

## 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
- Theater 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		
<b>Measurement range</b>										
Rated force	$F_{nom}$	kN	10	20	30	50	70	others on request		
<b>Accuracy and stability</b>										
Relative linearity error	$d_{lin}$	$x\%F_{nom}$	$\pm 1 / \pm 1.5 / \pm 2$							
Relative repeatability error in unchanged mounting position	$b_{rg}$	$x\%F_{nom}$	0.2							
Temperature effect on zero signal	$T_{K0}$	$\%/10\text{ K}$	0.2							
Temperature effect on characteristic value	$T_{KC}$	$\%/10\text{ K}$	0.2							
<b>Mechanical characteristics</b>										
Force limit	$F_L$	$x\%F_{nom}$	150							
Breaking force	$F_B$	$x\%F_{nom}$	300							
Lateral force effect <sup>1)</sup>	$d_Q$	$x\%F_{nom}$	$\pm 5$							
Rated displacement	$s_{nom}$	mm	< 0.1							
Material of measuring spring			corrosion resistant stainless steel ultrasonic tested 3.1 material / (optionally 3.2)							
<b>Temperature ranges</b>										
Rated temperature range	$B_{T, nom}$	$^{\circ}\text{C}$	-20...80				-20...80			
Operating temperature range	$B_{T, G}$	$^{\circ}\text{C}$	-30...80				-30...80			
Storage temperature range	$B_{T, S}$	$^{\circ}\text{C}$	-40...85							
<b>Electrical characteristics</b>										
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 <sup>®</sup> Configuration of device address and baud rate Sync/Async, Node/Lifeguarding, Heartbeat; Zero point and full scale up to $\pm 10\%$ by entries into object directory <sup>2)</sup>						
Current consumption		mA	Current output 4 ... 20 2-wire: signal current Current output 4 ... 20 3-wire: < 8 Voltage output: < 8, CANopen <sup>®</sup> : <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 <sup>®</sup>				DC 10...30 for current output			
Burden		Ohm	$\leq (UB-10\text{ V})/0.024\text{ A}$ for current output > 10 k $\Omega$ for voltage output				$\leq (UB-10\text{ V})/0.020\text{ A}$ (channel 1) for current output $\leq (UB-7\text{ V})/0.020\text{ A}$ (channel 2) for current output			
Response time		ms	$\leq 2$ (within 10% up to 90% $F_{nom}$ ) <sup>3)</sup>							
<b>General data</b>										
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 <sup>®</sup> 5-pin				2-circular connector M12x1, 4-pin			
Options			Certificates, Strength tests, 3D-CAD data (STEP, IGES) on request							

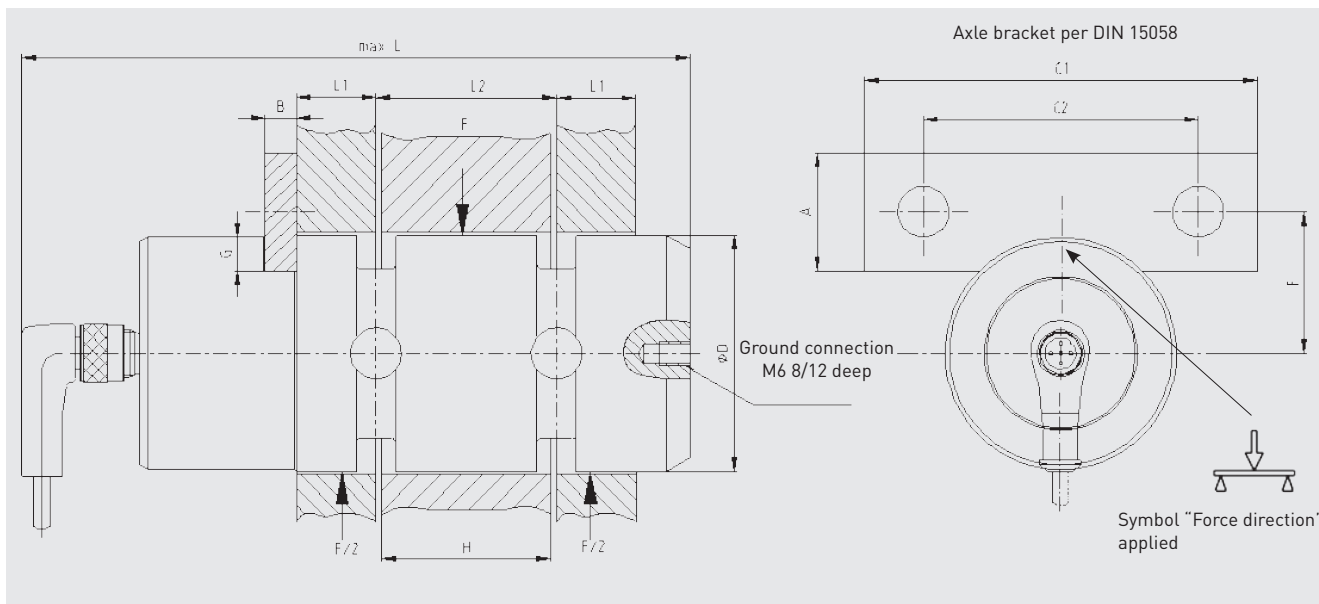
<sup>1)</sup> This value can be reached when 100%  $F_{nom}$  act. 90° rotated to the axis. <sup>2)</sup> Protocol acc. CiA DS-301 V.402. Device profile DS-404 V. 1.2. <sup>3)</sup> Other response times are available on request. CANopen<sup>®</sup> and CiA<sup>®</sup> are registered community trade marks of CAN in Automation e.V.

## Specifications in accordance with VDI/VDE/DK 2638

Model series	Symbol	Unit	F53C1 Version ATEX/IECEx Ex ib <sup>1)</sup>			F53C1 Version SIL-3 acc. EN 62061:2005		
			10	20	30	50	70	others on request
<b>Measurement range</b>								
Rated force	$F_{nom}$	<b>kN</b>	10	20	30	50	70	others on request
<b>Accuracy and stability</b>								
Relative linearity error	$d_{lin}$	<b>x%F<sub>nom</sub></b>	± 1 / ± 1.5 / ± 2					
Relative repeatability error in unchanged mounting position	$b_{rg}$	<b>x%F<sub>nom</sub></b>	0.2					
Temperature effect on zero signal	$T_{K0}$	<b>%/10 K</b>	0.2					
Temperature effect on characteristic value	$T_{KC}$	<b>%/10 K</b>	0.2					
<b>Mechanical characteristics</b>								
Force limit	$F_L$	<b>x%F<sub>nom</sub></b>	150					
Breaking force	$F_B$	<b>x%F<sub>nom</sub></b>	300					
Lateral force effect <sup>2)</sup>	$d_Q$	<b>x%F<sub>nom</sub></b>	± 5					
Rated displacement	$s_{nom}$	<b>mm</b>	< 0.1					
Material of measuring spring			corrosion resistant stainless steel ultrasonic tested 3.1 material / (optionally 3.2)					
<b>Temperature ranges</b>								
Rated temperature range	$B_{T, nom}$	<b>°C</b>	-20...80					
Operating temperature range	$B_{T, G}$	<b>°C</b>	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	$B_{T, S}$	<b>°C</b>	-40...85					
<b>Electrical characteristics</b>								
Output signal (rated output)	$C_{nom}$	<b>mA</b>	(4...)20, 2-wire				4...16, 2-wire <sup>3)</sup>	
		<b>V</b>	-				2...8, 3-wire <sup>3)</sup>	
Current consumption		<b>mA</b>	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		<b>V</b>	DC 10...30 for current output				DC 10...30 for current output DC 14...30 voltage output	
Burden		<b>Ohm</b>	≤ (UB-10 V)/0,024 A for current output, > 10 kΩ voltage output					
Response time		<b>ms</b>	≤ 2 (within 10% bis 90% F <sub>nom</sub> ) <sup>4)</sup>					
<b>General data</b>								
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)			<b>ATEX:</b> acc. EN 60079-0:2012 and EN 60079-11:2012 (Ex ib) or EN 60079-1:2007 (Ex d) <b>IECEx:</b> 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) <b>SIL:</b> acc. EN 62061:2005 <b>UL:</b> acc. UL 61010-1 and CSA C22.2 NO. 61010-1					

<sup>1)</sup> 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  
<sup>2)</sup> This value can be reached when 100% F<sub>nom</sub> act. 90° rotated to the axis. <sup>3)</sup> Other SIL-shifts are available on request. <sup>4)</sup> Other response times are available on request.

## Mounting situation of the load pin

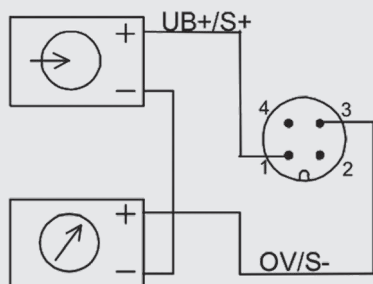


Dimensions: The customer-specific load pin drawing for the specific article number applies above all. For the F5301/F53C1/F53S1 series, there are no standard dimensions. All dimensions in mm.

## Pin assignment, analogue output

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

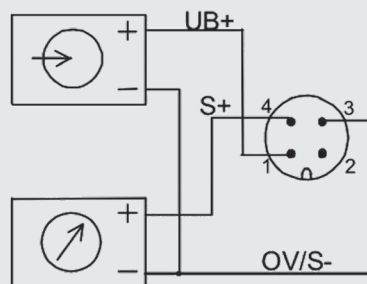
Circular connector M12 x 1, 4-pin



940E01

### 0...10 V output, 3-wire

Circular connector M12 x 1, 4-pin



940E04

## 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

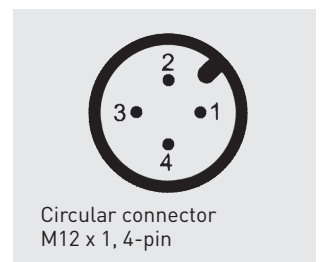
Cable outlet		
Cable colour	2-wire	3-wire
Brown	UB+/S+	UB+
White	UR+	UR+
Blue	0V/S-	0V/S-/UR-
Black	UR-	S+

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.

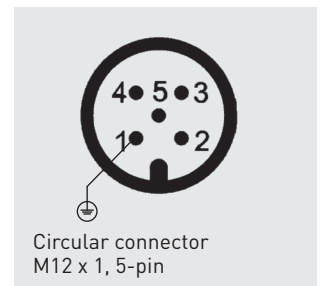
	4...20 mA/20...4 mA (redundant)	
	Connector 1	Connector 2
Supply: UB+	1	1
Supply: 0V/UB-	3	3
Signal: Channel 1	4	-
Signal: Channel 2	-	4
Screen ⊕	Case	Case



## 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

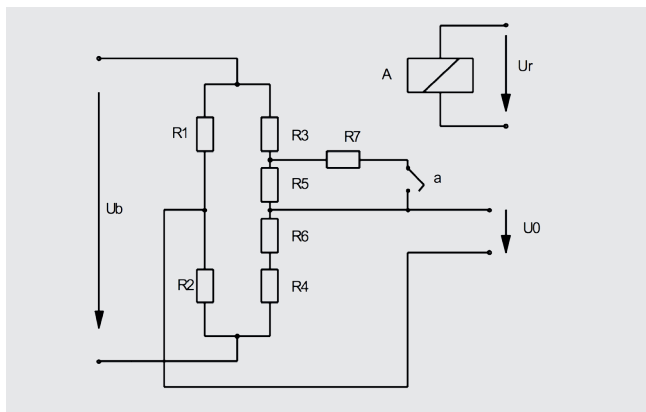


### List of abbreviations for connections

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  $U_0$ .

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  $U_r$  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.

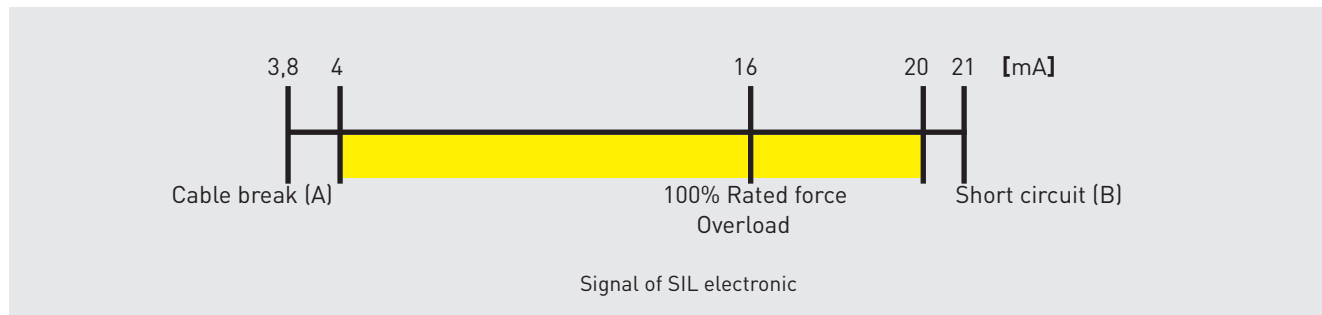
### Compliance with functional safety

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.:



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 relays. The measurement's upper limit of 20 mA will not be reached. This enables a check of the signal level.

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We reserve the right to make modifications to the specifications and materials.