK	L	M	SW
1, 2, 3, 5, 10	0.115	32	16	12 H7	15.4	50	M12	22	22	55	12	19
20, 30	0.415	50	25	20 H7	24.3	77	M20 x 1.5	33	34	102	18	32
50	0.750	60	31	25H7	29.6	94	M24 x 2	42	42	124	22	36
100	2	92	28	$40_{-0.012}$	45	142	M39 x 3	65	65	188	23	55

Pin assignment, analogue output

4...20 mA output, 2-wire
Circular connector M12 x 1, 4-pin



0...10 V output, 3-wire
Circular connector M12 x 1, 4-pin



Standard version

	4...20 mA, 2-wire	4...20 mA, 3-wire	0...10 V, 3-wire
Supply: UB+	1	1	1
Supply: 0V/UB-	3	3	3
Signal: S+	1	4	4
Signal: S-	3	3	3
Shield ⏚	Case	Case	Case

Cable outlet		
Cable colour	**3-wire**	**3-wire**
Brown	UB+/S+	UB+
White	-	-
Blue	0V/S-	0V/S-
Black	-	S+

Only when using the standard tecsis cable, e.g. EZE53X011016

Pin assignment, ATEX/IECEx version

	ATEX Ex ib, 4...20 mA, 2-wire
Supply: UB+	1
Supply: 0V/UB-	3
Signal: S+	1
Signal: S-	3
Shield ⏚	Case

Cable outlet	
Cable colour	**2-wire**
Brown	UB+/S+
White	-
Blue	0V/S-
Black	-

Nur bei Verwendung der tecsis-Standardkabel, z. B. EZE53X011016

Pin assignment, SIL 3 version in accordance with EN 62061:2005

	4...20 mA, 2-wire	4...20 mA, 3-wire	0...10 V, 3-wire
Supply: UB+	1	1	1
Supply: 0V/UB-	3	3	3
Relay: UR+	2	2	2
Relay: UR-	4	3	3
Signal: S+	1	4	4
Signal: S-	3	3	3
Shield ⏚	Case	Case	Case

Cable outlet		
Cable colour	**2-wire**	**3-wire**
Brown	UB+/S+	UB+
White	UR+	UR+
Blue	0V/S-	0V/S-/UR-
Black	UR-	S+

Only when using the standard tecsis cable, e.g. EZE53X011016

Pin assignment, analogue output, redundant, opposing

2-connector variant, for example, in combination with ELMS1 overload protection (F23S1).
Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

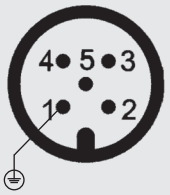
	4...20 mA/20...4 mA (redundant)	
	Connector 1	**Connector 2**
Supply: UB+	1	1
Supply: 0V/UB-	3	3
Signal: Channel 1	4	-
Signal: Channel 2	-	4
Screen ⏚	Case	Case

Circular connector
M12 x 1, 4-pin

Pin assignment CANopen®

The cable shield is connected with the GND of the load cell. With the accessory cable, the cable shield is connected with the knurled nut and, thus, with the GND of the load cell. When extending, only shielded and low-capacitance cable should be used. The permitted maximum and minimum lengths of cable are defined in ISO 11898-2. Care should be taken also to ensure a high-quality connection of the shielding.

Schirm ⏚	1
UB+ (CAN V+)	2
UB- (CAN GND)	3
Bus-Signal CAN-High	4
Bus-Signal CAN-Low	5

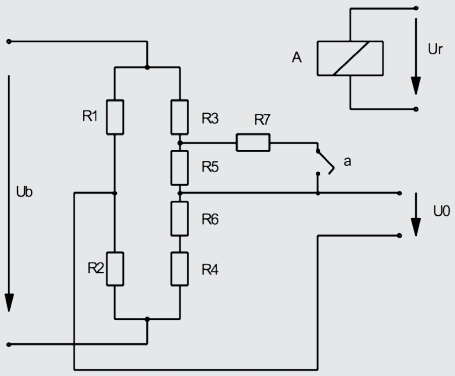


Circular connector
M12 x 1, 5-pin

List of abbreviations for connections	
UB+	Supply voltage +
0V/UB-	Supply voltage -
UR+	Supply voltage + for relay (SIL shift)
UR-	Supply voltage - for relay (SIL shift)

Short description of SIL 3 electronics

Amplifier electronics 4...20 mA or 0...10 V for SIL-3 applications with 2-channel PC control (certified by TÜV Süd, Germany) for use in stage technology applications only



tecsis force transducers are working with four variable resistors (R1...R4) connected to a Wheatstone Bridge. Caused by deformation of the body the respective opposite resistors are lengthened or compressed in the same way. This results in an unbalanced bridge and a diagonal voltage U0.

This well proven design has been amended by an additional resistor R7 in order to monitor the condition of the amplifier unit and signal path (Fig.1). This resistor is connected as a shunt to resistor R5 by a relay contact (a) as soon as an excitation voltage Ur appears at relay A. The connection of resistor R7 will always result in a defined unbalancing of the zero point (diagonal voltage) of the Wheatstone Bridge.

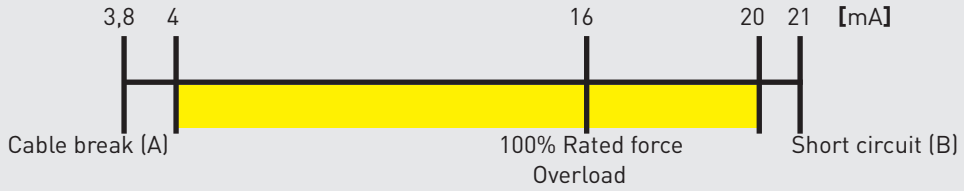
Compliance with functional safety

An external safety controller independently of the force transducer must monitor the safe functioning of the force transducer. The function test (SIL step) with a signal level of 4 mA / 2 V is generated at a 24-hour interval. The safety controller activates relay A and thus defines the output signal of the force transducer.

If the expected change in the output signal occurs, it can be assumed that the entire signal path from the Wheatstone bridge via the amplifier to the output functions correctly.

If it does not occur, an error in this signal path can be concluded. Furthermore, the measuring signal is to be checked by the safety controller for the Min- (A) and Max- (B) signal values in order to detect a possibly arising line break or short circuit.

The standard adjustment of force transducers with current output 4...20 mA for overload control is e.g.:



Signal of SIL electronic

With a fixed signal level of, for example, 4 mA, the testing cycle can be triggered in every operating status upon activation of the check relais. The measurement's upper limit of 20 mA will not be reached. This enables a check of the signal level.

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