Tension/compression load cell
With thin-film technology up to 100 kN
Models F2301, F23C1, F23S1

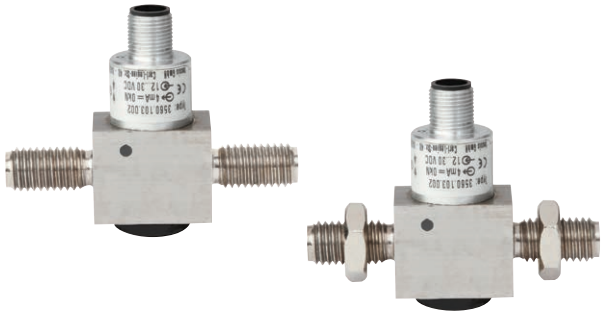
WIKA Data sheet FO 51.17

Applications

- Hoists, cranes
- Screw down forces in machinery
- Process automation
- Mechanical engineering and machinery

Special features

- Stainless steel
- Integrated amplifier
- Small temperature drift
- High long-term stability, high shock and vibration resistance
- Good repeatability, easy to install



Tension/compression load cell
Models F2301, F23C1, F23S1

Description

Load cells with welded-in thin-film sensors are designed for the measurement of static and dynamic pull and/or push forces in various applications.

Load cells are suitable for tough operating requirements and harsh environmental conditions. They are maintenance-free and can also be mounted in hard-to-reach locations.

Due to their small dimensions, operation in very small mounting spaces is also possible. Because of the variety of output signals, these load cells can be used in many application areas.

ATEX/IECEx (optional)
- Mining
- Chemical and petrochemical industries
- Dedusting and filtration units

Only equipment and protective systems with the corresponding certification and markings are to be put into operation in potentially explosive areas. Our force transducers with a thin-film measuring cell and integrated amplifier now have approval according to directive 94/9/EC in equipment group II (non-mining products), category 2G for zones 1 and 2 (gases). Other zones on request.

SIL 3 (optional)
For theatre and stage design:
- Above-stage machinery
- Below-stage machinery
- Point hoists

In cooperation with the TÜV Süddeutschland a special security electronics has been developed for theatre and stage applications. It fulfils security standard SIL 3 with a 2-channel PC control in connection.This international security standard for systems and processes is based on the standards IEC 61508 and 61511. The latter is used for ascertaining risk potentials of (engineering) systems. Depending on the potential existing risk a risk reduction has to be made. If automation components are used for that, they have to fulfil the demands of IEC 61508. Both standards subdivide systems and risk reducing actions in four security steps: SIL 1 ... SIL 4 (Safety Integrity Level) – from small up to very high risks. If persons are allowed to stay under hanging loads, e.g. in theatres, security level 3 (SIL 3) is valid.

UL-Certification (optional)
Load cells are also available with UL approval. FM and CSA Approval submitted.

Safety approval (optional)
Load cells are now available in versions in accordance with the requirements for functional safety per 2006/42/EC Machinery Directive. This is only valid in combination with a safe control unit such as the tecsis ELMS1 overload protection.

Measuring ranges
Tension and compression forces from 0 … 1 kN up to 0 … 500 kN

Accuracy
0.2 % of F.S.

Output signals
4 ... 20 mA, 2- or 3-wire
DC 0 ... 10 V, 3-wire
CANopen®

ATEX/IECEX (optional)
According with EN 60079-0:2012 and EN 60079-11:2012 (Ex ib)

IECEx-Zulassung (optional)
According with IEC 60079-0:2011 (Ed.6) and IEC 60079-11:2011 (Ed. 6) (Ex ib)

SIL 3 (optional)
According with EN 62061:2005

UL-Zulassung (optional)
According with UL 61010-1 and CSA C22.2 NO.61010-1

Specific information
Counter nuts included

Technical data in accordance with VDI/VDE/DKD 2638

Models	F2301	F23S1
Rated force F_{nom}	From 1 kN	
Force limit F_L	150 % F_{nom}	
Breaking force F_B	> 300 % F_{nom}	
Relative linearity error d_{lin} [1)]	±0.2 % of F.S.	
Relative reversibility error v	0.1 % F_{nom}	
Relative creep, 30 min. at F_{nom}	±0,1 % of F.S., -20 ... +80 °C	
Service life	20 Years	
Permissible oscillation stress F_{rb}	±50 % F_{nom} (in accordance with DIN 50100)	
Nominal deflection (typ.) s_{nom} ■ <10 kN ■ <100 kN	 < 0.02 mm < 0.2 mm	
Rated temperature $B_{T, nom}$	-20 … +80 °C	
Operating temperature $B_{T, G}$	-30 … +80 °C (optional -40 ... +80 °C)	-30 … +80 °C
Storage temperature $B_{T, S}$	-40 … +85 °C	
Temperature effect on ■ characteristic value TK_c ■ zero signal TK_0	0.2 % F_{nom}/10K	
Vibration resistance	20 g, 100 h, 50 ... 150 Hz in accordance with DIN EN 60068-2-6	
Protection type	IP67 in accordance with EN/IEC 60529	
Noise emission	DIN EN 55011	
Noise immunity	In accordance with DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC-strengthened versions)	
Electrical protection	Reverse voltage, overvoltage and short circuit protection	
Output signal ■ Signal type	4 … 20 mA, 2-wire, 4 … 20 mA, 3-wire or DC 0 … 10 V, 3-wire (Optional redundant signal) **CANopen®** Protocol in accordance with CiA 301, device profile 404, communication services LSS (CiA 305), configuration of the instrument address and baud rate Sync/Async, Node/Lifeguarding, heartbeat; zero and span ±10 % adjustable via entries in the object directory	Redundant, opposing 4 … 20 mA/20 … 4 mA Versions in accordance with requirements for functional safety per 2006/42/EC Machinery Directive
■ Current consumption	**Current output 4 … 20 mA 2-wire:** signal current **Current output 4 … 20 mA, 3-wire:** < 8 mA **Voltage output:** < 8 mA **CANopen®:** <1W	**Current output 4 … 20 mA:** signal current
■ Supply voltage	DC 10 ... 30 V for current output DC 14 ... 30 V for voltage output DC 12 ... 30 V for CANopen®	DC 10 … 30 V for current output
■ Burden	≤ (UB−10V)/0.024 A for current output > 10 kΩ for voltage output	≤ (UB–10V)/0.020 A (channel 1) for current output ≤ (UB–7V)/0.020 A (channel 2) for current output
■ Response time	≤ 2 ms (whitin 10 ... 90 % F_{nom})[2)]	
Electrical connection	Circular connector M12 x 1, 4-pin/ CANopen® 5-pin	2-connector variant, 4-pin
Material of measuring device	Stainless steel corrosion-resistant, ultrasonically tested 3.1 material (optional 3.2)	
Optional	Certificates, strength verifications, 3D-CAD files (STEP, IGES) on request	

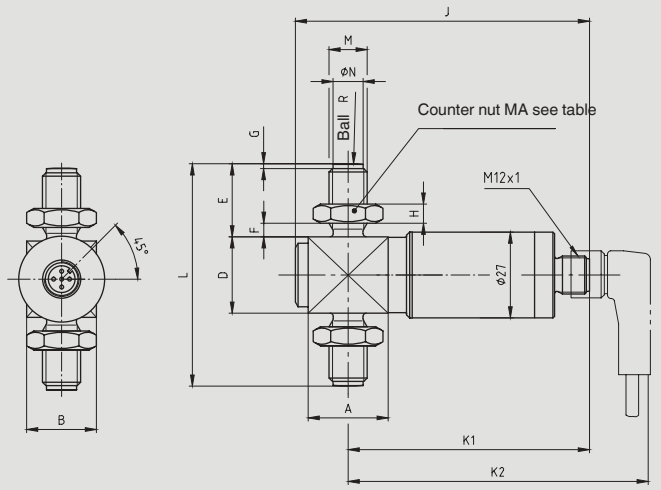
[1)] Dependent upon the application-specific selected geometry CANopen® and CiA® are registered community trade marks of CAN in Automation e.V.
[2)] Other response times are realisable upon request.

Models	F23C1 version ATEX/IECEx EX ib[1)]	F23C1 version SIL 3 in accordance with EN 62061:2005
Rated force F_{nom}	From 1 kN	
Force limit F_L	150 % F_{nom}	
Breaking force F_B	> 300 % F_{nom}	
Relative linearity error d_{lin}	±0.2 % of F.S.	
Relative reversibility error v	0.1 % F_{nom}	
Relative creep, 30 min. at F_{nom}		
Service life	20 Years	
Permissible oscillation stress F_{rb}	±50 % F_{nom} (in accordance with DIN 50100)	
Nominal deflection (typ.) s_{nom} **<10 kN** **<100 kN**	 < 0.02 mm < 0.2 mm	
Rated temperature $B_{T, nom}$	-20 … +80 °C	
Operating temperature $B_{T, G}$	Operating temperatures see operating instruction	-30 … +80 °C
Storage temperature $B_{T, S}$	-40 … +85 °C	
Temperature effect on ■ characteristic value TK_c ■ zero signal TK_0	0.2 % F_{nom}/10K	
Vibration resistance	20 g, 100 h, 50 ... 150 Hz in accordance with DIN EN 60068-2-6	
Protection type	IP67 in accordance with EN/IEC 60529	
Noise emission	DIN EN 55011	
Noise immunity	In accordance with DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC-strengthened versions)	
Electrical protection	Reverse voltage, overvoltage and short circuit prot	
Output signal ■ Output signal (characteristic value) C	4 … 20 mA, 2-wire	4 … 16 mA, 2-wire, DC 2 … 8 V, 3-wire [3)]
■ SIL Shifts	–	4 mA, 2-wire DC 2 V,– 3-wire [3)]
■ Current consumption	**Current output 4 … 20 mA, 2-wire:** signal current	**Current output 4 … 20 mA** **2-wire:** signal current, **Current output 4 … 20 mA** **3-wire:** < 8 mA, **Voltage output:** < 8 mA
■ Supply voltage	DC 10 ... 30 V for current output	DC 10 … 30 V for current output DC 14 ... 30 V for voltage output
■ Burden	≤ (UB–10 V)/0.024 A for current output > 10 kΩ for voltage output	
■ Response time	≤ 2 ms (within 10 ... 90 % F_{nom}) [2)]	
Electrical connection	Circular connector M12 x 1, 4-pin	
Material of measuring device	Stainless steel, ultrasonically tested 3.1 material (optional 3.2)	
Optional	Certificates, strength verifications, 3D-CAD files (STEP, IGES) on request	

[1)] The load cell with ignition protection type "ib" should only be powered using galvanically isolated repeater power supplies.
Suitable repeater power supplies can be offered as an option e.g. EZE08X030003.
[2)] Dependent upon the application-specific selected geometry CANopen® and CiA® are registered community trade marks of CAN in Automation e.V.
[3)] Other SIL shifts are realisable upon request.
[4)] Other response times are realisable upon request.

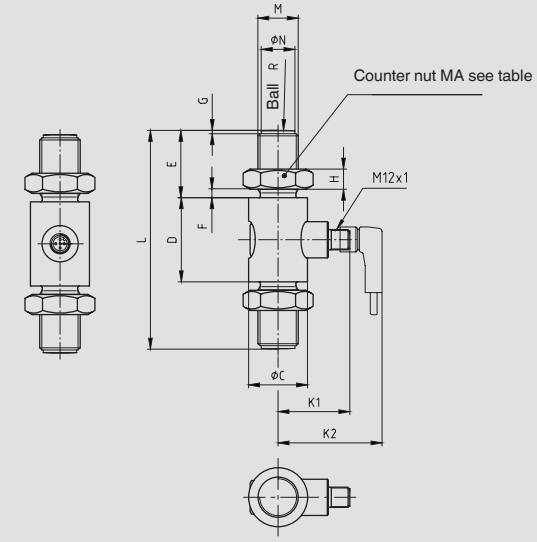
Dimensions in mm

Version 1 ... 30 kN



Nominal load in kN	A	B	D	E	F	G	H	J	K1	K2	K3	L	M	N -0.1	Ball R	MA (Nm)	Nominal deflection
1 ... 3	25.2	22	24	23	4.3	1.5	6	59	43	62	66	70	M12	9.5	60	60	< 0.5
5	25.2	22	24	23	4.3	1.5	6	59	43	62	66	70	M12	9.5	60	60	< 0.5
10	25.2	22	31	23	4.3	1.5	6	59	43	62	66	77	M12	9.5	80	60	< 0.5
20	25.2	26	33	34	3.8	2	10	59	43	62	66	101	M20 x 1.5	17	100	300	< 0.1
30	27.5	27.5	40	34	3.8	2	10	61.5	44	63	67	108	M20 x 1.5	17	120	300	< 0.1

Version from 50 kN



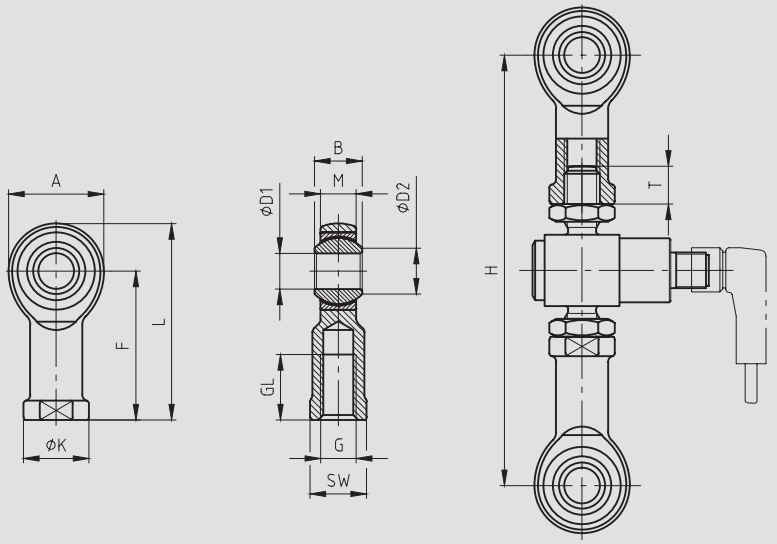
Nominal load in kN	C	D	E	F	G	H	K1	K2	K3	L	M	N -0.1	Ball R	MA (Nm)	Nominal deflection
50	35	50	40	5	2	12	43	62	66	130	M24 x 2	20	150	500	< 0.1
100	54	54	68	10	3	19.5	44	64	68	190	M39 x 3	34	200	2,500	< 0.1

Dimensions in mm

Accessories swivel heads

Nominal load 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

Nominal load in kN	H	Minimum screw-in depth T
2	148 ± 3	9.5
5		
10	155 ± 3	
20	219 ± 4	16
30	226 ± 4	
50	276 ± 4	19.5
100	405 ± 7	31
200	466 ± 13	36
300	568 ± 11	45
500	665 ± 13	51



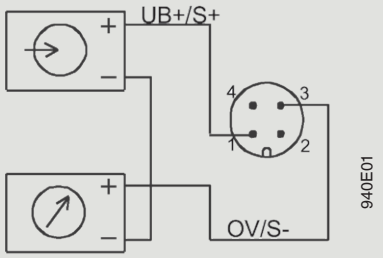
Swivel heads in accordance with DIN ISO 12240-4
Ø -D1 = 12 ... 25 dim. column K
Ø -D2 = 40 ... 80 dim. column E

Nominal load in kN	Weight in kg	A	B	$ØD_1$	$ØD_2$	F	G	GL	ØK	L	M	SW
0 … 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	M 20 x 1.5	33	34	102	18	32
50	0.750	60	31	25H7	29.6	94	M 24 x 2	42	42	124	22	36
100	2	92	28	$40_{-0.012}$	45	142	M 39 x 3	65	65	188	23	55

Electrical connection analogue output

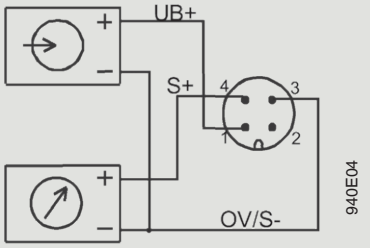
Analogue output 4 ... 20 mA, 2-wire

Circular connector M12 x 1, 4-pin



Analogue output DC 0 ... 10 V, 3-wire

Circular connector M12 x 1, 4-pin



Standard version

	4 … 20 mA	4 … 20 mA	0 … 10 V
	2-wire	3-wire	3-wire
Supply: UB+	1	1	1
Supply: OV/UB-	3	3	3
Signal: S+	1	4	4
Signal: S-	3	3	3
Screen ⏚	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 version ATEX/IECEx

	ATEX Ex ib, 4 … 20 mA, 2-wire	ATEX Ex d, 4 … 20 mA, 2-wire	ATEX Ex d, 4 … 20 mA, 3-wire
Supply: UB+	1	1	1
Supply: OV/UB-	3	3	3
Signal: S+	1	1	4
Signal: S-	3	3	3
Screen ⏚	Case	Case	Case

Cable outlet		
Cable colour	**2-wire**	**3-wire (only Ex d)**
Brown	UB+/S+	UB+
White	-	-
Blue	0V/S-	0V/S-
Black	-	S+

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

Pin assignment version SIL 3 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: OV/UB-	3	3	3
Relay: UR+	2	2	2
Relay UR-	4	3	3
Signal: S+	1	4	4
Signal: S-	3	3	3
Screen ⏚	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

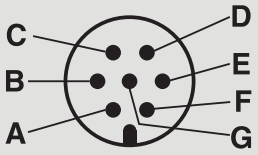
2-connector variant, for example, in combination with ELMS1 overload protection (F53S1).
Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

	4 … 20 mA / 20 … 4 mA (redundant)	
	Connector 1	**Connector 2**
Supply: UB+	1	1
Supply: 0V/UB-	3	3
Signal: channel1	4	-
Signal: channel 2	-	4
Screen ⏚	Case	Case

Circular connector
M 12 x 1, 4-pin

Pin assignment, analogue output, with MIL connector

MIL	mA/V 3-wire		mA/V 2-wire	
A	UB+	Channel 1	UB+ / S+	Channel 1
C	0V / S-		0V / S-	
D	S+		UB+ / S+	Channel 2
B	UB+	Channel 2	-	-
E	0V / S-		-	
F	S+		0V / S-	Channel 2
G	-		-	-
Screen ⏚	Case		Case	-

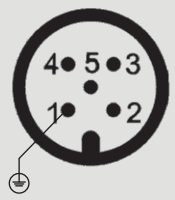


MIL-CA3102E 16S-1P-B

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.

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

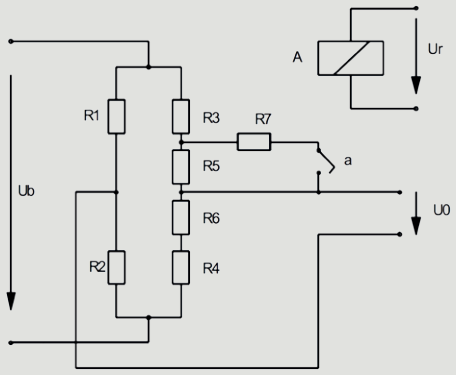


Circular connector
M12 x 1, 5-pin

Short description of SIL 3 electronics

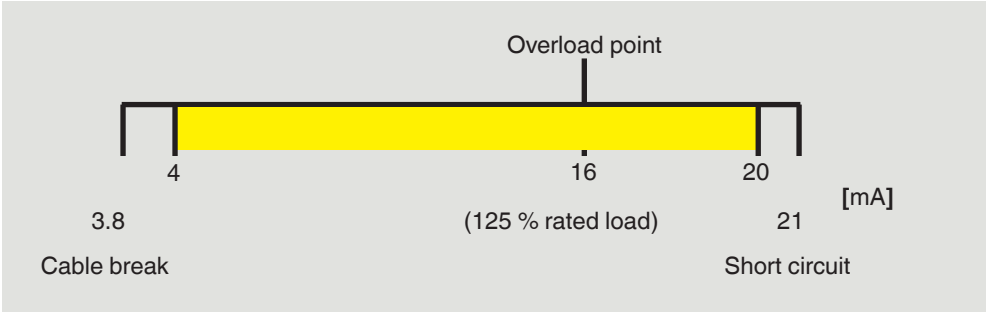
4 ... 20 mA or 0 ... 10 V amplifier electronics for SIL 3 applications with 2-channel computer control (approval through TÜV Süddeutschland, only for applications in stage technology).

Load cells, which are based on strain gauges, operate with four variable resistors (R1 ... R4) connected to a Wheatstone bridge.
Through the deformation of the measuring body the respective opposite resistors are either lengthened or compressed in the same way. This results in an unbalanced bridge and a diagonal voltage U0. In the context of the checking of the subsequent amplifier switching and the subsequent signal direction, the test resistance R7 is now important. This is switched via the relay contact (a), parallel to the resistor R5, as soon as the excitation voltage Ur is on the relay A.



Circuit diagram of the SIL electronics

The switching of the resistor R7 causes a defined, always consistent, unbalancing voltage of the zero point (diagonal voltage) of the Wheatstone bridge. An external control unit, independent of the load cell (2-channel for safety reasons), can now activate relay A which changes the output signal of the force transducer by a defined value. If the expected change in output signal occurs, then it can be assumed that the entire signal path from the Wheatstone bridge, via the amplifier to the output is functioning correctly. If this does not occur, then it can be concluded that there is a fault in the signal path.



Signals of the SIL electronics

With a fixed, set signal jump of, for example, 4 mA, then, in any operating state, the test cycle can be triggered by activating the test relay. The upper measuring range limit of 20 mA will never be reached and thus the testing of the signal jump is enabled.

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