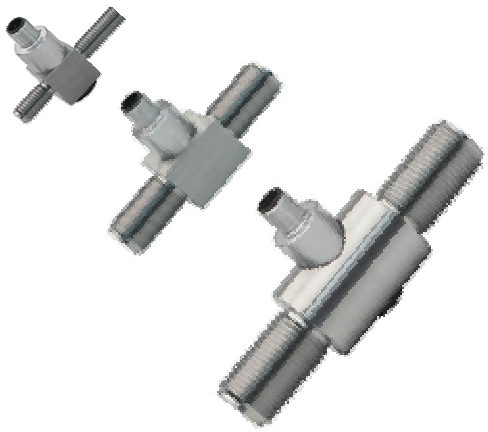
Tension/compression force transducers with thin-film sensor



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

Optional for SIL3-Applications with 2-channel PC control

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

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 0,2%, the new tension / compression force transducers 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).

Tension / compression force transducers can be applied directly into the force flux. They are used for weight measuring or as an overload protection. In machineries they are used to monitor press-capacities, clamping forces. Mounted indirectly they can be used as torque supports in order to supervise momentums.

Different output signals are available. These force transducers fulfil the regulations of EMC according to directive EN 61326.

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: **SIL**1...SIL4 (**S**afety **I**ntegrity **L**evel) – 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.

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

SIL-3 (Option)

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

Measuring ranges

Tension and compression forces
from 1 kN … 500 kN

Applications

- hoists, cranes
- screw down forces in machinery
- process automation
- mechanical engineering and machinery

SIL-3 (Option)
For theatre and stage design:

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

Specific information

- Counter nuts included

Model: F2301, F23C1

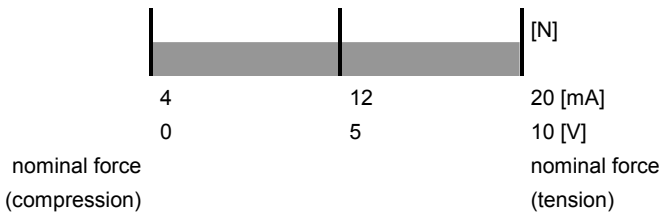
Technical data

Model	**F2301**	**F23C1 SIL-3 (Option)**
Nominal load F_{nom}	1 / 2 / 3 / 5 / 10 / 20 / 30 / 50 / 100 / 200 / 300 / 500 kN	2 / 3 / 5 / 10 / 20 / 30 kN
Accuracy	< 0,2 % C_n	
Limit load	150 % F_{nom}	
Breaking load	> 300 % F_{nom}	
Combined error	≤± 0.2% of F.S.	
Hysteresis	≤± 0.1 % of F.S. C_n	
Max. dynamic load	± 50 % F_{nom} acc. to DIN 50100 *)	
Creep, 30 min. at F_{nom}	≤± 0.1 % of F.S. C_n	
Nominal deflection	see table	
Nominal temperature range	-20 … +80 °C	
Service temperature range	-40 … +80 °C	
Storage temperature range	-40 … +85 °C	
Temperature effect - span - zero	≤± 0,2 % of F.S. /10K ≤± 0,2 % of F.S. /10K	
Vibration resistance	20g, 100h, 50...150Hz acc. to DIN EN 60068-2-6	
Protection type (acc. to EN 60529/IEC 529)	IP 67	
Noise emission	acc. to EN 61326	
Noise immunity	acc. to EN 61326	
Insulation resistance	> 5 GΩ / 50 V	
Electrical protection	Reverse voltage, overvoltage and short circuit protection	
Analogue output		
- Output signal	4 … 20 mA; 2-wire (4 (compression) … 20 (tension) mA)	4 … 16 mA – 2-wire;
- (max. span of output signal: C_n)	0 … 10 V; 3-wire (0 (compression) … 10 (tension) V)	0 ... 7 V – 3-wire
- Bridge resistance	2 mV/V	
- Current consumption	approx. 6.500 Ω 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-6V) / 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, Option: Cable junction	
Relay power supply U_R Power consumption relay P_R Signal amplitude		Standard 24 V, max. 1.5 x UR, min. 0.8 x UR approx. 100 mW 4 ± 0.2 mA resp. 3 ± 0.2 V, others upon request
Material of measuring device	stainless steel	
Material counter nut	nickel-plated steel	

*) for higher load please order higher load class

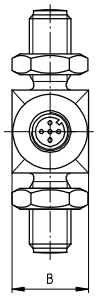
of F.S. = full scale value

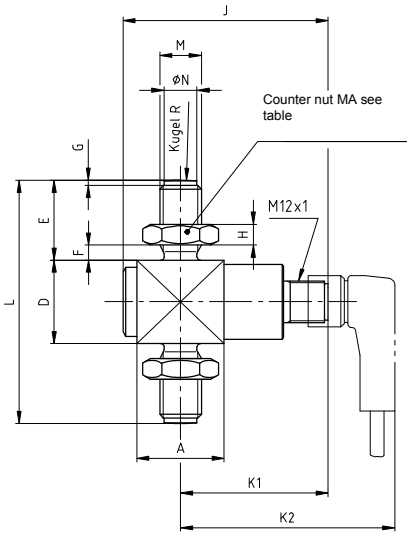
Tension/Compression



Dimensions

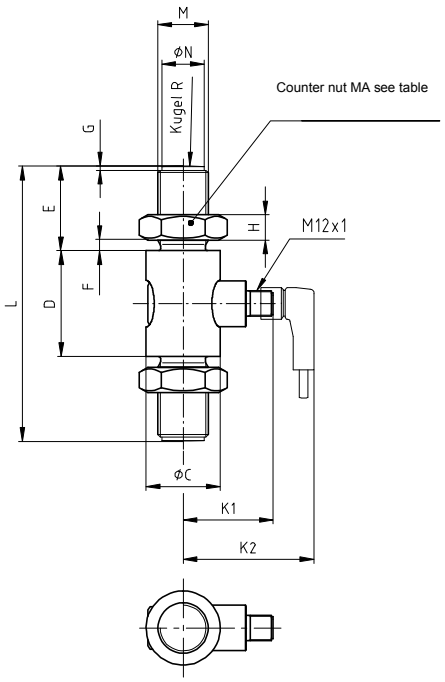
Version
1 - 30 kN





Nominal load kN	Dimensions (mm)																
	A	B	D	E	F	G	H	J	K1	K2	K3	L	M	ØN -0,1	Bowl R	M_A Nm	Nominal deflection
1/2/3	25,2	22	24	23	4,3	1,5	6	59	43	62	66	70	M12	9,5	60	60	< 0,5
5																	
10			31									77			80		
20		26	33	34	3,8	2	10					101	M20 X 1,5	17	100	300	< 0,1
30	27,5	27,5	40					61,5	44	63	67	108			120		

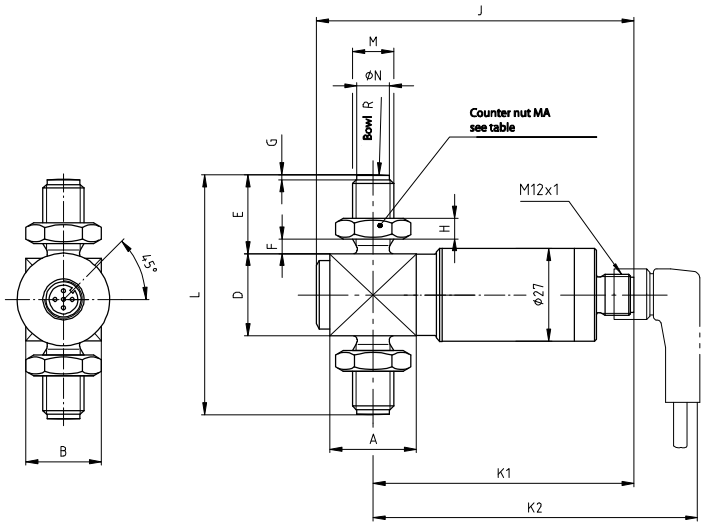
Version
> 50 kN



Nominal load kN	Dimensions (mm)														
	ØC	D	E	F	G	H	K1	K2	K3	L	M	ØN -0,1	Bowl R	M_A Nm	Nominal deflection
50	35	50	40	5	2	12	43	62	66	130	M24 x2	20	150	500	< 0,1
100	54	54	68	10	3	19,5	44	64	68	190	M39 x3	34	200	2.500	< 0,2
200	67	67	82	12		22,5	45	65	69	231	M45 x3	40	250	4.000	
300	73	73	98	14		28	49	69	73	269	M56 x4	50	300	6.000	
500	94	94	113	17		32	59	79	83	320	M64 x4	58	400	9.000	

SIL-3 (Option)

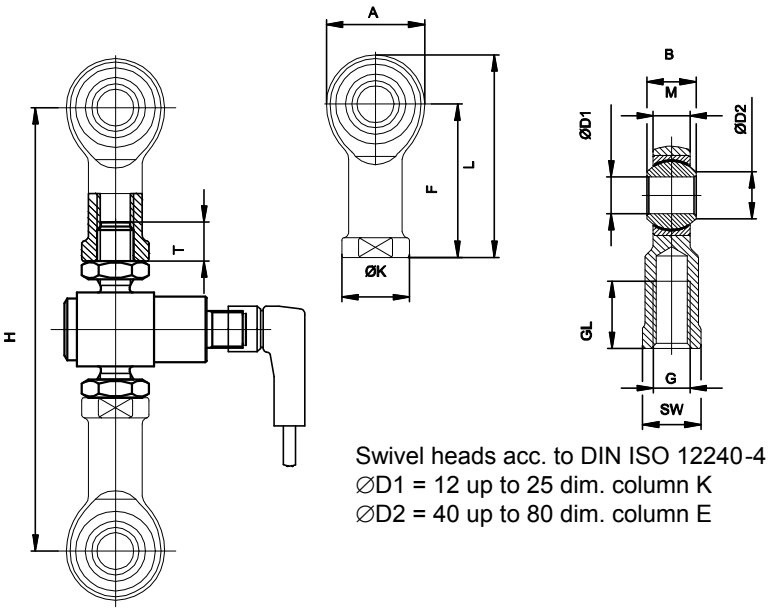
Version
2 - 30 kN



Nominal load kN	Dimensions (mm)														
	A	B	D	E	F	G	H	J	K1	K2	L	M	ØN -0,1	Bowl R	M_A Nm
2	25,2	22	24	23	4,3	1,5	6	89	72	91,5	70	M12	9,5	60	60
3															
5															
10			31								77			80	
20		26	33	34	3,8	2	10				101	M20 X 1,5	17	100	300
30	27,5	27,5	40					91,5	73	92,5	108			120	

Dimensions incl. swivel head

Dimensions incl. swivel ends (mm)		
F_{nom} (kN)	H	Min. screw in depth T
1/2/3	148±3	9,5
5		
10	155±3	
20	219±4	16
30	226±4	
50	276±4	19,5
100	405±7	31
200	466±13	36
300	568±11	45
500	665±13	51



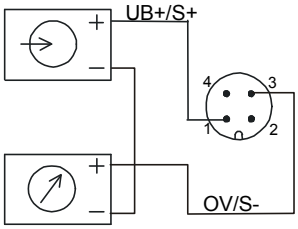
Swivel heads acc. to DIN ISO 12240-4
∅D1 = 12 up to 25 dim. column K
∅D2 = 40 up to 80 dim. column E

Nominal load kN	Weight in kg	A	B	ØD1	ØD2	F	G	GL	ØK	L	M	SW
1…10	0,115	32	16	12 H7	15,4	50	M12	22	22	66	12	19
20…30	0,415	50	25	20 H7	24,3	77	M20 x 1,5	33	34	102	18	32
50	0,750	60	31	25 H7	29,6	94	M24 x 2	42	42	124	22	36
100	2	92	28	40 -0,012	45	142	M39 x 3	65	65	188	23	55
200	3,5	112	35	50-0,012	56	160	M45 x 3	68	75	216	30	65
300	8,6	160	49	70-0,015	77,9	200	M56 x 4	80	98	280	42	85
500	12	180	55	80-0,015	89,4	230	M64 x 4	85	110	320	47	100

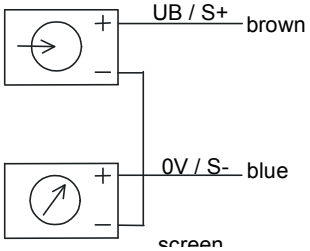
Electrical connection

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

Circular connector M12x1, 4-pin

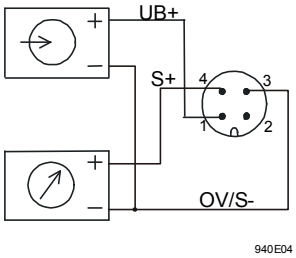


Cable outlet

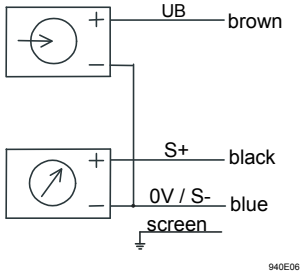


Output signal 0...10V (3-wire)

Circular connector M12x1, 4-pin



Cable outlet



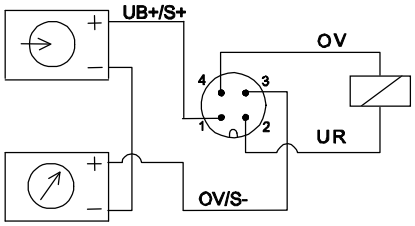
Pin configuration M12x1 (4-pin) /
Open cable outlet of the tecsis standard connection cable (STL 288, black)

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

SIL-3 (Option)

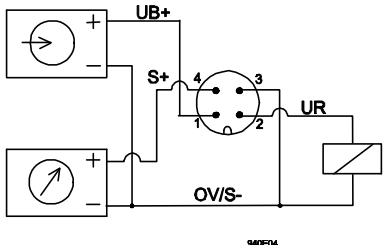
Output signal 4..20mA (2-wire)

Circular connector M12x1, 4-pin



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

Circular connector M12x1, 4-pin



Pin configuration M12x1 (4-pin) /
Open cable outlet of the tecsis standard connection cable (STL 288, black)

	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
Supply Relay: (UR)	2	white	2	white
Supply Relay: (0V)	4	black	3	blue
Signal: (+)	1	brown	4	black
Signal: (-)	3	blue	3	blue
⏚	thread M12x1	screen	thread M12x1	screen

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.

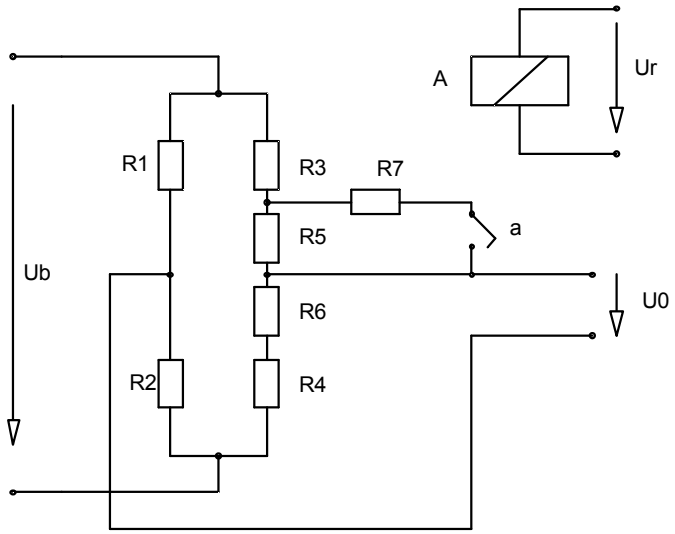
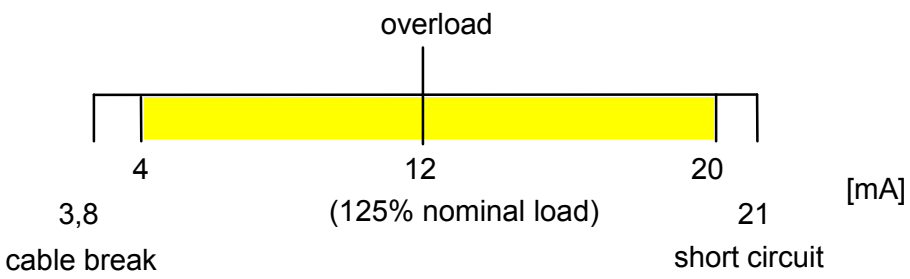


Fig.

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