tecsis
A division of the WIKA Group

Load pin
With thin-film technology, 0...10 kN up to 0...70kN
Models F5301, F53C1, F53S1

Applications

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

Special features

- Measurement ranges 0...10 kN up to 0...70 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

Load pins are designed for static and dynamic measurement tasks. They directly replace existing bolts and determine the tension and compression forces in a wide range of applications.

The force sensors of this series are often used in hoist and crane systems, as well as for special machine constructions, in pulleys, rope winches, fork heads and rolling bearings. Further application areas are mining industry, production automation and stage systems. Appropriate technical and regional approvals are available as an option.

These load pins are made of high-strength, corrosion-resistant stainless steel 1.4542, which is particularly suitable for their application areas. 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 pins 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	F5301			F53S1		
Measurement range								
Rated force	F_{nom}	**kN**	10	20	30	50	70	others on request
Accuracy and stability								
Relative linearity error	d_{lin}	**x%F_{nom}**	± 1 / ± 1.5 / ± 2					
Relative repeatability error in unchanged mounting position	b_{rg}	**x%F_{nom}**	0.2					
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[1]	d_Q	**x%F_{nom}**	± 5					
Rated displacement	s_{nom}	**mm**	< 0.1					
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			-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 [2]					
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})[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. to DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC ruggedized version)					
Electrical connection			Circular connector M12x1, 4-pin, CANopen® 5-pin			2-circular connector M12x1, 4-pin		
Options			Certificates, Strength tests, 3D-CAD data (STEP, IGES) on request					

[1] This value can be reached when 100% F_{nom} act. 90° rotated to the axis. [2] Protocol acc. CiA DS-301 V.402. Device profile DS-404 V. 1.2. [3] Other response times are available on request.
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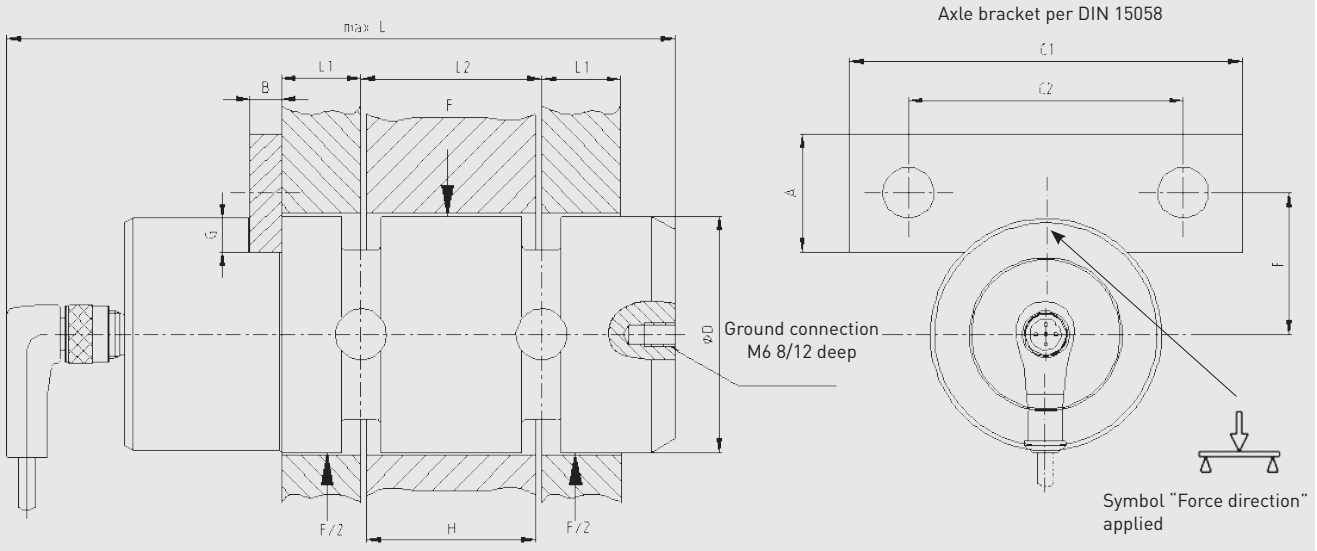
Specifications in accordance with VDI/VDE/DKD 2638

Model series	Symbol	Unit	F53C1 Version ATEX/IECEx Ex ib[1]			F53C1 Version SIL-3 acc. EN 62061:2005		
Measurement range								
Rated force	F_{nom}	**kN**	10	20	30	50	70	others on request
Accuracy and stability								
Relative linearity error	d_{lin}	**x%F_{nom}**	± 1 / ± 1.5 / ± 2					
Relative repeatability error in unchanged mounting position	b_{rg}	**x%F_{nom}**	0.2					
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[2]	d_Q	**x%F_{nom}**	± 5					
Rated displacement	s_{nom}	**mm**	< 0.1					
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[3]		
		V	-			2...8, 3-wire[3]		
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 DC 14...30 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})[4]					
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 M12x1, 4-pin; MIL connector; Cable gland			Circular connector M12x1, 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 load pins with ignition protection type "ib" must only be supplied using galvanically-isolated power supplies. Suitable supply isolators are also optionally available eg. EZE08X030003
[2] This value can be reached when 100% F_{nom} act. 90° rotated to the axis. [3] Other SIL-shifts are available on request. [4] Other response times are available on request.

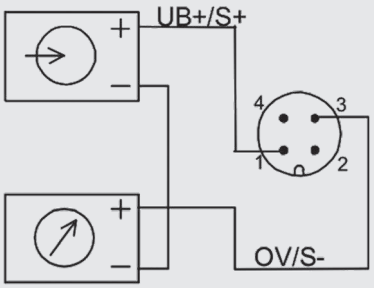
Mounting situation of the load pin



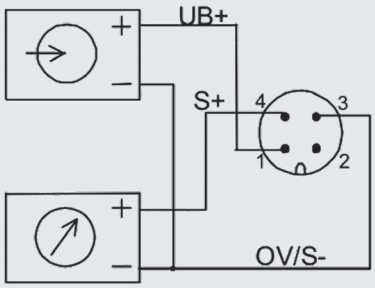
Dimensions: The customer-specific load pin drawing for the specific article number applies above all.
For the F5301/F53C1/F53S1 series, there are no standard dimensions. All dimensions in mm.

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	**2-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 (F53S1).
Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

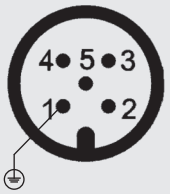
	4...20 mA/20...4 mA (redundant)	
	Connector 1	**Connector 2**
Supply: UB+	1	1
Supply: 0V/UB-	3	3
Signal: Channel 1	4	-
Signal: Channel 2	-	4
Screen ⏚	Case	Case

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.

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

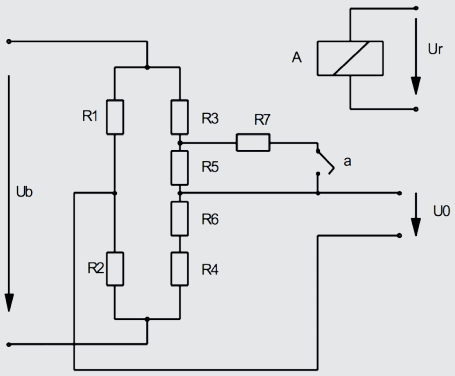


Circular connector
M12 x 1, 5-pin

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

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.

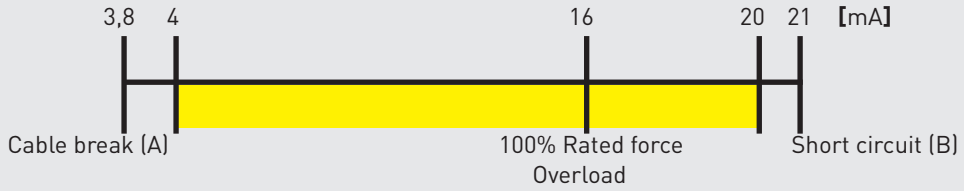
Compliance with functional safety

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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