

Shear beam

With thin-film technology up to 100 kN

Models F3301, F33C1, F33S1



WIKA data sheet FO 51.42



Applications

- Industrial weighing technology
- Machine building and plant construction, manufacturing automation
- Theatre and stage construction
- Chemistry and petrochemistry
- Weighing in safety applications

Special features

- Measuring ranges 0 ... 2 kN up to 0 ... 100 kN
- Corrosion-resistant stainless steel design
- Integrated amplifier
- High long-term stability, high shock and vibration resistance
- Good reproducibility, simple installation

Description

Shear beams are designed for static and dynamic measurement tasks. They determine the shear forces in a wide scope of applications.

These load cells are often used for industrial weighing as well as for special machine constructions, production automation and stage systems. Furthermore, they are used in laboratory technology and in process industry to determine the torque. Appropriate technical and regional approvals are available as an option.



Shear beam, Models F3301, F33C1, F33S1

The load cells F3301 are made of high-strength, corrosion-resistant stainless steel 1.4542, the properties are particularly suitable for the application areas of the load cells.

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.

The shear beams are a part of our certified product ELMS1 overload protection (DIN EN ISO 13849-1 with PL d/Kat. 3).

Specifications in accordance with VDI/VDE/DKD 2638

Model	F3301	F33S1
Rated force F_{nom} kN	2, 10, 20, 30, 50, 100	
Relative linearity error $d_{lin}^{1)}$	$\pm 1 \% F_{nom}$	
Relative reversibility error v	$< 0.1 \% F_{nom}$	
Relative creep	0,05 % F_{nom}	
Temperature effect on <ul style="list-style-type: none"> ■ characteristic value TK_C ■ zero signal TK_0 	0.2 % $F_{nom}/10\text{ K}$ 0.2 % $F_{nom}/10\text{ K}$	
Force limit F_L	150 % F_{nom}	
Breaking force F_B	300 % F_{nom}	
Permissible oscillation stress F_{rb}	$\pm 50 \% F_{nom}$	
Rated displacement (typ.) s_{nom}	< 10 kN: < 0.02 mm < 100 kN: < 0.2 mm < 1,000 kN: < 0.5 mm	
Material of measuring device	Stainless steel corrosion-resistant, ultrasonically tested 3.1 material (optional 3.2)	
Rated temperature $B_{T, nom}$	-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	
Electrical connection	Circular connector M 12x1, 4-pin CANopen®, 5-pin	2-circular connector M 12x1, 4-pin
Output signal (rated output) C_{nom}	4 ... 20 mA, 2-wire, 4 ... 20 mA, 3-wire 4 ... 20 mA, redundant DC 0 ... 10 V, 3-wire 2 x DC 0 ... 10 V redundant 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 $\pm 10 \%$ adjustable via entries in the object directory ²⁾	Redundant, opposing 4 ... 20 mA/20 ... 4 mA versions in accordance with requirements for functional safety per 2006/42/EC Machinery Directive
Current consumption	Current output 4 ... 20 mA 2-wire: signal current Current output 4 ... 20 mA, 3-wire: < 8 mA Voltage output: < 8 mA CANopen®: < 1 W	Current output 4 ... 20 mA: 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	$\leq (UB-10\text{ V})/0.024\text{ A}$ for current output > 10 k Ω 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	$\leq 2\text{ ms}$ (within 10 ... 90 % F_{nom}) ³⁾	
Protection (acc. to EN/IEC 60529)	IP67 (optional IP69k)	IP67
Electrical protection	Reverse voltage, overvoltage and short-circuit protection	
Vibration resistance	20 g, 100 h, 50...150 Hz (acc. to DIN EN 60068-2-6)	
Noise emission	DIN EN 55011	
Noise immunity	In accordance with DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC-strengthened versions)	
Optional	Certificates, strength verifications, 3D-CAD files (STEP, IGES) on request	

1) Relative linearity error acc. to VDI/VDE/DKD 2638 chap. 3.2.6.

2) Protocol acc. to CiA DS-301 V.402. Device profile DS-404 V. 1.2.

3) Other response times are available on request.

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Model	F33C1 ATEX/IECEX EX ib ¹⁾	F3301 signal jump
Rated force F_{nom} kN	2, 10, 20, 30, 50, 100	
Relative linearity error d_{lin} ²⁾	$\pm 1 \% F_{nom}$	
Relative reversibility error v	$< 0.1 \% F_{nom}$	
Relative creep	$0.05 \% F_{nom}$	
Temperature effect on ■ characteristic value TK_C ■ zero signal TK_0	$0.2 \% F_{nom}/10 K$ $0.2 \% F_{nom}/10 K$	
Force limit F_L	$150 \% F_{nom}$	
Breaking force F_B	$300 \% F_{nom}$	
Permissible oscillation stress F_{rb}	$\pm 50 \% F_{nom}$	
Rated displacement (typ.) s_{nom}	$< 10 kN: < 0.02 mm$ $< 100 kN: < 0.2 mm$ $< 1,000 kN: < 0.5 mm$	
Material of measuring device	Stainless steel corrosion-resistant, ultrasonically tested 3.1 material (optional 3.2)	
Rated temperature $B_{T, nom}$	$-20 \dots +80 \text{ }^\circ C$	
Operating temperature $B_{T, G}$	Ex II 2G Ex ib IIC T4 Gb $-25^\circ C < Tamb < +85 \text{ }^\circ C$ Ex II 2G Ex ib IIC T3 Gb $-25^\circ C < Tamb < +100 \text{ }^\circ C$ Ex I M2 Ex ib I Mb $-25^\circ C < Tamb < +85 \text{ }^\circ C$ Ex II 2G Ex ib IIC T4 Gb $-40^\circ C < Tamb < +85 \text{ }^\circ C$ Ex I M2 Ex ib I Mb (for cabel connection only)	$-30 \dots +80 \text{ }^\circ C$
Storage temperature $B_{T, S}$	$-40 \dots +85 \text{ }^\circ C$	
Electrical connection	Circular connector M 12x1, 4-pin Cable gland	
Output signal (rated output) C_{nom}	4 ... 20 mA, 2-wire	4 ... 16 mA, 2-wire ³⁾ DC 2 ... 8 V, 3-wire ³⁾
Current consumption	Current output 4 ... 20 mA 2-wire: signal current	Current output 4 ... 20 mA 2-wire: signal current, Current output 4 ... 20 mA 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	$< (UB-10 V)/0,024 A$ for current output $> 10 k\Omega$ for voltage output	
Response time	$\leq 2 ms$ (whitin 10 ... 90 % F_{nom}) ⁴⁾	
Protection (acc. to EN/IEC 60529)	IP67	
Electrical protection	Reverse voltage, overvoltage and short-circuit protection	
Vibration resistance	20 g, 100 h, 50...150 Hz acc. to DIN EN 60068-2-6	
Noise emission	DIN EN 55011	
Noise immunity	In accordance with DIN EN 61326-1/DIN EN 61326-2-3 (optional EMC-strengthened versions)	
Optional	Certificates, strength verifications, 3D-CAD files (STEP, IGES)	
Certificates (optional)	ATEX: acc. to EN 60079-0:2012 and EN 60079-11:2012 (Ex ib) IECEX: acc. to IEC 60079-0:2011 (Ed.6) and IEC 60079-11:2011 (Ed. 6) (Ex ib) UL: acc. to 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.

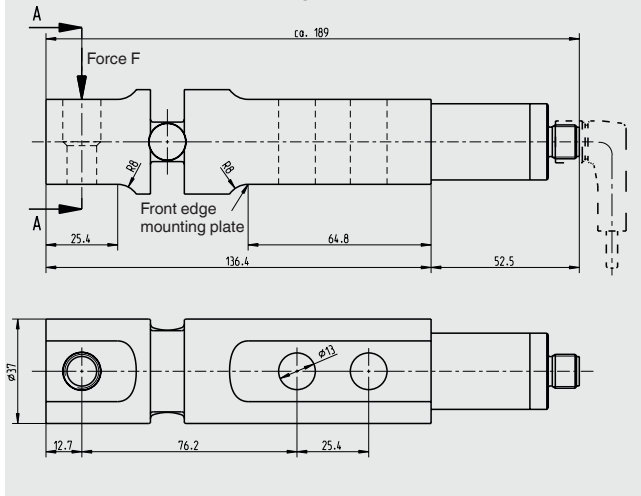
2) Relative linearity error acc. to VDI/VDE/DKD 2638 chap. 3.2.6.

3) Other signal jumps are available on request.

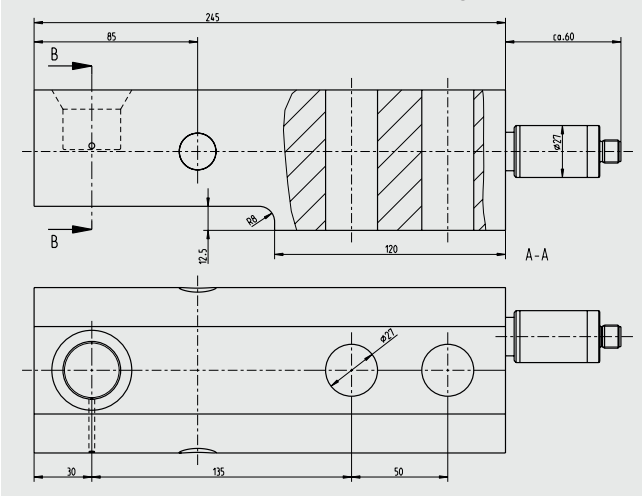
4) Other response times are available on request.

Version

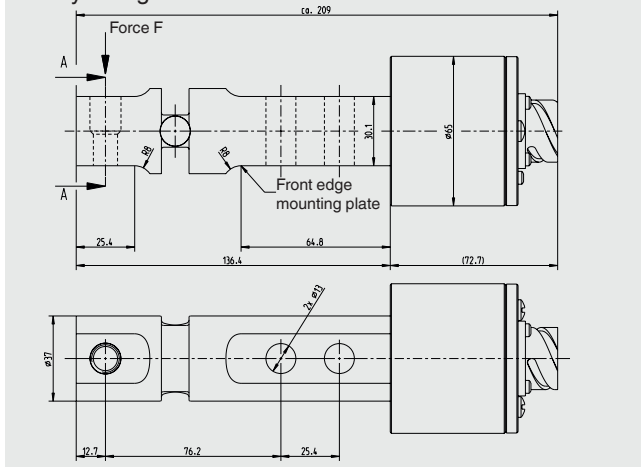
2-20 kN - Option with through hole



30-100 kN - Option with blind hole or through hole possible



Safety Design



kN	Mounting screws	Tightening torque [Nm]
2, 10	M12 8.8	90
20	M12 10.9	120
30, 50	M20 8.8	400
100	M24 8.8	700

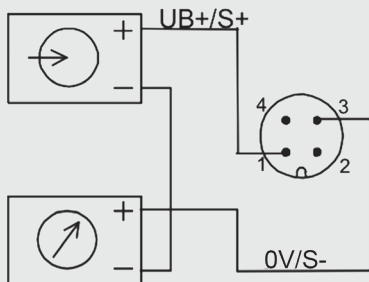
Dimensions: The customer-specific shear beam drawing for the specific article number applies above all.

For the F3301, F33C1, F33S1 series, there are no standard dimensions. All dimensions in mm.

Pin assignment analogue output

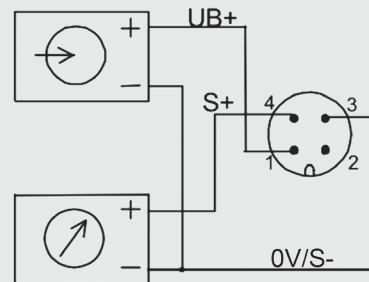
4 ... 20 mA output, 2-wire

Circular connector M12 x 1, 4-pin



0 ... 10 V, 4 ... 20 mA output, 3-wire

Circular connector M12 x 1, 4-pin



Circular connector M12 x 1, 4-pin

	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
Screen	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 cable, e.g. EZE53X011016

Pin assignment ATEX/IECEX

Circular connector M12 x 1, 4-pin	
	ATEX Ex ib 4...20 mA 2-wire
Supply UB+	1
Supply 0V/UB-	3
Signal S+	1
Signal S-	3
Screen ⊕	Case

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

Only when using the standard cable, e.g. EZE53X011016

Pin assignment with signal jump in accordance with EN 62061:2005

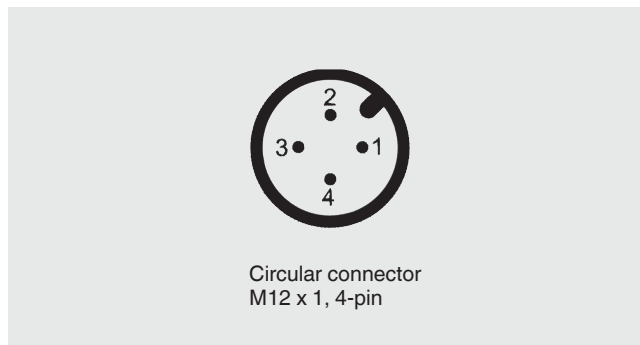
Circular connector M12 x 1, 4-pin			
	4...20 mA 2-wire	4...20 mA 3-wire	0...10 V 3-wire
Supply UB+	1	1	1
Supply 0V/UB-	3	3	3
Relay UR+	2	2	2
Relay UR-	4	3	3
Signal S+	1	4	4
Signal S-	3	3	3
Screen ⊕	Case	Case	Case

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 cable, e.g. EZE53X011016

Pin assignment, analogue output, redundant, opposing

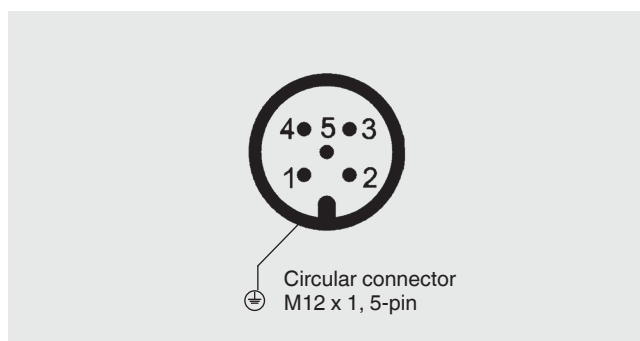
Circular connector M12 x 1, 4-pin		
	4 ... 20 mA / 20 ... 4 mA (redundant)	
	Connector 1	Connector 2
Supply UB+	1	1
Supply 0V/UB-	3	3
Signal channel 1	4	-
Signal channel 2	-	4
Screen ⊕	Case	Case



2-connector variant, for example, in combination with ELMS1 overload protection (F33S1). Version in accordance with requirements for functional safety per 2006/42/EC Machinery Directive.

Pin assignment CANopen®

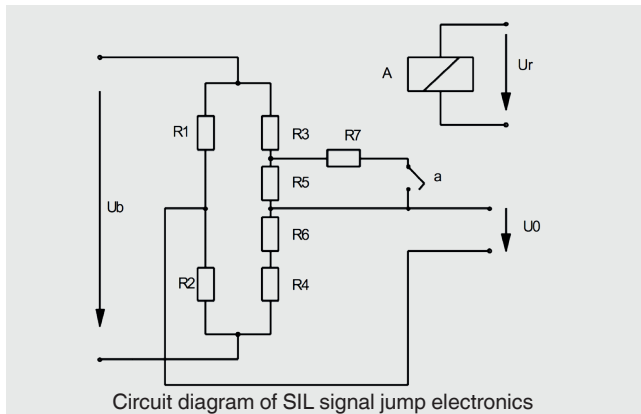
Circular connector M12 x 1, 5-pin	
Screen ⊕	1
Supply UB+ (CAN V+)	2
Supply UB- (CAN GND)	3
Bus-Signal CAN-High	4
Bus-Signal CAN-Low	5



Connect the cable shield to the force transducer housing. In the case of accessory cables, the cable shield must be connected with the knurled nut and thus connected to the housing of the force transducer. When extending, only shielded and low capacitance cables should be used. The permitted maximum and minimum lengths of the cable are specified in ISO 11898-2. A high-quality connection of the shielding must also be ensured.

Short description of signal jump electronics

Amplifier electronics 4 ... 20 mA or 0 ... 10 V for signal jump applications with 2-channel PC control



These 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. 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.

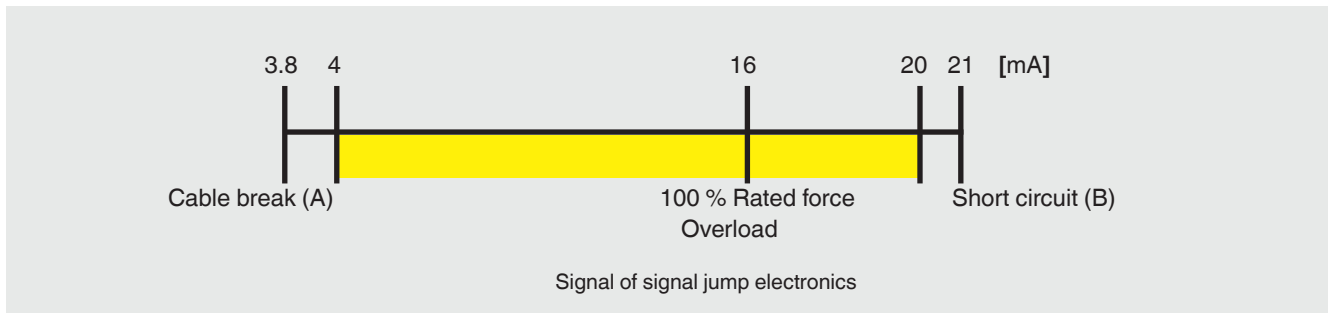
Compliance with functional safety

An external safety controller independently of the force transducer must monitor the safe functioning of the force transducer. The function test with a signal jump 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 of 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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