

Load pin with thin-film sensor for Heavy Duty applications

Optional

ATEX

 II 2G Ex ib IIC T4/T3


Description

The rugged design of these force transducers is needed for use in harsh operating conditions such as in cranes, construction machinery and for maritime applications. The sensors are suitable for force measurement in pulleys, fork bearings and roller bearings. The force is measured either directly in the full force flow or at a torque support in these locations. Because of their structural design, measuring axles can be installed as a direct substitute for clevis pins in existing structures. Sensitive components such as connectors or electronics are given mechanically protection.

In addition to our force transducer program with bonded foils, this new force transducer with a welded thin film sensor was developed. The usage of standardised sensors, which are welded into the measuring element, makes an automated manufacturing possible. Thin film sensors, produced by very modern manufacturing technology, have all advantages of the conventional bonded foil strain gauges, but without having their substantial disadvantages (temperature drifts of the glue and creeping).

Different output signals are available: analogue standard output signals 4...20 mA, 0...10V or an mV/V output signal. The load pins meet EMC requirements acc. to EN 61326-1:2006, EN 61326-2-3:2006 and work reliable in difficult electromagnetic environment. For safety relevant applications the load pins are optionally available in a redundant version.


ATEX (Option)

Only equipment and protective systems with the corresponding certification and markings are to be put into operation in potentially explosive areas. Our force transducers with a thin-film measuring cell and integrated amplifier now have approval according to directive 94/9/EC in equipment group II (non-mining products), category 2G for zones 1 and 2 (gases). Other zones on request.

Features

- thin film implants (instead of conventional bonded foil strain gauges)
- corrosion resistant stainless steel
- integrated amplifier
- small temperature drift
- high long term stability
- high shock and vibration resistance
- for dynamic or static measurements
- good repeatability
- easy to install
- MTTFd on request

ATEX (Option)

- redundant signal output
- CANopen®
- ATEX zone 1 and 2
 II 2G Ex ib IIC T4/T3

Measuring ranges

- 1t/10 KN and higher

Applications

- cranes and hoisting devices
- pulleys, fork bearings
- marine applications
- winches
- rope tension
- machine and plant construction

ATEX (Option)

- mining
- chemical and petrochemical industries
- dedusting and filtration units

Model: F5308, F53C8

Technical data

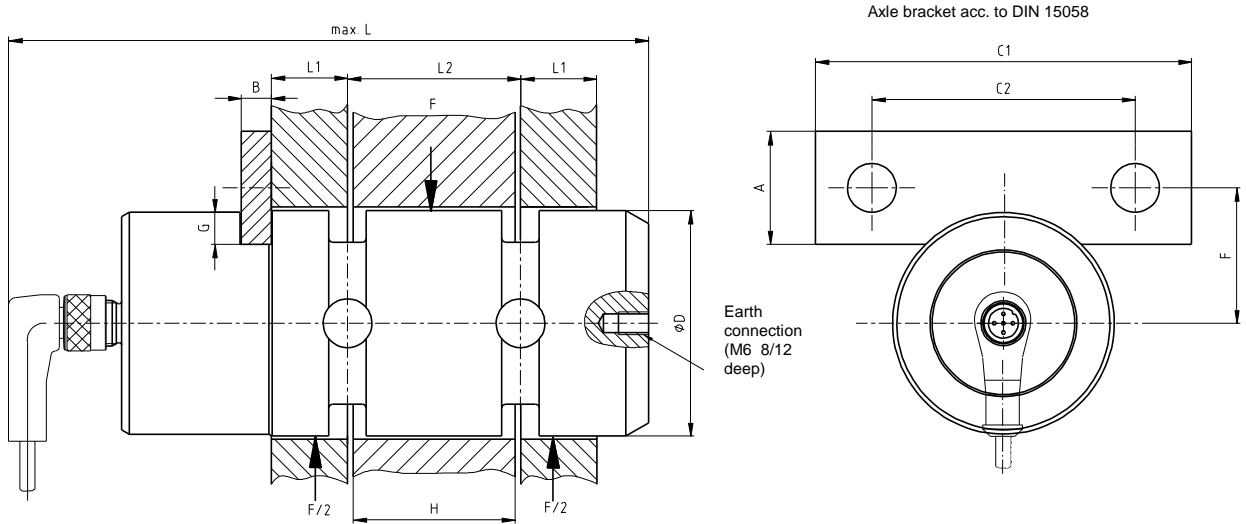
Model	F5308	F53C8 ATEX ¹⁾ (Option)
Nominal load F_{nom}	1t/10 KN and higher	
Limit load	200 % F_{nom}	
Breaking load	> 500 % F_{nom}	
Non-linearity (typical) ²⁾	$\leq \pm 1\%$ of F.S.	
Hysteresis	$\leq \pm 0,2\%$ of F.S.	
Cross sensitivity (Signal with 100% F_{nom} at 90°)	$\leq \pm 5\%$	
Stability (annual, typical)	$\leq \pm 0,1\%$ of F.S.	
Nominal deflection (typical)	<0,1mm	
Nominal temperature range	-20 ... 80°C (optional -40 ... 120°C)	
Service temperature range	-30°C ... 80°C (optional -40°C ... 80°C)	-30°C ... 80°C
Storage temperature	-40°C ... 85°C	
Temperature effect - span - zero signal	0,2 % F_{nom} / 10K 0,2 % F_{nom} / 10K	
Vibration resistance	20g, 100h, 50...150Hz acc. to DIN EN 60068-2-6	
Protection type (acc. to EN 60 529/IEC 529)	IP67 (optional IP69k)	
Emission	acc. to EN 61326-1:2006, EN 61326-2-3:2006	
Interference resistance	acc. to EN 61326 (optional EMC ruggedized version >200 V/m)	
Electrical protection	Reverse voltage, overvoltage and short-circuit protection	
Analogue output - Output signal	4 ... 20 mA; 2-wire 0 ... 10 V DC; 3-wire Redundant signal 2 x 4 ... 20 mA; 2-wire Redundant signal 2 x 0 ... 10 VDC; 3-wire CANopen [®] <i>Protocol acc. CiA DS-301 V.402, Device profile DS-404 V. 1.2 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</i>	
- Electron. Life-Test	optional	
- Current consumption	Current output 4 ... 20 mA: signal current; Voltage output approx. 8 mA CANopen [®] : <1W	
- Power requirement	10 ... 30 V DC for current output 14 ... 30 V DC for voltage output 12 ... 30 VDC for CANopen [®]	
- Burden	$\leq (UB-6 V) / 0.024 A$ for current output > 10 k Ω for voltage output	
- Response time	$\leq 2 ms$ (within 10 % ... 90 % F_{nom})	
Electrical connection	Circular connector M 12x1, 4-pin / CANopen [®] 5-pin (other connectors like CIR or MIL plugs optional)	
Material of measuring device	corrosion resistant stainless steel ultrasonic tested 3.1 material / (optionally 3.2)	
Options	Certificates, stress analysis, finite element analysis, provision of 3D-CAD files (e.g. STEP, IGES) on request	

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: EZE08X030003 (1-channel) und EZE08X03000x (2-channel).

²⁾ Depending on application specific geometry

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Installation sketch of a load pin F5308/F53C8



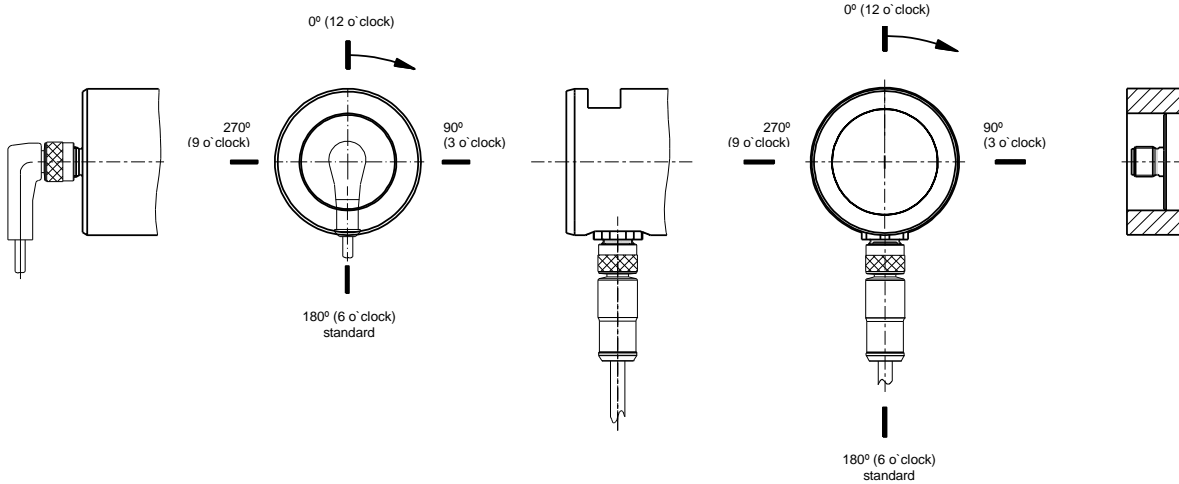
The dimensions for the load pins are according to the customer requirements of the existing bearing.

Connecting Options (described with M12x1 plug)

1. Axial plug (optionally aligned)

2. Radial plug ($D \geq 45$)

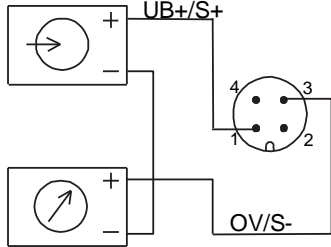
3. Recessed plug ($D \geq 50$)



Electrical connection

Output Signal 4..20mA (2-wire)

Circular connector M12x1, 4-pin

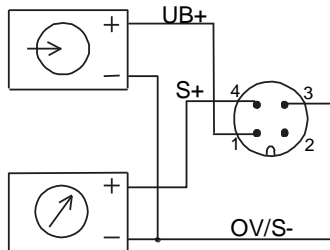


940E01

4..20mA (2-wire)	Pin
Supply: UB+	1
Supply: 0V	3
Signal: S+	1
Signal: S-	3
Screen	thread M12x1

Output Signal 0...10V (3-wire)

Circular connector M12x1, 4-pin



940E04

0..10V (3-wire)	Pin
Supply: UB+	1
Supply: 0V	3
Signal: S+	4
Signal: S-	3
Screen	thread M12x1

CANopen®

Circular connector M12x1, 5-pin



CANopen®	Pin
Supply: UB+ (CAN V+)	2
Supply: 0V (CAN GND)	3
Bus-Signal: CAN-High	4
Bus-Signal: CAN-Low	5
Screen	1

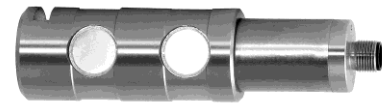
Subject of technical changes

Load pin with thin-film sensor for OEM applications

Accuracy: 2% or 1%
Output signals: 4...20 mA; 2-wire,
 0...10 VDC; 3-wire
 CANopen®

Optional ATEX/IECEX
 Ex II 2G Ex ib IIC T4/T3

Optional for SIL3-Applications
 with 2-channel PC control



Description

In addition to our force transducer program with bonded foils, a new force transducer with a welded thin film sensor was developed. The usage of standardised sensors, which are welded into the measuring element, makes an automated manufacturing possible. Combined with an accuracy of 2% or 1%, the load pins are also of interest for OEM applications due to the attractive price-performance ratio.

Thin film sensors, produced by very modern manufacturing technology, have all advantages of the conventional bonded foil strain gauges, but without having their substantial disadvantages (temperature drifts of the glue and creeping).

Load pins are suited to mounting in deviation rolls, fork heads and rolling bearings. Due to their structural shape load pins fit into the constructions directly replacing on existing bolt.

Different output signals are available: analogue standard-output signals (4...20 mA, 0...10V) or CANopen®-fieldbus. Load pins fulfil the regulations of EMC according to directive EN 61326.

ATEX/IECEX (Option)

Only equipment and protective systems with the corresponding certification and markings are to be put into operation in potentially explosive areas. Our force transducers with a thin-film measuring cell and integrated amplifier now have approval according to directive 94/9/EC in equipment group II (non-mining products), category 2G for zones 1 and 2 (gases). Other zones on request.

SIL-3 (Option)

In cooperation with the TÜV Süddeutschland a special security electronics has been developed for theatre and stage applications. It fulfils security standard SIL 3 with a 2-channel PC control in connection.

This international security standard for systems and processes is based on the standards IEC 61508 and 61511. The latter is used for ascertaining risk potentials of (engineering) systems. Depending on the potential existing risk a risk reduction has to be made. If automation components are used for that, they have to fulfil the demands of IEC 61508.

Both standards subdivide systems and risk reducing actions in four security steps: **SIL1...SIL4 (Safety Integrity Level)** – from small up to very high risks. If persons are allowed to stay under hanging loads, e.g. in theatres, security level 3 (SIL 3) is valid.

UL-Certification (Option)

tecsis force transducers are also available with UL approval.

FM and CSA Approval submitted.

Features

- thin film implants (instead of conventional bonded foil strain gauges)
- corrosion free stainless steel
- integrated amplifier
- small temperature drift
- high long term stability
- high shock and vibration resistance
- for dynamic or static measurements
- good repeatability
- easy to install

ATEX/IECEX (Option)

- for Zone 1 and 2
- Ex II 2G Ex ib IIC T4/T3

SIL-3 (Option)

- Security electronic
- SIL-3 approval with 2-channel PC control; accreditation: TÜV-Süd-Nr. 2005-08-11/tecsis

Measuring ranges

- 5 kN ... 50 kN

Applications

- shear bolt in deviation rolls and mountings on rolling bearings
- industrial weighing
- automation of the manufacturing process
- measuring of tensions in cables
- machine and plant construction

ATEX/IECEX (Option)

- Mining
- Chemical and petrochemical industries
- Dedusting and filtration units


SIL-3 (Option)

For theatre and stage design:

- Above-stage machinery
- Below-stage machinery
- Point hoists
- Bar hoists

Model: F5301, F53C1

Technical data

Model	F5301	F53C1 ATEX/IECEx ¹⁾ (Option)	F53C1 SIL-3 (Option)
Nominal load F_{nom}	5 / 10 / 20 / 30 / 50 kN ²⁾	5 / 10 / 20 / 30 / 50 kN ²⁾	5 / 10 / 20 / 30 / 50 kN ²⁾
Limit load	150 % F_{nom}		
Breaking load	> 300 % F_{nom}		
Non-linearity	2.0 or 1.0 % of F.S.		
Cross sensitivity (Signal with 100% F_{nom} at 90°)	≤ ± 5 %		
Hysteresis	< 0.2 % C_n of F.S.		
Max. dynamic load	± 80% F_{nom} acc. to DIN 50100		
Nominal deflection	see table		
Nominal temperature range	-20 ... +80°C		
Service temperature range	-40 ... +80°C		
Storage temperature	-40 ... +85 °C		
Temperature effect	0.2 % F_{nom} / 10K		
- span	0.2 % F_{nom} / 10K		
- zero signal			
Vibration resistance	20g, 100h, 50...150 Hz acc. to DIN EN 60068-2-6		
Protection type (acc. to EN 60 529/IEC 529)	IP 67		
Noise emission	acc. to EN 61326		
Noise immunity	acc. to EN 61326		
Analogue output			
- Output signal	4 ... 20 mA; 2-wire 0 ... 10 V DC; 3-wire		4 ... 16 mA - 2-wire; 0 ... 7 V - 3-wire
- Current consumption	Current output 4 ... 20 mA: signal current; Voltage output approx. 8 mA		Current output: signal current; Voltage output approx. 8 mA
- Power requirement	10 ... 30 V DC for current output 14 ... 30 V DC for voltage output		
- Burden	≤ (UB-6 V) / 0.024 A for current output > 10 kΩ for voltage output		
- Response time	≤ 1 ms (within 10 % ... 90 % F_{nom})		≤ 5 ms (within 10 %-90 % F_{nom})
Electrical connection	Circular connector M 12x1, 4-pin		
Material of measuring device	stainless steel		
Weight	see table		
CANopen[®] – data not shown separately correspond to the product with analogue output			
Output signal	CANopen [®] protocol acc. to CiA DS-301, Device profile DS-404 Communication services: LSS (CiA DSP 305) Services: Configuration of device address and baud rate; sync/async; node/lifeguarding, heartbeat		
Repeatability	≤ ± 0.1% of F.S.		
Stability per year	≤ ± 0.2% of F.S. at reference conditions		
Power requirement	12 ... 30 V DC		
Power consumption	< 1 W (with galvanic isolation)		
Adjustment	Zero point and span to ±10% by entries into object directory		
Response time	1 ms (baud rate ³ 125K) within 10... 90% of C_n F.S.		
Electrical connection	Circular connector M12 x 1 - 5-pin		
Relay power supply U_R			Standard 24 V, max. 1.5 x UR, min. 0.8 x UR
Power consumption relay P_R			approx. 100 mW
Signal amplitude			4 ± 0.2 mA resp. 3 ± 0.2 V, others upon request
Certification		 II 2G Ex ib IIC T4/T3	TÜV: 2005-08-11/teccis

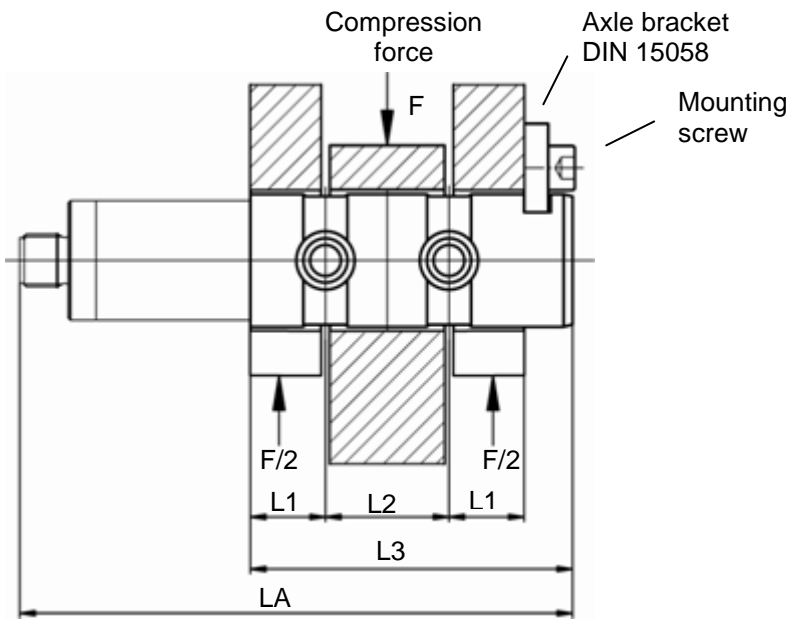
Construction: stainless steel material

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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: EZE08X030003 (1-channel) und EZE08X03000x (2-channel).

²⁾ For higher nominal load see model F5308/F53C8

Example of installation: load pin with surrounding parts



Arrangement of bearings at two ends: Tolerance of bearing-/ bolt pair H9/ f9

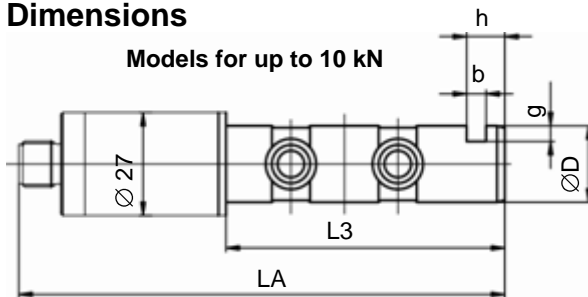
Measuring range [kN]	Dimensions in mm														Nominal deflection mm	Weight g
	$\varnothing D$ (f9) ¹⁾	LA	ANALOGUE	CAN ²⁾	L1	L2	L3	a	b	c1	c2	$\varnothing d$	f	g		
5	20	105	120	10	20	50.5	20	5	60	36	9	16	4.0	10	< 0.05	230
10	25	115	130	12.5	25	60.5	20	5	60	36	9	18	4.5	10		300
20	30	125	140	15	30	72.5	25	6	80	50	11	22	5.5	12		430
30	35	135	150	17.5	35	82.5	25	6	80	50	11	24	6	12		630
50	40	150	165	22.5	40	97.5	25	6	80	50	11	26	6.5	12		950

¹⁾ other load pin- \varnothing on demand

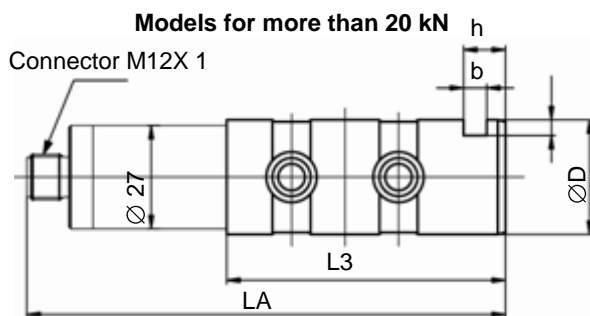
²⁾ case diameter 40 mm

Dimensions

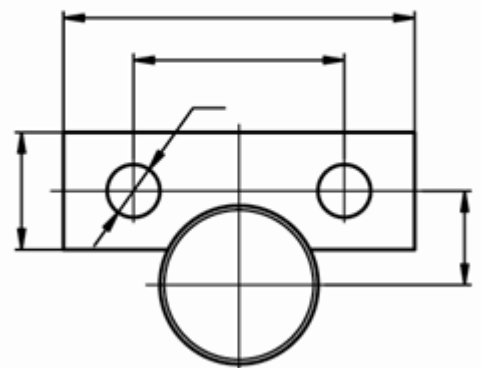
Models for up to 10 kN



Models for more than 20 kN



Axle bracket acc. to DIN 15 058
(to be ordered separately)

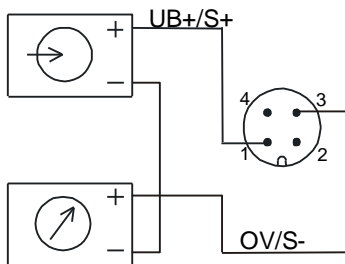


Electrical connection

F5301/F53C1 ATEX/IECEX (Option)

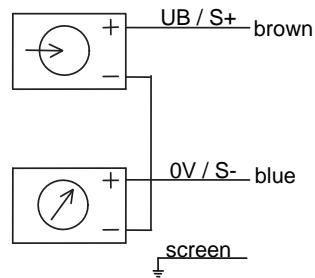
Output signal 4..20mA (2-wire)

Circular connector M12x1, 4-pin



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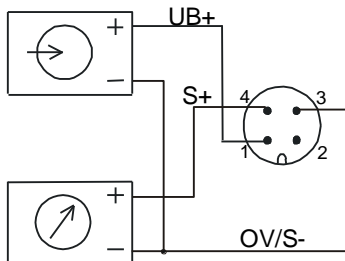
Cable outlet



940E03

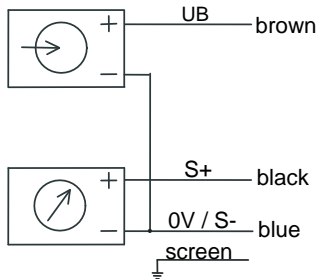
Output signal 0...10V (3-wire)

Circular connector M12x1, 4-pin



940E04

Cable outlet



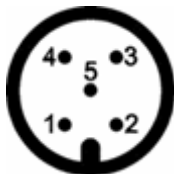
940E06

Pin configuration of connector M12x1 (4-pin) /

Open cable outlet of the tectsis standard connection cable (STL 288, black)

Analogue output Electrical connection	4...20 mA (2 – wire)		0...10 VDC (3 – wire)	
	pin	cable outlet	pin	cable outlet
Supply: UB+	1	brown	1	brown
Supply: 0V	3	blue	3	blue
Signal: S+	1	brown	4	black
Signal: S-	3	blue	3	blue
⊕	thread M12x1	screen	thread M12x1	screen

CANopen®



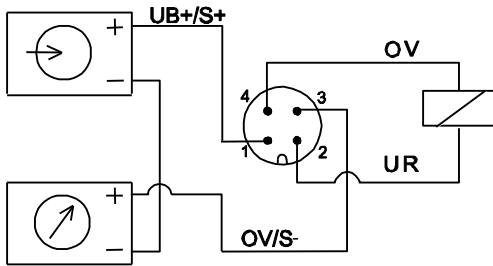
Connexion plug arrangement M12x1 (5-pin)

CANopen®	Pin
UB+ (CAN V+)	2
UB- (CAN GND)	3
Bus signal CAN-High	4
Bus signal CAN-Low	5
Screen	1

F53C1 SIL-3 (Option)

Analogue output 4..20mA (2-wire)

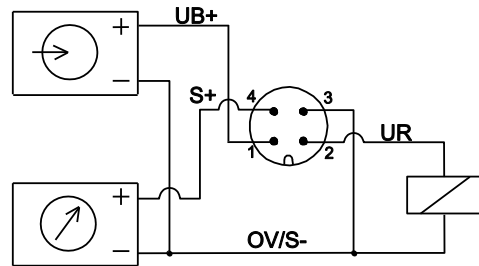
Circular connector M12x1, 4-pin



940E01

Analogue output 0...10V (3-wire)

Circular connector M12x1, 4-pin



940E04

Pin configuration of connector M12x1 (4-pin) /

Open cable outlet of the tectis standard connection cable (STL 288, black)

Analogue output Electrical connection	4...20 mA (2 – wire)		0...10 VDC (3 – wire)	
	pin	cable outlet	pin	cable outlet
Supply: (UB+)	1	brown	1	brown
Supply: (OV)	3	blue	3	blue
Supply Relay: (UR)	2	white	2	white
Supply Relay: (OV)	4	black	3	blue
Signal: (+)	1	brown	4	black
Signal: (-)	3	blue	3	blue
⊥	thread M12x1	screen	thread M12x1	screen

Brief description SIL-3

Amplifier-Electronics 4...20mA or 0...10V
for SIL-3 applications with 2-channel PC control
 (Certified by TÜV Süddeutschland, Germany)



Certificate-no.: 2005-08-11/tecsis

Force Transducers, which are based on strain gauges, 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. 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.

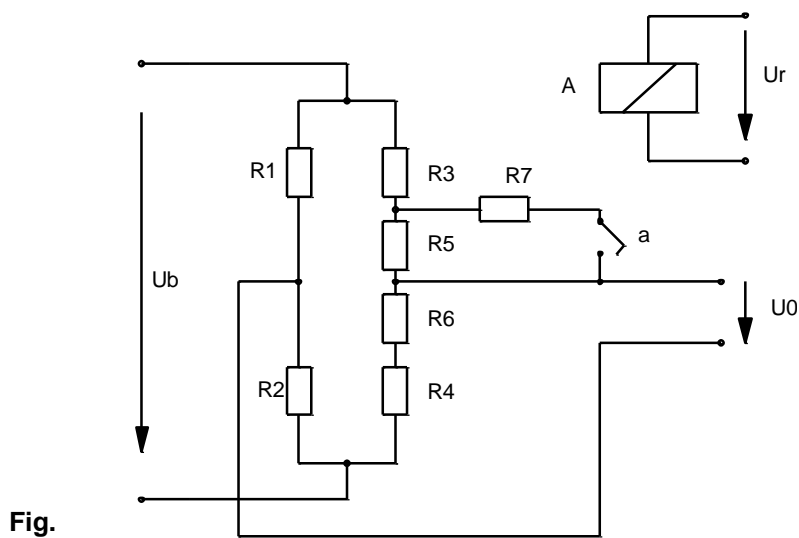
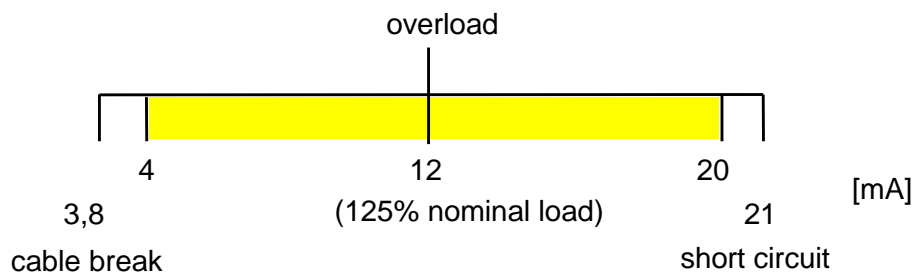


Fig.

The connection of resistor R7 will always result in a defined unbalancing of the zero point (diagonal voltage) of the Wheatstone Bridge.

An external independent control unit activates relay A which changes the output by a certain value. Because of security reasons the control unit has to be a 2-channel one. When the expected change of the output signal is detected it can be assumed that the whole signal path (Wheatstone Bridge – amplifier – output) works well. If it does not appear it can be concluded that there is a defect in the signal path.

The standard adjustment of force transducers with current output for overload control is e.g.:



With activating the check relay a fixed signal jump of 8 mA will exceed the overload limit in every working condition. The measurement's upper limit of 20 mA however will never be reached. This makes the checking of the signal jump possible.

Subject of technical changes