# Load pin Heavy Duty
# With thin-film technology from 10 kN
# Models F5308, F53C8, F53S8

## Rated force

From 0 ... 10 kN

## Applications

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

## 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

## Certificates

## Description

Load pins in Heavy Duty version are designed for static and dynamic measurement tasks. They directly replace existing bolts and determine the tension and compression forces in a wide scope of applications in harsh environments.

Load pins of this series are often used in hoist and crane systems, for example in construction cranes or in harbor and offshore cranes. Appropriate technical and regional approvals are available as an option.

The load cells F5308 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 heavy duty 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 | F5308 | F53S8 |
|---|---|---|---|---|
| **Measurement range** | | | | |
| Rated force | $F_{nom}$ | **kN** | from 0...10 | |
| **Accuracy and stability** | | | | |
| Relative linearity error[1)] | $d_{lin}$ | **x%$F_{nom}$** | ± 1 / ± 1.5 | |
| Repeatability[2)] | $b_{rg}$ | **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%$F_{nom}$** | 200 | |
| Breaking force | $F_B$ | **x%$F_{nom}$** | 500 | |
| Lateral force effect[3)] | $d_Q$ | **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 (optional -40...120) | -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,<br>(4...)20, 3-wire,<br>2 x (4...)20 redundant | Redundant opposing<br>4...20 mA/ 20...4 mA acc. the requirements for functional safety acc. Machinery Directive 2006/42/EG |
| | | **V** | (0...)10, 3-wire,<br>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<br>2-wire: signal current<br>Current output 4 ... 20 mA<br>3-wire: < 8 mA<br>Voltage output: < 8 mA,<br>CANopen®: <1W | Current output<br>4 ... 20 mA: signal current |
| Supply voltage | | **VDC** | 10...30 for current output,<br>14...30 for voltage output,<br>12...30 for CANopen® | 10...30 for current output |
| Burden | | **Ohm** | ≤ (UB–10 V)/0.024 A<br>for current output<br>> 10 kΩ for voltage output | ≤ (UB–10 V)/0.020 A<br>(channel 1) for current output<br>≤ (UB–7 V)/0.020 A<br>(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<br>(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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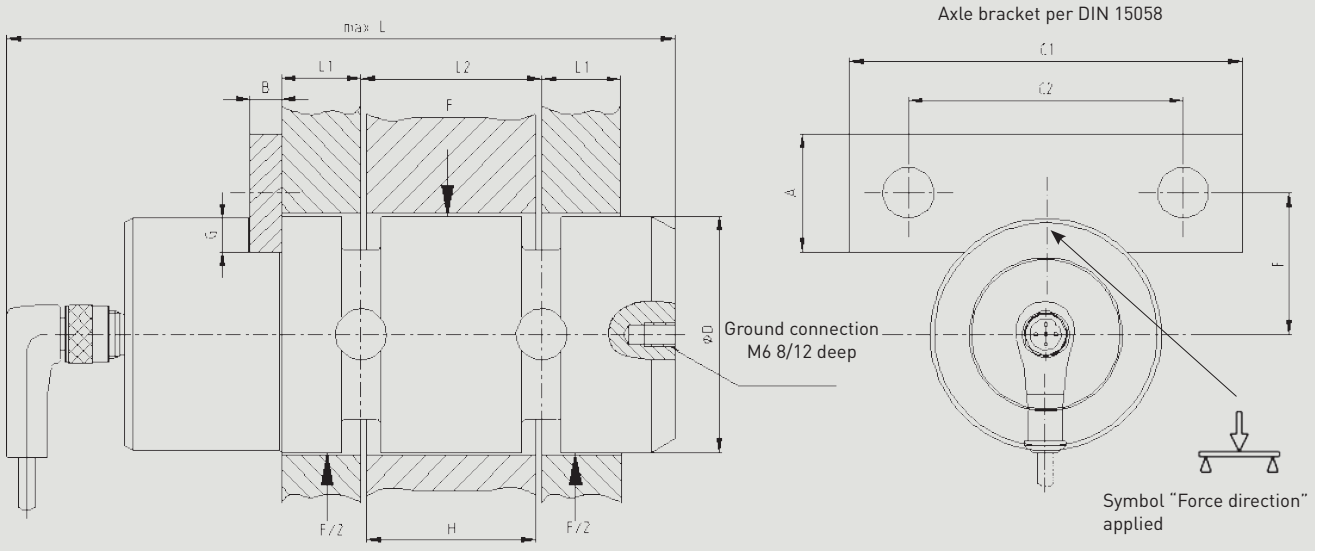
## Specifications in accordance with VDI/VDE/DKD 2638

| Model series | Symbol | Unit | F53C1 Version ATEX/IECEx Ex ib[1] | F53C1 Version ATEX/IECEx Ex d | F53C1 Version SIL-3 nach EN 061:2005 |
|---|---|---|---|---|---|
| **Measurement range** | | | | | |
| Rated force | **$F_{nom}$** | **kN** | from 0...10 | | |
| **Accuracy and stability** | | | | | |
| Relative linearity error[1] | **$d_{lin}$** | **x%$F_{nom}$** | ± 1 / ± 1,5 | | |
| Repeatability[2] | **$b_{rg}$** | **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%$F_{nom}$** | 200 | | |
| Breaking force | **$F_B$** | **x%$F_{nom}$** | 500 | | |
| Lateral force effect[3] | **$d_Q$** | **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<br>-25°C < Tamb < +85°C<br>Ex II 2G Ex ib IIC T3 Gb<br>-25°C < Tamb < +100°C<br>Ex I M2 Ex ib I Mb<br>-25°C < Tamb < +85°C<br>Ex II 2G Ex ib IIC T4 Gb<br>-40°C < Tamb < +85°<br>Ex I M2 Ex ib I Mb<br>(for cabel connection only) | Ex II 2G Ex d IIC T4 Gb<br>-40°C < Tamb < +85°C | -30...80 |
| Storage temperature range | **$B_{T, S}$** | **°C** | -40...85 | | |
| **Electrical characteristics** | | | | | |
| Signal type | | **mA** | (4...)20, 2-wire | (4...)20, 2-wire<br>(4...)20, 3-wire | 4 ... 16, 2-wire[5] |
| | | **V** | - | | 2 ... 8, 3-wire[5] |
| Current consumption | | **mA** | Current output 4 ... 20 mA<br>2-wire: signal current | Current output<br>4 ... 20 mA<br>2-wire: signal current,<br>Current output<br>4 ... 20 mA<br>3-wire: < 8 mA | Current output 4 ... 20 mA<br>2-wire: signal current,<br>Current output 4 ... 20 mA<br>3-wire: < 8 mA,<br>Voltage output: < 8 mA |
| Supply voltage | | **VDC** | 10...30 for current output | | 10 ... 30 VDC for current output<br>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;<br>MIL connector; Cable gland | Cable gland (only cables which approved for ATEX/IECEx Ex d) | 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)<br>**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)<br>**SIL:** acc. EN 62061:2005<br>**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] 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.

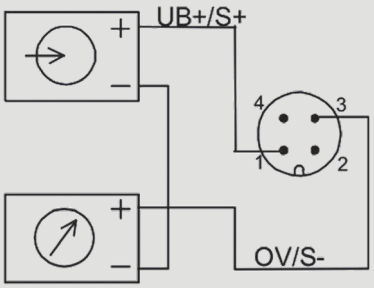
## Mounting situation of the load pin



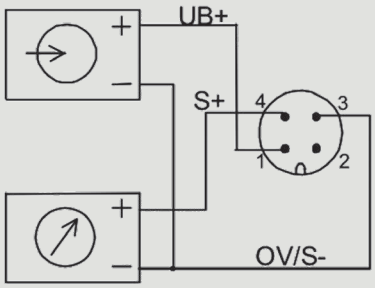

Dimensions: The customer-specific load pin drawing for the specific article number applies above all.
For the F5308/F53C8/F53S8 series, there are no standard dimensions. All dimensions in mm.

## 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 | 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

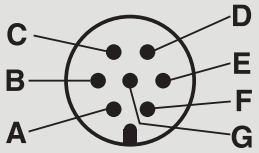
2-connector variant, for example, in combination with ELMS1 overload protection (F53S8).
Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

| | 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 | - |

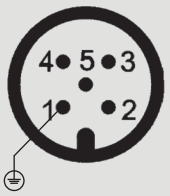


MIL-CA3102E 16S-1P-B

## 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 |



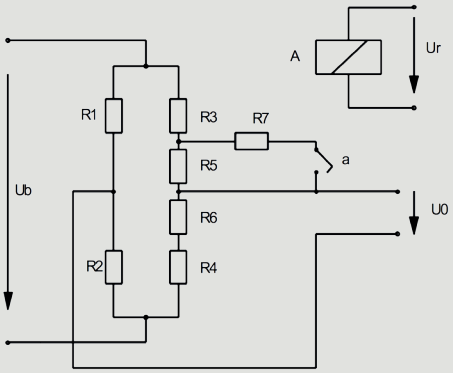
Circular connector
M12 x 1, 5-pin

| 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

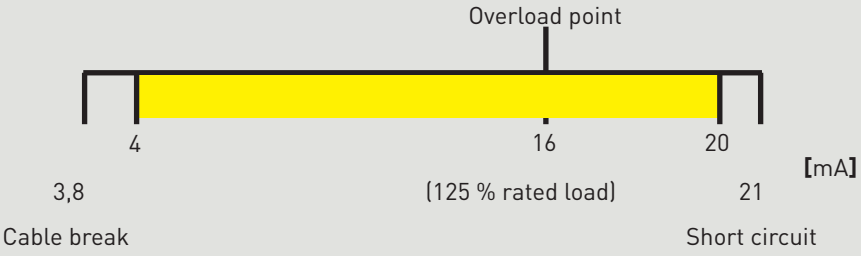
4 ... 20 mA or 0 ... 10 V amplifier electronics for SIL 3 applications with 2-channel computer control (approval through TÜV Süddeutschland, only for applications in stage technology).

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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