Load pin
With thin-film technology up to 500 kN
Models F5301, F53C1, F53S1

Applications

- Load pins in guide rollers and roller bearings
- Crane systems and hoists
- Industrial weighing technology
- Machine building and plant construction, manufacturing automation
- Cable winch measurement

Load pin
Models F5301, F53C1, F53S1

Special features

- 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

Description

Load pins with welded-in thin-film sensors are designed for the measurement of static and dynamic pressure forces in various applications. Load pins can be integrated without difficulty into existing applications. Therefore, they can easily be exchanged for non-measuring pins (bolts). Since the load pins are adapted to meet the requirements of the application, there is no need for costly redesign.

The load pins are suitable for harsh environmental conditions and tough operational demands. They are maintenance-free and can also be mounted in hard-to-reach locations. Through the variety of output signals, these load cells adapt to a wide range of operating conditions.

ATEX/IECEx (optional)
- Mining
- Chemical and petrochemical industries
- Dust removal and filtration systems

In hazardous areas, only instruments and protective systems which are appropriately certified and marked may be brought into operation.

SIL 3 (optional)
For theatre and stage construction
- Above-stage machinery
- Below-stage machinery
- Point hoists, fly systems and theatrical rigging

Specifically for applications in stage technology, in co-operation with TÜV Süddeutschland, a safety electronics has been developed. When used in conjunction with a 2-channel processing system, this fulfils the SIL 3 safety standard.

Safety (optional)
- Crane systems
- Hoists

UL approval (optional)
These load cells are also available with UL approval.

Safety approval (optional)
The load cells are also 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, e.g. ELMS1 overload protection.

Measuring ranges
0 … 1 kN to 0 … 300 kN

Specifications in accordance with VDI/VDE/DKD 2638

Models	F5301	F53S1
Rated force F_{nom}	From 1t or 10 kN	
Force Limit F_L	150 % F_{nom}	
Breaking force F_B	> 300 % F_{nom}	
Relative linearity error d_{lin} [1]	1 % of FS	
Shear force influence d_Q (Signal with 100% F_{nom} under 90°)	≤ ±5 %	
Stability per year (typical)	±0.1 % of F.S.	
Service life	20 years	
Nominal deflection (typical) s_{nom}	< 0.1 mm	
Rated temperature $B_{T, nom}$	-20 … +80 °C (optional -40 ... +120 °C)	-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 (optional up to IP69k)	IP67
Noise emission	DIN EN 55011	
Noise immunity	DIN EN 61326-1 /DIN EN 61326-2-3 (optional EMC-strengthened versions)	
Electrical protection	Reverse polarity, overvoltage and short-circuit protection	
Output signals ■ Type of signal	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	**4 … 20 mA current output, 2-wire:** Signal current **4 … 20 mA current output, 3-wire:** < 8 mA **Voltage output:** < 8 mA **CANopen®:** <1W	**4 … 20 mA current output:** 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 (within 10 ... 90 % F_{nom}) [2]	
Electrical connection	Circular connector M12 x 1, 4-pin / CANopen® 5-pin, MIL connector (optional other connectors such as CIR or MS robust connectors)	2-connector variant, 4-pin or MIL connector
Material of the measuring device	1.4542 stainless steel, 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.

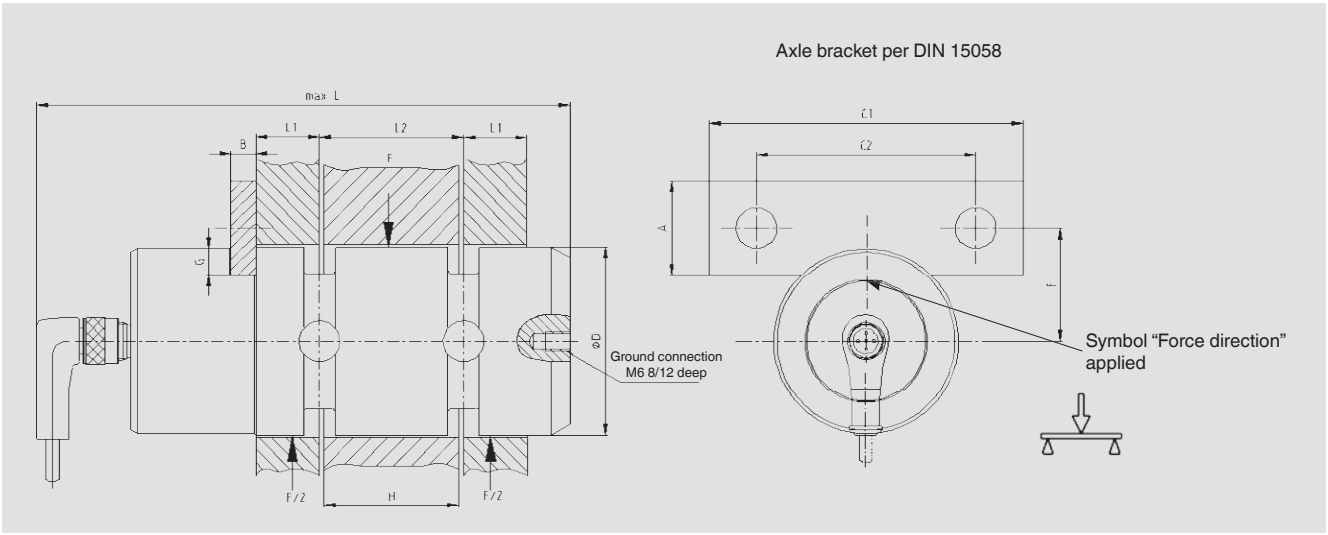
Specifications in accordance with VDI/VDE/DKD 2638

Models	F53C1 version ATEX/IECEx Ex ib[1)]	F53C1 version ATEX/IECEx Ex d	F53C1 version SIL 3 per EN 62061:2005
Rated force F_{nom}	From 1t or 10 kN		
Force limit F_L	150 % F_{nom}		
Breaking force F_B	> 300 % F_{nom}		
Relative linearity error d_{lin} [2)]	1 % of F.S.		
Shear force influence d_Q (Signal with 100% F_{nom} under 90°)	≤ ±5 %		
Stability per year (typical)	±0.1 % of F.S.		
Service life	20 years		
Nominal deflection (typical) s_{nom}	< 0.1 mm		
Rated temperature $B_{T, nom}$	-20 … +80 °C		
Operating temperature $B_{T, G}$	For operating temperatures, see operating instructions BD_BE_907 a		-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 polarity, overvoltage and short-circuit protection		
Output signals ■ Type of signal	4 … 20 mA, 2-wire	4 … 20 mA, 2-wire 4 … 20 mA, 3-wire	4 … 16 mA, 2-wire DC 2 … 8 V, 3-wire [3)]
■ SIL shift			4 mA, 2-wire DC 2 V, 3-wire [3)]
■ Current/power consumption	**4 … 20 mA current output, 2-wire:** Signal current	**4 … 20 mA current output, 2-wire:** Signal current **4 … 20 mA current output, 3-wire:** < 8 mA	**4 … 20 mA current output, 2-wire:** Signal current **4 ... 20 mA current output 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–10V)/0.024 A for current output > 10 kΩ for voltage output		
■ Response time	≤ 2 ms (within 10 ... 90 % F_{nom}) [4)]		
Electrical connection	Circular connector M12 x 1, 4-pin MIL connector, cable gland	Cable gland	Circular connector M12 x 1, 4-pin Cable gland
Material of the measuring device	1.4542 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 optional 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

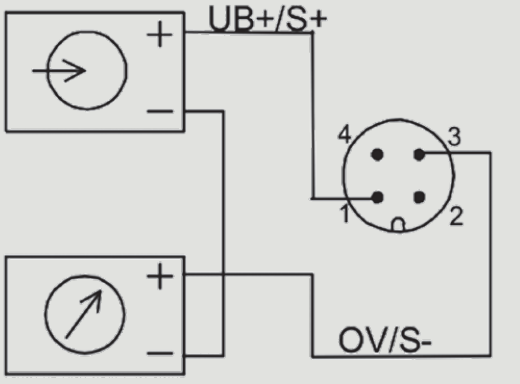
Mounting situation of the load pin



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.

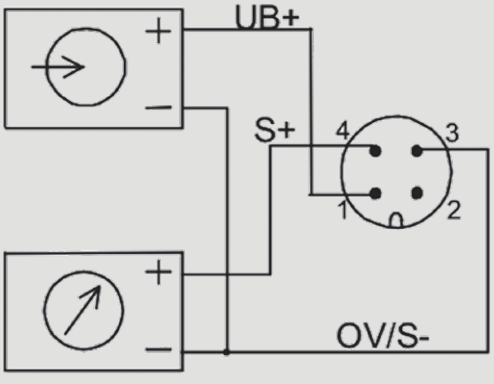
Pin assignment, analogue output

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	**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	ATEX Ex d, 4 … 20 mA, 2-wire	ATEX Ex d, 4 … 20 mA, 3-wire
Supply: UB+	1	1	1
Supply: 0V/UB-	3	3	3
Signal: S+	1	1	4
Signal: S-	3	3	3
Shield ⏚	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, 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

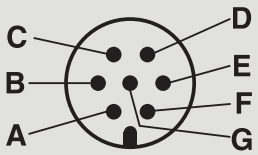
2-connector variant, for example, in combination with ELMS1 overload protection (F53S1).
Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

	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, 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	-

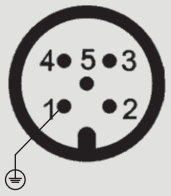


MIL-CA3102E 16S-1P-B

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



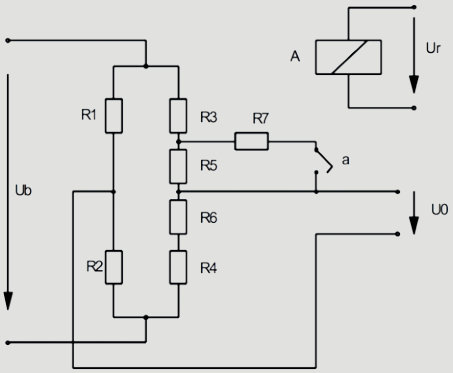
Circular connector
M12 x 1, 5-pin

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

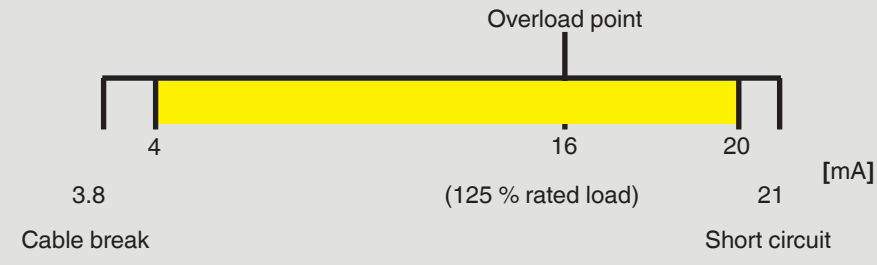
4 ... 20 mA or 0 ... 10 V amplifier electronics for SIL 3 applications with 2-channel computer control (approval through TÜV Süddeutschland, only for applications in stage technology).

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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