Data sheet

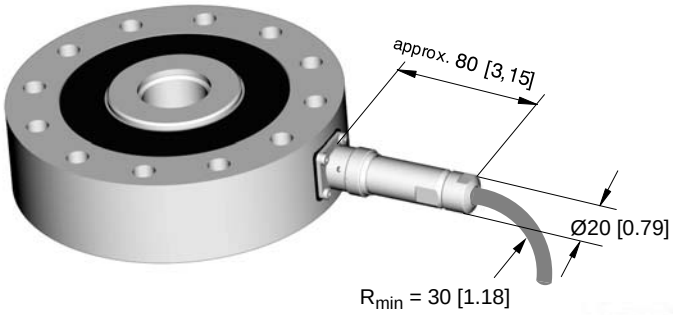
U10M

Force transducer

Special features

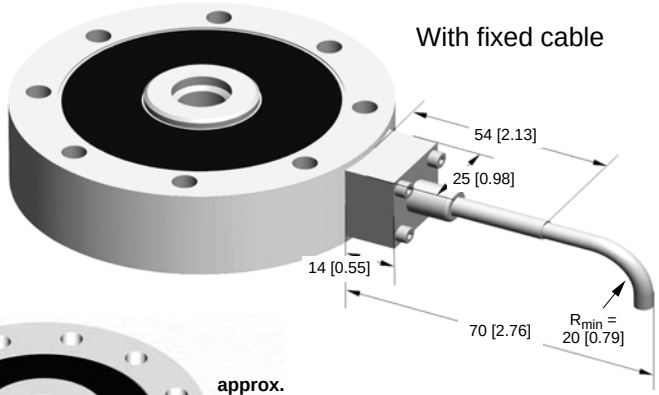
- **Precise and robust load/ force transducer for static and dynamic measuring tasks**
- **High lateral force and bending moment stability; bending moment influence is compensated electrically**
- **For forces of up to 1 MN**
- **Various configuration options (TEDS, double bridge, various electric connections, etc.) mean that it can be flexibly adapted to lots of measurement tasks**
- **Made of stainless steel materials, including protection class IP68 upon request**
- **High fundamental resonance frequency − Ideal for measuring fast processes**

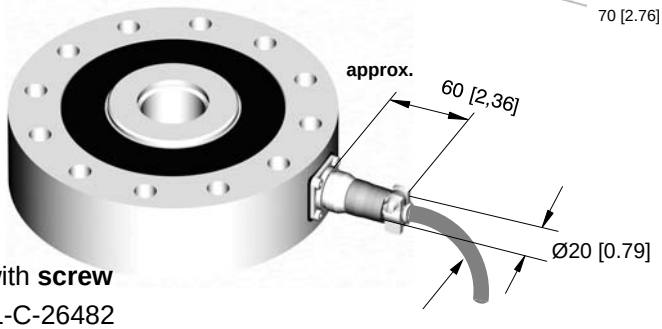
Mounting dimensions of the connection variants in mm [inch]



Connection cable **KAB 157−3** with **bayonet locking**, compatible with an MIL-C-26482 series 1 connection

With fixed cable

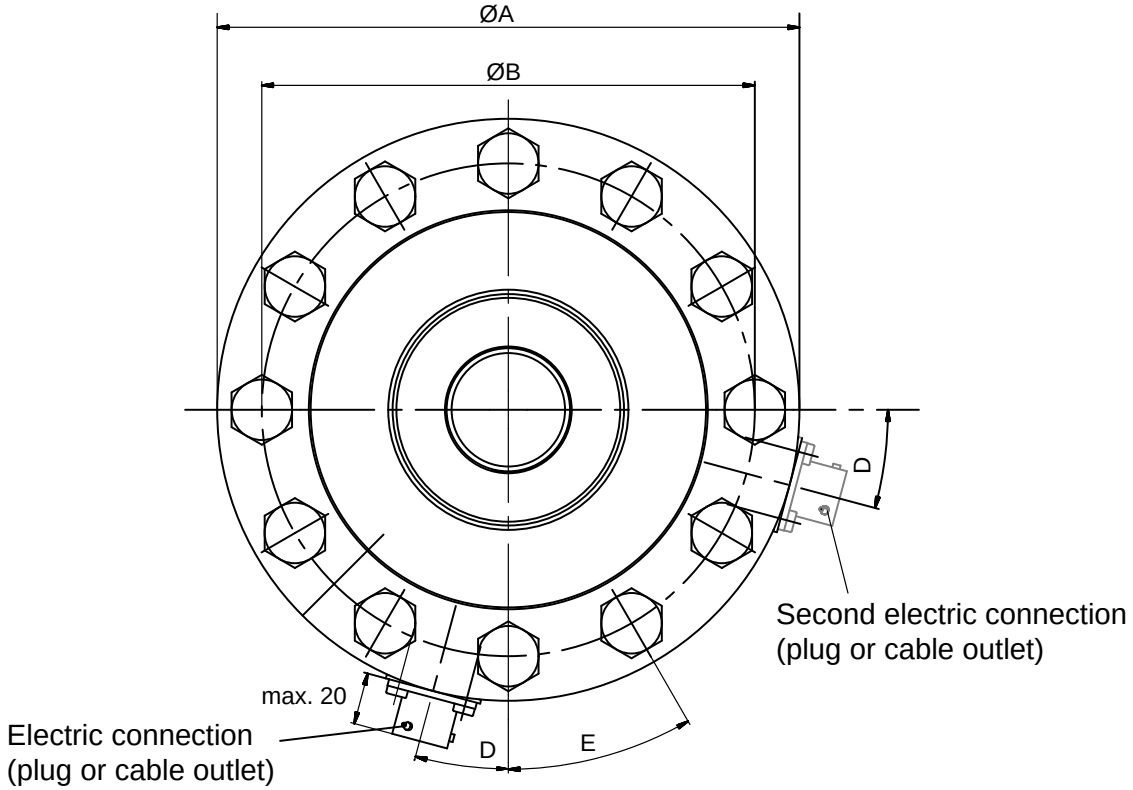


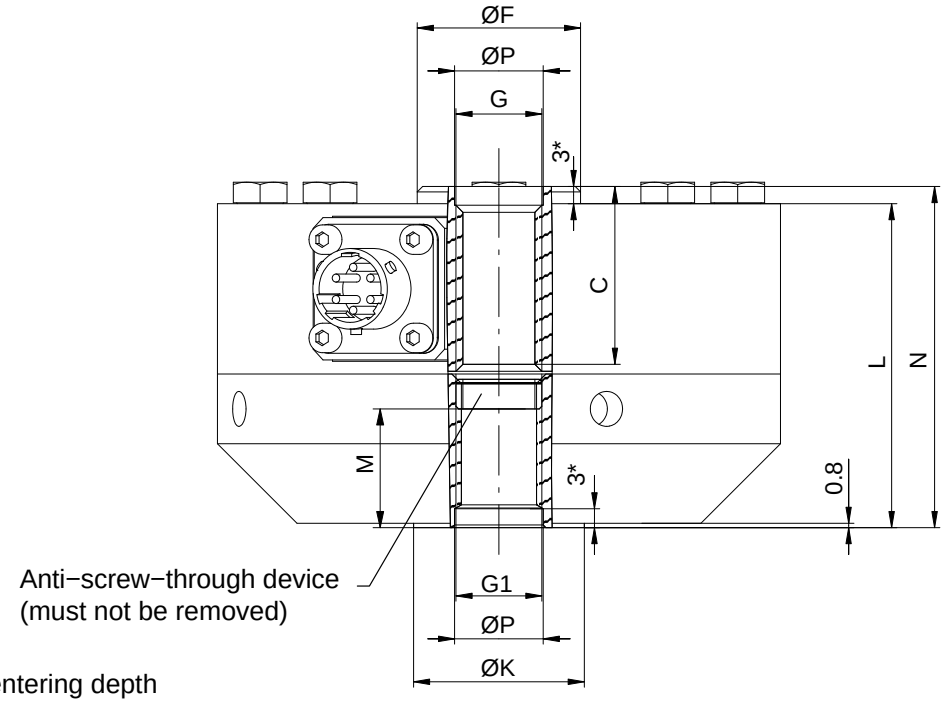


Connection cable **KAB 158−3** with **screw locking**, compatible with an MIL-C-26482 series 1 connection

Dimensions of U10M with foot adapter

Dimensions in mm; 1 mm = 0.03937 inch





*) Maximum centering depth

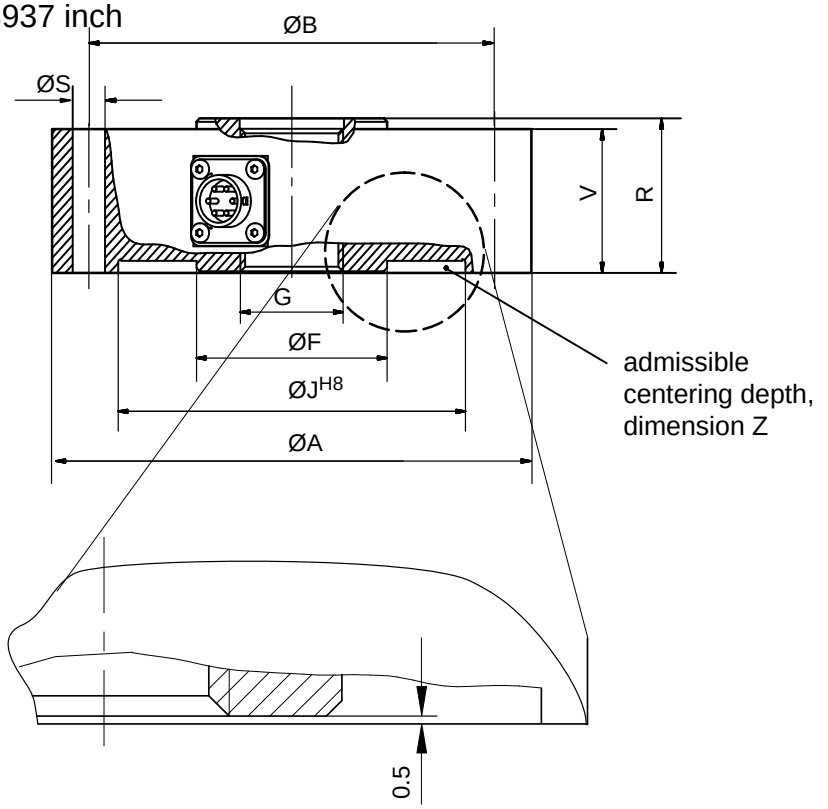
Nominal force	Dimensions in	ØA	ØB	C	D	E	ØF	G	M
1.25 kN − 5 kN	mm	104.8	88.9	33.3	22.5°	45°	30.4	M16x2−4H	22
	inch	4.13	3.5	1.3			1.2		
12.5 kN − 25 kN	mm	104.8	88.9	33.3	22.5°	45°	31.5	M16x2−4H	22
	inch	4.13	3.5	1.3			1.24		
50 kN	mm	153.9	130.3	42.9	15°	30°	61.2	M33x2−4H	35.5
	inch	6.06	5.13	1.69			2.41		

Nominal force	Dimensions in	ØA	ØB	C	D	E	ØF	G	M
125 kN	mm	153.9	130.3	42.9	15°	30°	67.3	M33x2−4H	35.5
	inch	6.06	5.13	1.69			2.65		
250 kN	mm	203.2	165.1	61.9	11.25°	22.5°	95.5	M42x2−4H	44
	inch	8.00	6.51	2.4			3.76		
500 kN	mm	279	229	87.3	11.25°	22.5°	122.2	M72x2−4H	69.5
	inch	10.98	9.02	3.4			4.81		

Nominal force	Dimensions in	G1	ØK	L	N	$ØP_{H8}$
1.25 kN − 25 kN	mm	M16x2−4H 22.1 mm deep	31.8	60.3	63.5	16.5
	inch		1.25	2.37	2.5	0.65
50 kN − 125 kN	mm	M33x2−4H 35.6 mm deep	57.2	85.9	89	33.5
	inch		2.25	3.38	3.5	1.32
250 kN	mm	M42x2−4H 54.6 mm deep	76.2	108	114.3	43
	inch		3	4.25	4.5	1.69
500 kN	mm	M42x2−4H 82.6 mm deep	114	152.4	165.1	73
	inch		4.49	6	6.5	2.87

Dimensions of U10M without foot adapter

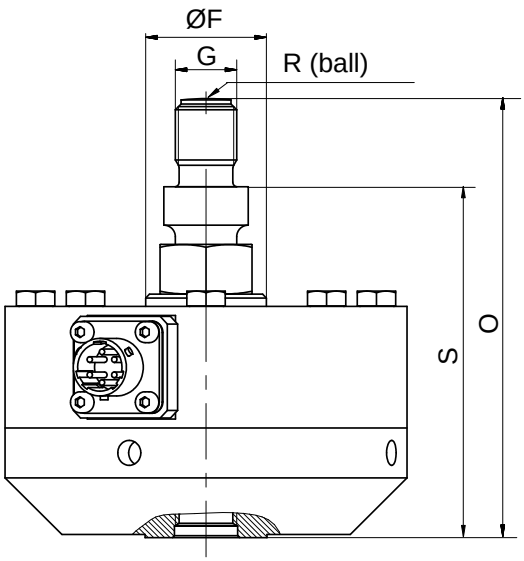
Dimensions in mm; 1 mm = 0.03937 inch



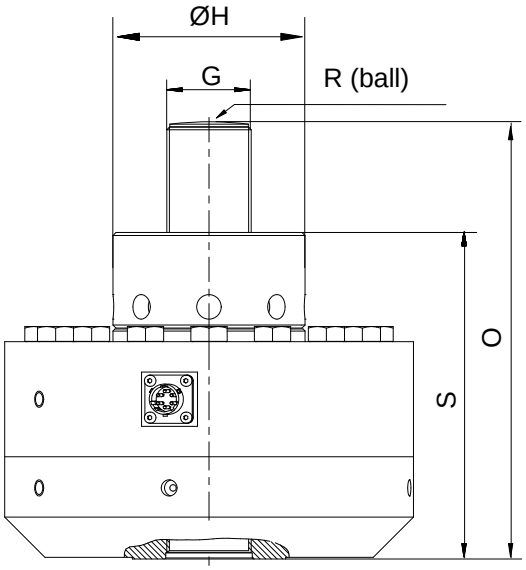
Nominal force	Dimensions in	ØA	ØB	ØS	ØF	G	$ØJ^{H8}$	V	R	Z
1.25 kN − 5 kN	mm	104.8	88.9	6.8	30.4	M16x2−4H	78	31.7	34.9	2.5
	inch	4.13	3.5	0.27	1.2		3.07	1.25	1.37	0.1
5 kN − 25 kN	mm	104.8	88.9	6.8	31.5	M16x2−4H	78	31.7	34.9	2.5
	inch	4.13	3.5	0.27	1.24		3.07	1.25	1.37	0.1
50	mm	153.9	130.3	10.4	61.2	M33x2−4H	111.5	41.4	44.5	2.5
	inch	6.06	5.13	0.41	2.41		4.39	1.63	1.75	0.1
125	mm	153.9	130.3	10.4	67.3	M33x2−4H	111.5	41.4	44.5	2.5
	inch	6.06	5.13	0.41	2.65		4.39	1.63	1.75	0.1
250	mm	203.2	165.1	13.5	95.5	M42x2−4H	143	57.2	63.5	3.5
	inch	8.00	6.51	0.53	3.76		5.63	2.25	2.5	0.14
500	mm	279	229	16.8	122.2	M72x2−4H	175	76.2	88.9	6
	inch	10.98	9.02	0.66	4.81		6.89	3	3.5	0.24

Dimensions of U10M with force application and foot adapter

1.25 kN ... 25 kN

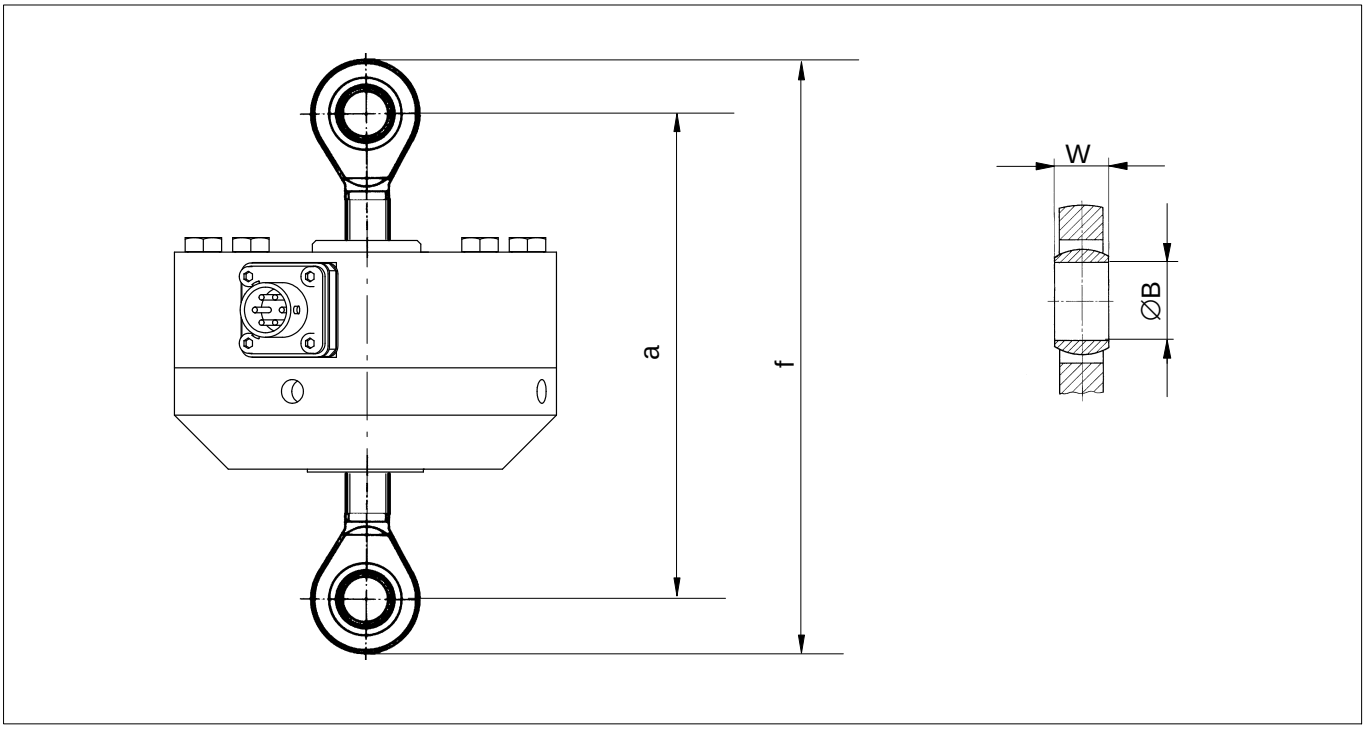


50 kN ... 500 kN



Nominal force	Dimensions in	ØF	G	ØH	S	O	R
1.25 kN − 5 kN	mm	30.4	M16x2	–	91.5	114.5	60
	inch	1.2			3.6	4.51	2.36
5 kN − 25 kN	mm	31.5	M16x2	–	91.5	114.5	60
	inch	1.24			3.6	4.51	2.36
50	mm	61.2	M33x2−6g	67.3	131.5	174.5	160
	inch	2.41		2.65	5.18	6.87	6.3
125	mm	67.3	M33x2−6g	67.3	131.5	174.5	160
	inch	2.65		2.65	5.18	6.87	6.3
250	mm	95.5	M42x2−6g	95.5	162.3	217.3	160
	inch	3.76		3.76	6.39	8.56	6.3
500	mm	122.2	M72x2−6g	135	230.1	307.3	400
	inch	4.81		5.31	9.06	12.1	15.75

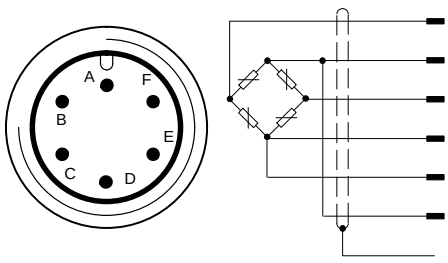
Dimensions of U10M with knuckle eyes



Nominal force	Order number for knuckle eye	a (approx.)		f (approx.)		W		ØB	
		mm	inch	mm	inch	mm	inch	mm	inch
1.25 kN − 25 kN	1−Z4/20kN/ZGUW	150	5.9	192	7.5	21	0.827	16	0.630
50 kN − 125 kN	1−ZGAM33F	263	10.35	392	15.4	35	1.387	50	1.969
250 kN	1−ZGAM42F	301	11.85	437	17.2	44	1.732	60	2.362
500 kN	1−ZGAM72F	439.5	17.3	643.5	25.3	60	2.362	90	3.543

Please observe the instructions in the Operating Manual

Pin and cable assignment



	Device plug PIN assignment	Cable assignment
B	Measurement signal (+)	wh (white)
D	Excitation voltage (−) (TEDS*)	bk (black)
C	Measurement signal (−)	rd (red)
A	Excitation voltage (+)	bu (blue)
F	Sensor lead (+)	gn (green)
E	Sensor lead (−) (TEDS*)	gy (gray)
	Cable shield, connected to the housing	Shield

* Only with selected option T (transducer identification)

Specifications (for 100% calibration)

Nominal force	F_{nom}	kN	1.25	2.5	5	12.5	25	50	125	250	500
Accuracy											
Accuracy class				0.02			0.03		0.04		0.05
Relative reproducibility and repeatability errors without rotation	b_{rg}	%					0.02				
rel. reversal error (hysteresis) at 0.4 F_{nom}	$v_{0.4}$	%		0.02			0.03		0.04		0.05
Non−linearity	d_{lin}	%		0.02			0.025		0.035		0.05
rel. zero point return		%					0.008				
Relative creep	$d_{cr, F+E}$	%					0.02				
Effect of the bending moment at 10% F_{nom} * 10 mm	d_{Mb}	%					0.01				
Effect of lateral forces (lateral force = 10% F_{nom})	d_Q	%					0.01				
Temperature influence on characteristic value	TK_C	%/10 K					0.015				
Effect of temperature on the zero signal	TK_0	%/10 K					0.015				
Electrical characteristic value											
Rated characteristic value	C_{nom}	mV/V		1			2				
Relative deviation of zero signal	$d_{S,0}$	%					1				
Deviation of the characteristic value (with optional ”adjusted characteristic value”)	d_C	%					0.1				
Characteristic value range (without optional ”adjusted characteristic value”)	C	mV/V		1 … 1.5			2 … 2.5				
Tensile/compression characteristic value variation	d_{ZD}	%					0.2				
Input resistance	R_e	Ω					>345				
Output resistance (without optional ”adjusted characteristic value”)	R_a	Ω					280 … 360				
Output resistance (with optional ”adjusted characteristic value”)	R_a	Ω					365				
Tolerance of the output resistance with optional ”adjusted characteristic value”	d_{Ra}	%					±0.5 Ω				
Insulation resistance	R_{is}	GΩ					>2				
Operating range of excitation voltage	$B_{U,G}$	V					0.5 … 12				
Reference excitation voltage	U_{ref}	V					5				
Connector							Six-wire circuit				
Temperature											
Reference temperature	T_{ref}	°C					23				
	T_{ref}	°F					73.4				
Nominal temperature range	$B_{T,nom}$	°C					−10 … +45				
	$B_{T,nom}$	°F					14 … 113				
Operating temperature range	$B_{T, G}$	°C					−30 … +85				
	$B_{T, G}$	°F					−22 … +185				
Storage temperature range	$B_{T,S}$	°C					−30 … +85				
	$B_{T,S}$	°F					−22 … +185				
Mechanical parameters											
Max. operating force	F_G	% of F_{nom}					240				
Limit force	F_L	% of F_{nom}					240				
Breaking force	F_B	% of F_{nom}					>400				
Limit torque	$M_{G\ max}$	N*m	30	60	125	315	635	1270	3175	5715	11430
Limit bending moment	$M_{b\ max}$	N*m	30	60	125	315	635	1270	3175	5715	11430

Specifications (for 100% calibration)

Nominal force	F_{nom}	kN	**1.25**	**2.5**	**5**	**12.5**	**25**	**50**	**125**	**250**	**500**
Static lateral limit force	F_Q	% of F_{nom}	100								
Nominal displacement	s_{nom}	mm	0.02			0.03			0.04	0.05	0.06
Fundamental resonance frequency	f_G	kHz	4.5	5.9	9.3	6.6	9.2	6.5	8.1	6.6	6.1
Relative permissible oscillatory stress	f_{rb}	% of F_{nom}	200								
Rigidity	F/S	10^5 N/mm	0.625	1.25	2.5	4.17	8.33	16.7	31.3	50	83.3
General information											
Protection class as per EN 60529, with bayonet connector (standard design), bushing connected to sensor			IP67								
Protection class as per EN 60529, with optional "threaded connector"			IP64								
Protection class as per EN 60529, with optional "integrated cable"			IP67			IP68[1)]					
Spring element material			Aluminum			Stainless steel					
Measuring point protection			Measuring element sealed tightly			Hermetically sealed measuring element					
Cable (only with optional "integrated cable")			Six-wire connection, TPE − isolation. External diameter 5.4 mm								
Cable length		m	6 or 15								
Mechanical shock resistance as per IEC 60068-2-6											
Quantity		n	1000								
Duration		ms	3								
Acceleration		m/s^2	1000								
Oscillatory stress as per IEC 60068-2-27											
Frequency range		Hz	5 ⍁ 65								
Duration		min	30								
Acceleration		m/s^2	150								
Weight (with adapter)	m	kg	1.2			3		10		23	60
	m	lbs	2.65			6.61		22.05		50.71	132.28
Weight (without adapter)	m	kg	0.5			1.3		5		11	28
	m	lbs	1.1			2.87		11.02		24.25	61.73

1) Test condition: 1 m water column, 100 hours

Specifications (for 200% calibration)

Nominal force	F_{nom}	kN	**1.25**	**2.5**	**5**	**12.5**	**25**	**50**	**125**	**250**	**500**
Calibrating force	F_{cal}	kN	2.5	5	10	25	50	100	250	500	1000
Accuracy											
Accuracy class				0.02		0.03		0.04			0.05
Relative reproducibility and repeatability errors without rotation	b_{rg}	%					0.02				
Rel. reversal error (hysteresis) at 0.4 F_{cal}	$v_{0.4}$	%		0.02		0.03		0.04			0.05
Non-linearity	d_{lin}	%		0.02		0.025		0.035			0.05
rel. zero point return							0.01				0.02
Relative creep	$d_{cr, F+E}$	%					0.02				
Effect of the bending moment at 10% F_{cal} * 10 mm	d_{Mb}	%					0.01				
Effect of lateral forces (lateral force = 10% F_{cal})	d_Q	%					0.01				
Temperature influence on characteristic value	TK_C	%/10 K					0.015				
Effect of temperature on the zero signal	TK_0	%/10 K					0.0075				
Electrical characteristic value											
Rated characteristic value	C_{nom}	mV/V		2			4				
Relative deviation of zero signal	$d_{S,0}$	%					1				
Characteristic value range		mV/V		2 … 3			4 … 4.9				
Deviation of the characteristic value with optional "adjusted characteristic value"	d_C	%					0.1				
Tensile/compression characteristic value variation	d_{ZD}	%					0.2 (typ. 0.1)				
Input resistance	R_e	Ω					>345				
Output resistance (without optional "adjusted characteristic value")	R_a	Ω					280 … 360				
Output resistance (with optional "adjusted characteristic value")	R_a	Ω					365				
Tolerance of the output resistance with optional "adjusted characteristic value"	d_{Ra}	%					±0.5 Ω				
Insulation resistance	R_{is}	GΩ					>2				
Operating range of excitation voltage	$B_{U,G}$	V					0.5 … 12				
Reference excitation voltage	U_{ref}	V					5				
Connector							Six-wire circuit				
Temperature											
Reference temperature	T_{ref}	°C					23				
	T_{ref}	°F					73.4				
Nominal temperature range	$B_{T,nom}$	°C					−10 … +45				
	$B_{T,nom}$	°F					14 … 113				
Operating temperature range	$B_{T, G}$	°C					−30 … +85				
	$B_{T, G}$	°F					−22 … +185				
Storage temperature range	$B_{T,S}$	°C					−30 … +85				
	$B_{T,S}$	°F					−22 … +185				
Mechanical parameters											
Max. operating force	F_G	% of F_{nom}					240				
Limit force	F_L	% of F_{nom}					240				
Breaking force	F_B	% of F_{nom}					>400				
Limit torque	$M_{G\ max}$	N*m	30	60	125	315	635	1270	3175	5715	11430
Limit bending moment	$M_{b\ max}$	N*m	30	60	125	315	635	1270	3175	5715	11430
Static lateral limit force	F_Q	% of F_{nom}					100				

Specifications (for 200% calibration)

Nominal force	F_{nom}	kN	**1.25**	**2.5**	**5**	**12.5**	**25**	**50**	**125**	**250**	**500**
Nominal displacement	s_{nom}	mm	0.02			0.03			0.04	0.05	0.06
Fundamental resonance frequency	f_G	kHz	4.5	5.9	9.3	6.6	9.2	6.5	8.1	6.6	6.1
Relative permissible oscillatory stress	f_{rb}	% of F_{nom}	200								
Rigidity	F/S	10^5 N/mm	0.625	1.25	2.5	4.17	8.33	16.7	31.3	50	83.3
General information											
Protection class as per EN 60529, with bayonet connector (standard design), bushing connected to sensor			IP67								
Protection class as per EN 60529, with optional "threaded connector"			IP64								
Protection class as per EN 60529, with optional "integrated cable"			IP67			IP68[1)]					
Spring element material			Aluminum			Stainless steel					
Measuring point protection			Measuring element sealed tightly			Hermetically sealed measuring element					
Cable (only with optional "integrated cable")			Six-wire connection, TPE − isolation. External diameter 5.4 mm								
Cable length		m	6 or 15								
Mechanical shock resistance as per IEC 60068-2-6											
Quantity		n	1000								
Duration		ms	3								
Acceleration		m/s^2	1000								
Oscillatory stress as per IEC 60068-2-27											
Frequency range		Hz	5 … 65								
Duration		min	30								
Acceleration		m/s^2	150								
Weight (with adapter)	m	kg	1.2			3		10		23	60
	m	lbs	2.65			6.61		22.05		50.71	132.28
Weight (without adapter)	m	kg	0.5			1.3		5		11	28
	m	lbs	1.1			2.87		11.02		24.25	61.73

1) Test condition: 1 m water column, 100 hours

U10M versions and order numbers

Code	Measuring range	Order number
1k25	1.25 kN	1−U10M / 1.25 kN
2k50	2.5 kN	1−U10M / 2.5 kN
5k00	5 kN	1−U10M / 5 kN
12k5	12.5 kN	1−U10M / 12.5 kN
25k0	25 kN	1−U10M / 25 kN
50k0	50 kN	1−U10M / 50 kN
125k	125 kN	1−U10M / 125 kN
250k	250 kN	1−U10M / 250 kN
500k	500 kN	1−U10M / 500 kN

Preferred version, available at short notice

The order number for the preferred types is 1−U10M…, the order number for customer-specific versions is K−U10M…

Number of measuring bridges	Characteristic value	Calibration	Transducer identification	Mechanical design	Plug protection	El. connection bridge A	El. connection bridge B	Force application
Single bridge **SB**	Not adjusted **N**	100% (dyn.) **1**	Without TEDS **S**	With adapter **W**	Without **U**	Bayonet connector **B**	Bayonet connector **B**	Without **O**
Double bridge **DB**	Adjusted **J**	200% (stat.) **2**	With TEDS **T**	Without adapter **N**	With **P**	Threaded connector **G**	Threaded connector **G**	With **L**
						Fixed cable (6 m) **K**	Fixed cable (6 m) **K**	

K−U10M−	12k5	DB	J	2	T	W	P	B	G	O

Number of measuring bridges	For reasons of redundancy, in devices relevant to safety it is necessary to check the plausibility of the measurement signal with a second measuring bridge (installed on the same measuring element). The signals are independently conditioned and evaluated using two separate measuring amplifiers.
Characteristic value	The exact nominal characteristic value is specified on the identification plate. The transducer can also be adjusted to an exact characteristic value of 1.0 mV/V or 2.0 mV/V (if 200% calibration selected: 2 mV/V or 4 mV/V). The rel. characteristic value error is then 0.1% of the nominal characteristic value. The characteristic value range of an unadjusted transducer is between 1 and 1.5 or 2 and 2.5 mV/V.
Calibration	In the standard version, the transducer is designed for dynamic application up to a vibration bandwidth of ±100% F_{nom}. For quasistatic applications, the transducer can be used up to 200% F_{nom}. The option is available to calibrate accordingly to 200% F_{nom}.
Transducer identification	Integration of TEDS (integrated electronic data sheet) as per IEEE1451.4. If the relevant amplifier electronics are provided, the measurement chain will parameterize itself.
Mechanical design	The U10 can optionally also be ordered as a flange assembly. The version does not include the screwed adapter. During mounting, please observe the instructions in the Operating Manual
Plug protection	Mechanical protection provided by installation of additional square profile around the connector. Dimensions in mm approx.: WxHxB: 30x30x20
Electrical connection Bridge A	The standard version is the male device connector with bayonet locking (PT02E10−6P−compatible). The option is also available to install a screw−fitting male device connector (PC02E10−6P−compatible). A third variant where the force transducers are fitted with a fixed cable is also available. In this version, all U10 achieve degree of protection IP68 with a nominal force equal to or greater than 12.5 kN.
Electrical connection Bridge B	The standard version is the male device connector with bayonet locking (PT02E10−6P−compatible). The option is also available to install a screw−fitting male device connector (PC02E10−6P−compatible). Both of the connection variants are often used for differentiation purposes in the double−bridge version. A third variant where the force transducers are fitted with a fixed cable is also available. In this version, all U10 achieve degree of protection IP68 with a nominal force equal to or greater than 12.5 kN.
Force application	Mounted force application. Standard is supplied without force application, although a force application bolt can be mounted upon request. Dimensions, see Page 4.

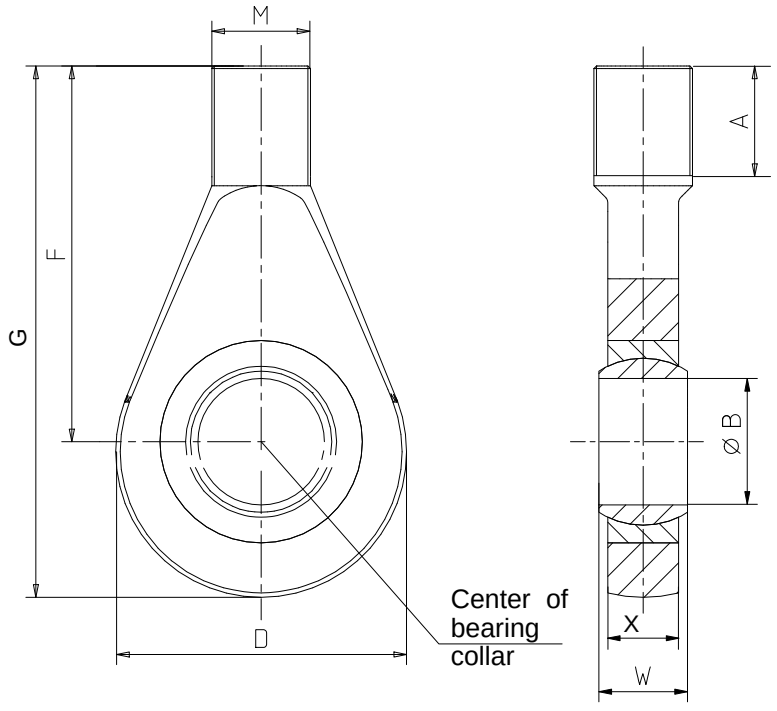
Accessories (to be ordered separately):

Cables/plugs	**Order number**
Connection cable KAB157−3; IP67 (with bayonet locking); 3 m long, TPE outer sheath; 6x0.25 mm^2; free ends, shielded, outside diameter 6.5 mm	1−KAB157−3
Connection cable KAB158−3; IP54 (with screw locking); 3 m long, TPE outer sheath; 6x0.25 mm^2; free ends, shielded, outside diameter 6.5 mm	1−KAB158−3
Cable, configurable with different plugs and lengths	K−KAB−F
Loose connecting socket (bayonet locking)	3−3312.0382
Loose connecting socket (screw locking)	3−3312.0354
Ground cable (400 mm long)	1−EEK4
Ground cable (600 mm long)	1−EEK6
Ground cable (800 mm long)	1−EEK8
Knuckle eye, M16 external thread	1−Z4/20kN/ZGUW
Knuckle eye, M33x2 external thread	1−ZGAM33F
Knuckle eye, M42x2 external thread	1−ZGAM42F
Knuckle eye, M72x2 external thread	1−ZGAM72F
Knuckle eye, M16 internal thread	1−Z4/20kN/ZGOW
Knuckle eye, M33x2 internal thread	1−ZGIM33F
Knuckle eye, M42x2 internal thread	1−ZGIM42F
Knuckle eye, M72x2 internal thread	1−ZGIM72F

Accessories − Knuckle eyes

ZGUW / ZGAM

Dimensions in mm; 1 mm = 0.03937 inch



Nominal force	**Order no. knuckle eye**	**A**	**ØB**	**D**	**F**	**G**	**M**	**W**	**X**	**Weight**
1.25 kN − 25 kN	1−Z4/20kN/ZGUW	41.7	$16^{+0.018}$	42	67.7	88.7	M16	21	15	0.2 kg
50 kN − 125 kN	1−ZGAM33F	35	$50^{-0.012}$	115	118	182.5	M33x2	35	28	2.5 kg
250 kN	1−ZGAM42F	45	$60^{-0.015}$	126	134	202	M42x2	44	36	3.8 kg
500 kN	1−ZGAM72F	70	$90^{-0.02}$	190	203	305	M72x2	60	50	12.6 kg

Knuckle eyes are only suitable for static tensile loads.