Tension link
With thin-film technology from 5 kN
Models F7301, F73C1, F73S1

Rated force

from 5 kN

Applications

- Crawler cranes, mobile cranes, harbour cranes, for recording load and torque
- Conveyor systems
- Drives and winches
- Cable winch measurement
- Ship-lifting facilities

Special features

- Fine-grained structural steel with high-quality surface protection or in corrosion-resistant stainless steel version
- High long-term stability, high shock and vibration resistance
- For dynamic and static measurements
- Excellent reproducibility

Certificates

Description

Tension links are designed for static and dynamic measurement tasks in the direct flux of force. As a load-bearing component in existing constructions, they determine the tension forces in a wide scope of applications.

Tension links of this series are often used in hoist and crane systems as torque support or rope fix point for load measurements. Further application areas are special machine constructions, e. g. in polymer processing machines. Appropriate technical and regional approvals are available as an option.

The tension links of the series F7301 are either made of high-strength, corrosion-resistant stainless steel 1.4542 or robust fine-grained steel with surface protection. Due to their properties, these materials are particularly suitable for the applications of tension links. Besides the standard active current and voltage outputs (4 ... 20 mA / 0 ... 10 V) also digital outputs (CANopen®) are available as output signals. Redundant output signals are possible.

This kind of load cells are a 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	F7301	F73S1
Measurement range				
Rated force	F_{nom}	**kN**	from 5	
Accuracy and stability				
Relative linearity error[1)]	d_{lin}	**x%$_{Fnom}$**	± 0.5	
Repeatability[2)]	b_{rg}	**x%$_{Fnom}$**	± 0.05	
Temperature effect on zero signal	T_{K0}	**%/10 K**	0.2	
Temperature effect on characteristic value	T_{KC}	**%/10 K**	0.2	
Mechanical characteristics				
Force limit	F_L	**x%$_{Fnom}$**	150	
Breaking force	F_B	**x%$_{Fnom}$**	300	
Lateral force effect[3)]	d_Q	**x%$_{Fnom}$**	± 2	
Rated displacement	s_{nom}	**mm**	< 0.1	
Material of measuring spring			corrosion resistant stainless steel or fine-grained steel with surface protection, 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 (optional -40...80)	-30...80
Storage temperature range	$B_{T, S}$	**°C**	-40...85	
Electrical characteristics				
Signal type		**mA**	(4...)20, 2-wire, (4...)20, 3-wire, 2 x (4...)20 redundant	Redundant opposing 4...20 mA/ 20...4 mA acc. the requirements for functional safety acc. Machinery Directive 2006/42/EG
		V	(0...)10, 3-wire, 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 [4)]	
Current consumption		**mA**	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		**VDC**	10...30 for current output, 14...30 for voltage output, 12...30 for CANopen®	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})[5)]	
General data				
Protection (acc. to EN 60529/IEC 529)			IP67 (optional IP69k)	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, MIL connector	2-circular connector M 12x1, 4-pin, MIL connector
Options			Certificates, Strength tests, 3D-CAD data (STEP, IGES) on request	

[1)] Relative linearity error is specified acc. to VDI/VDE/DKD 2638 chapter 3.3.6 b. [2)] Acc. to VDI/VDE/DKD 2638 Relative repeatability error in unchanged mounting position.
[3)] This value can be reached when 100% F_{nom} act. 90° rotated to the axis. [4)] Protocol acc. CiA DS-301 V.402. Device profile DS-404 V. 1.2. [5)] Other response times are available on request.
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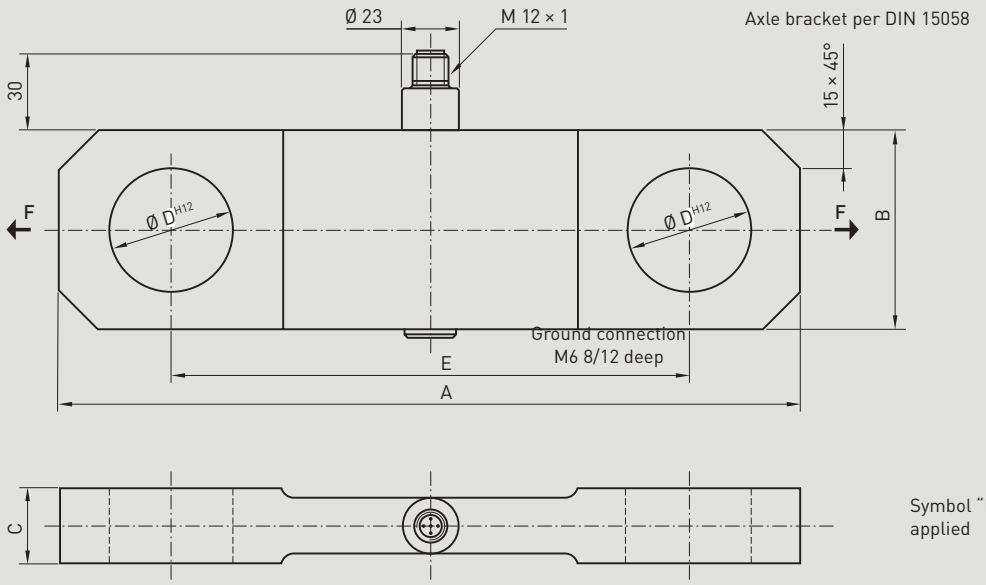
Specifications in accordance with VDI/VDE/DKD 2638

Model series	Symbol	Unit	F73C1 Version ATEX/IECEx Ex ib[1]	F73C1 Version SIL-3 acc. EN 62061:2005
Measurement range				
Rated force	F_{nom}	**kN**	from 5	
Accuracy and stability				
Relative linearity error[1]	d_{lin}	**x%F_{nom}**	± 0.5	
Repeatability[2]	b_{rg}	**x%F_{nom}**	± 0.05	
Temperature effect on zero signal	T_{K0}	**%/10 K**	0.2	
Temperature effect on characteristic value	T_{KC}	**%/10 K**	0.2	
Mechanical characteristics				
Force limit	F_L	**x%F_{nom}**	150	
Breaking force	F_B	**x%F_{nom}**	300	
Lateral force effect[3]	d_Q	**x%F_{nom}**	± 2	
Rated displacement	s_{nom}	**mm**	< 0.1	
Material of measuring spring			corrosion resistant stainless steel or fine-grained steel with surface protection, 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				
Signal type		**mA**	(4...)20, 2-wire	4 ... 16, 2-wire[5]
		V	-	2 ... 8, 3-wire[5]
Current consumption		**mA**	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		**VDC**	10...30 for current output	10 ... 30 VDC for current output 14 ... 30 VDC voltage output
Burden		**Ohm**	≤ (UB–10 V)/0,024 A for current output, > 10 kΩ voltage output	
Response time		**ms**	≤ 2 (within 10% bis 90% F_{nom})[6]	
General data				
Protection (acc. to EN 60529/IEC 529)			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; MIL connector; Cable gland	Circular connector M 12x1, 4-pin; Cable gland
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) or EN 60079-1:2007 (Ex d) **IECEx:** acc. IEC 60079-0:2011 (Ed.6) and IEC 60079-11:2011 (Ed. 6) (Ex ib) or IEC 60079-1:2007-04 (Ed. 6) (Ex d) **SIL:** acc. EN 62061:2005 **UL:** acc. UL 61010-1 and CSA C22.2 NO. 61010-1	

[1] The force transducers with ignition protection type "ib" must only be supplied using galvanically-isolated power supplies. Suitable supply isolators are also optionally available eg. EZE08X030003 [2] Relative linearity error is specified acc. to VDI/VDE/DKD 2638 chapter 3.3.6 b. [3] Acc. to VDI/VDE/DKD 2638 Relative repeatability error in unchanged mounting position. [4] This value can be reached when 100% F_{nom} act. 90° rotated to the axis. [5] Other SIL-shifts are available on request. [6] Other response times are available on request.

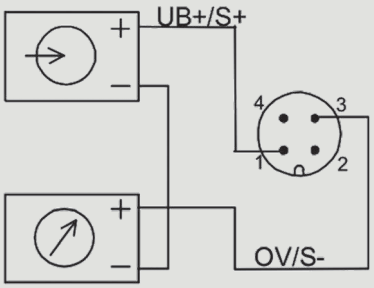
Tension link example



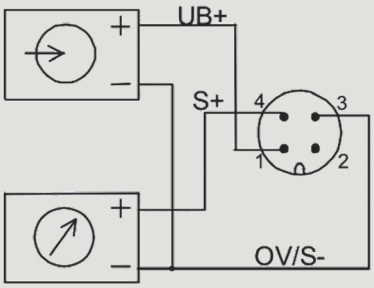
Dimensions: The customer-specific transducer drawing for the specific article number applies above all.
For the F7301/F73C1/F73S1 series, there are no standard dimensions. All dimensions in mm.

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	-

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

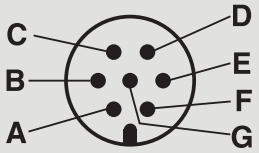
2-connector variant, for example, in combination with ELMS1 overload protection (F73S1).
Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

	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, 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	-

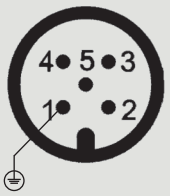


MIL-CA3102E 16S-1P-B

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



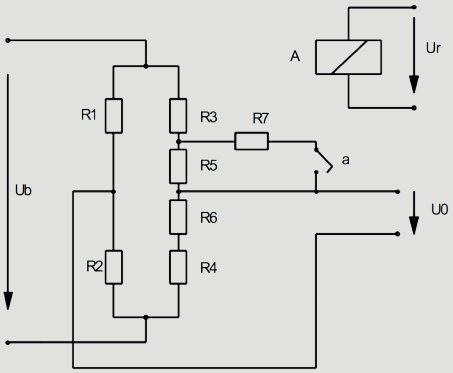
Circular connector
M12 x 1, 5-pin

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

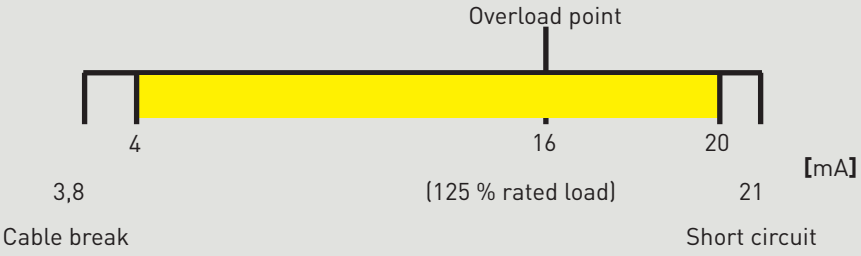
4 ... 20 mA or 0 ... 10 V amplifier electronics for SIL 3 applications with 2-channel computer control (approval through TÜV Süddeutschland, only for applications in stage technology).

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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