Data Sheet

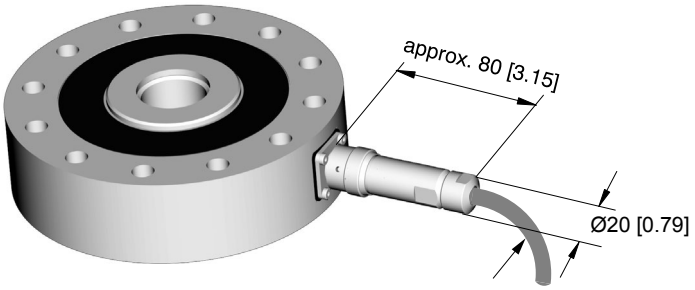
U10M

Force transducers

Special features

- **Tensile/compressive force transducer**
- **For dynamic and static applications**
- **High endurance at high vibration bandwidths**
- **Electronic bending moment adjustment**
- **Double bridge version option**
- **Rust-resistant materials**
- **Flange screw fittings corrosion-protected**

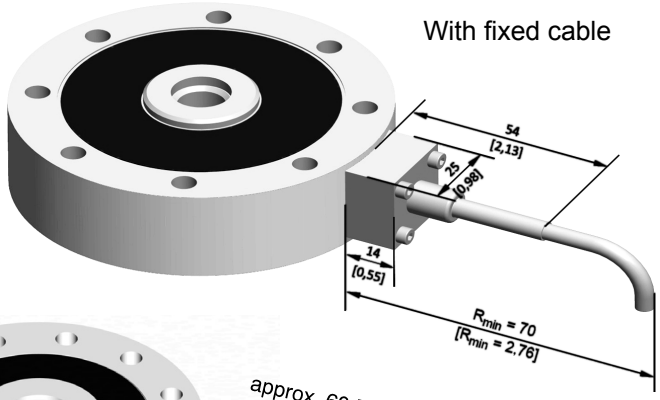
Mounting dimensions of the connection variants in mm [inch]

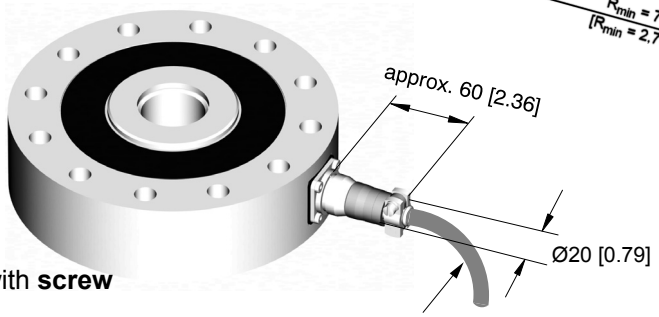


Connection cable **KAB 157-3** with **bayonet locking**, compatible with an MIL-C-26482 series 1 connection

R_{min} = 30 [1.18]

With fixed cable



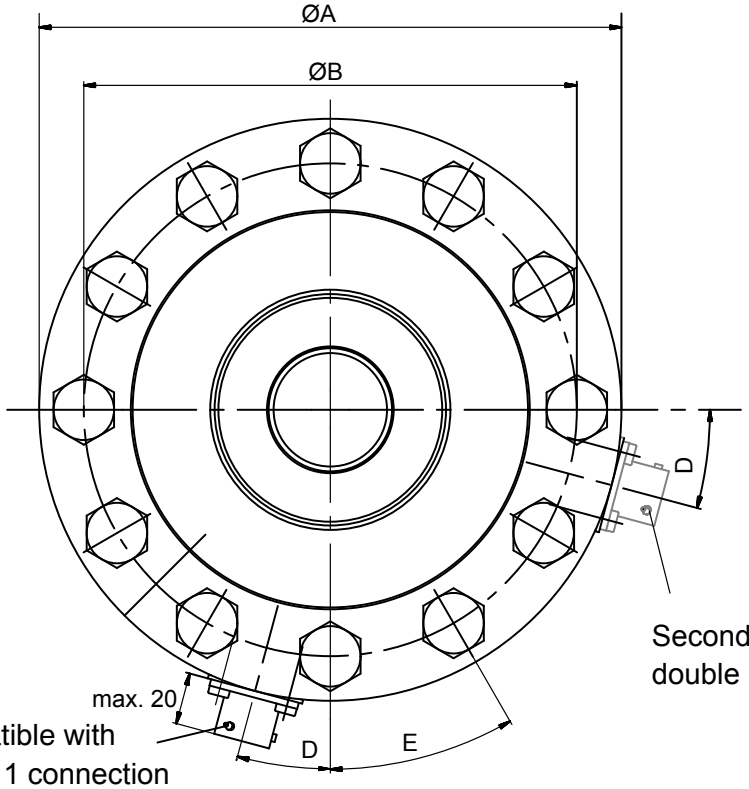


Connection cable **KAB 158-3** with **screw locking**, compatible with an MIL-C-26482 series 1 connection

R_{min} = 30 [1.18]

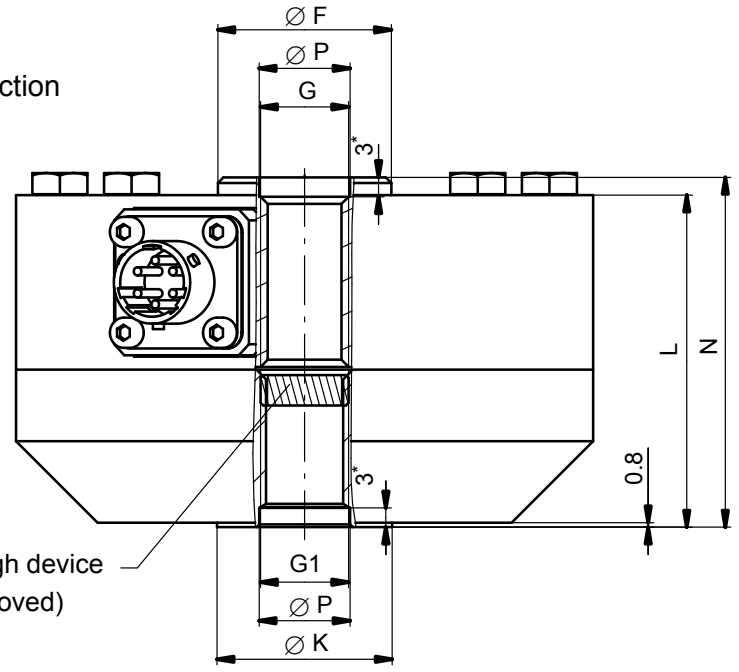
U10M dimensions with foot adapter

Dimensions in mm; 1 mm = 0.03937 inch



Bayonet: plug-compatible with
MIL-C-26482 series 1 connection

Option:
Thread: plug-compatible with
MIL-C-26482 series 1 connection



Anti-screw-through device
(must not be removed)

*) Maximum centering depth

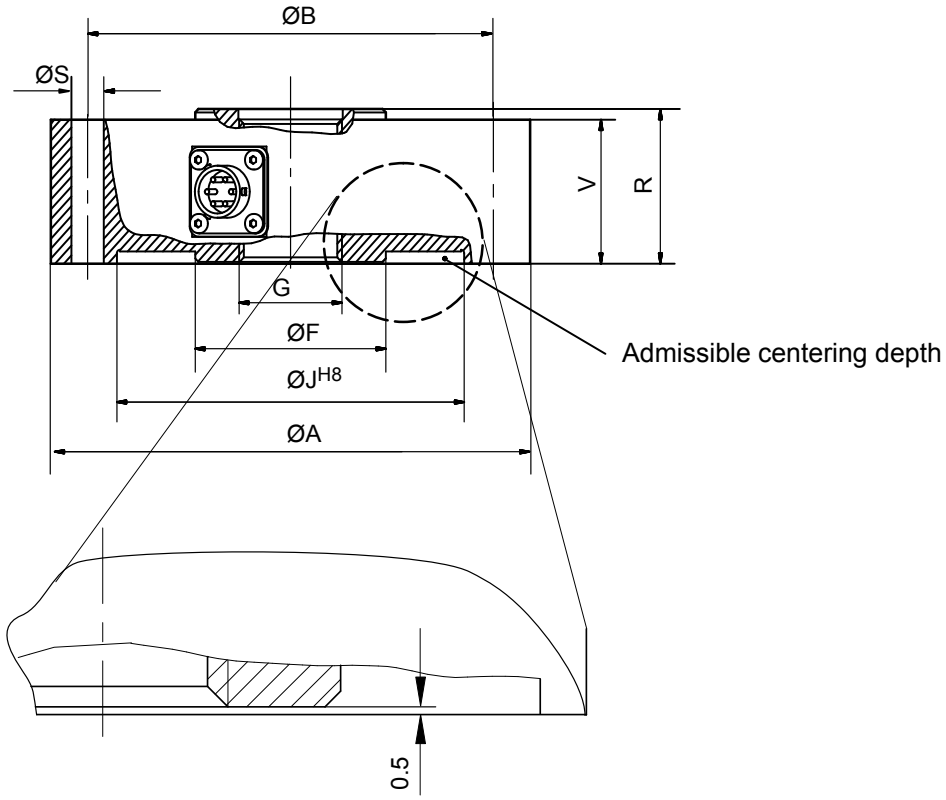
Nominal (rated) force	Dimensions in	ØA	ØB	D	E	ØF	G
1.25 kN - 5 kN	mm	104.8	88.9	22.5°	45°	30.4	M16x2-4H 28.4 mm deep
	inch	4.13	3.5			1.2	
12.5 kN - 25 kN	mm	104.8	88.9	22.5°	45°	31.5	M16x2-4H 28.4 mm deep
	inch	4.13	3.5			1.24	
50 kN	mm	153.9	130.3	15°	30°	61.2	M33x2-4H 35.6 mm deep
	inch	6.06	5.13			2.41	
125 kN	mm	153.9	130.3	15°	30°	67.3	M33x2-4H 35.6 mm deep
	inch	6.06	5.13			2.65	

Nominal (rated) force	Dimensions in	ØA	ØB	D	E	ØF	G
250 kN	mm	203.2	165.1	11.25°	22.5°	95.5	M42x2-4H 54.6 mm deep
	inch	8.00	6.51			3.76	
500 kN	mm	279	229	11.25°	22.5°	122.2	M42x2-4H 82.6 mm deep
	inch	10.98	9.02			4.81	

Nominal (rated) 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

U10M dimensions without foot adapter

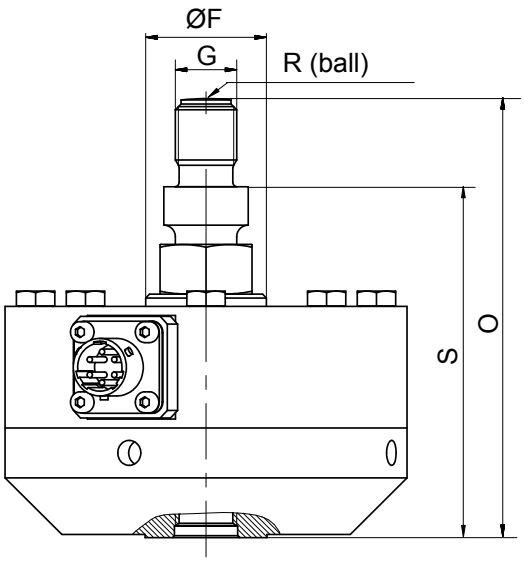
Dimensions in mm; 1 mm = 0.03937 inch



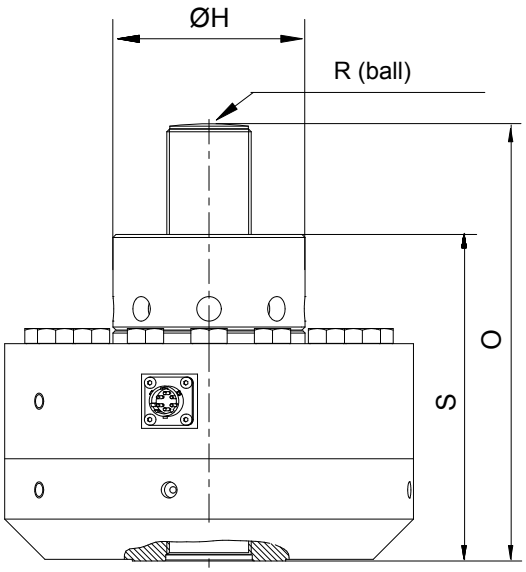
Nominal (rated) force	Dimensions in	ØA	ØB	ØS	ØF	G	$ØJ^{H8}$	V	R	N
1.25 kN - 5 kN	mm	104.8	88.9	6.8	30.4	M16x2-4H	78	31.7	34.9	2.5
	inch	4.13	3.5	0.27	1.2		3.07	1.25	1.37	0.1
5 kN - 25 kN	mm	104.8	88.9	6.8	31.5	M16x2-4H	78	31.7	34.9	2.5
	inch	4.13	3.5	0.27	1.24		3.07	1.25	1.37	0.1
50	mm	153.9	130.3	10.4	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

U10M dimensions with force application and foot adapter

1.25 kN ... 25 kN

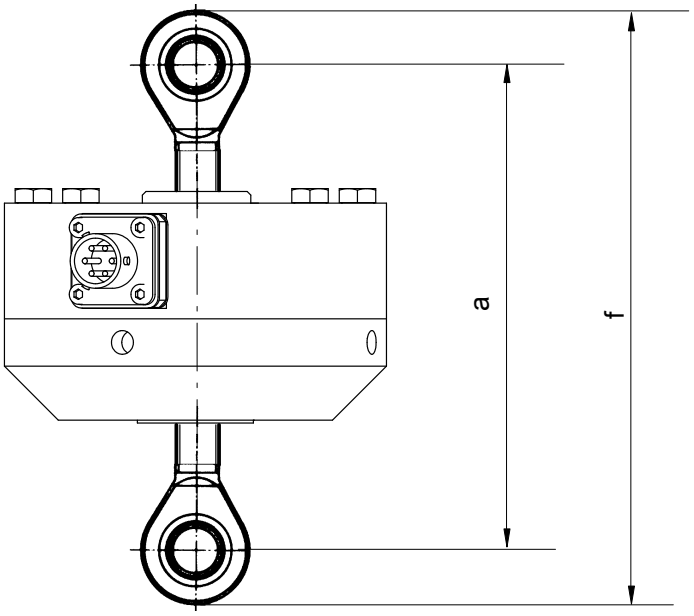


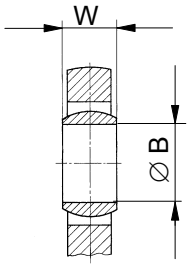
50 kN ... 500 kN



Nominal (rated) force	Dimensions in	ØF	G	ØH	S	O	R
1.25 kN - 5 kN	mm	30.4	M16x2-4H	-	91.5	114.5	60
	inch	1.2			3.6	4.51	2.36
5 kN - 25 kN	mm	31.5	M16x2-4H	-	91.5	114.5	60
	inch	1.24			3.6	4.51	2.36
50	mm	61.2	M33x2-4H	67.3	131.5	174.5	160
	inch	2.41		2.65	5.18	6.87	6.3
125	mm	67.3	M33x2-4H	67.3	131.5	174.5	160
	inch	2.65		2.65	5.18	6.87	6.3
250	mm	95.5	M42x2-4H	95.5	162.3	217.3	160
	inch	3.76		3.76	6.39	8.56	6.3
500	mm	122.2	M72x2-4H	135	230.1	307.3	400
	inch	4.81		5.31	9.06	12.1	15.75

U10M dimensions with knuckle eyes

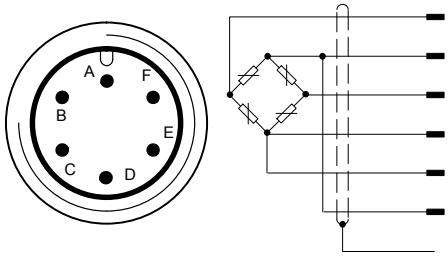




Detailed data on the knuckle eyes, see Page 9

Nominal (rated) force	Order number for knuckle eye	a (approx.)		f (approx.)		W		∅ B	
		mm	inch	mm	inch	mm	inch	mm	inch
1.25 kN - 25 kN	1-Z4/20kN/ZGUW	146	5.748	167	6.575	21	0.827	16	0.630
50 kN - 125 kN	1-ZGAM33F	258	10.157	322	12.577	35	1.387	50	1.969
250 kN	1-ZGAM42F	277	10.906	345	13.583	44	1.732	60	2.362
500 kN	1-ZGAM72F	360	14.173	462	18.189	60	2.362	90	3.543

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	Sense lead (+)	gn (green)
E	Sense lead (-) (TEDS *)	gy (gray)
	Cable shield, connected to the housing	Shielding

* Only with selected option T (transducer identification)

Accessories (to be ordered separately):

Cables/plugs	Order number
Connection cable KAB157-3; IP67 (with bayonet locking); 3 m long, TPE outer sheath; 6 x 0.25 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; 6 x 0.25 mm^2; free ends, shielded, outside diameter 6.5 mm	1-KAB158-3
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

Specifications (VDI/VDE 2638)

Nominal (rated) force	F_{nom}	kN	**1.25**	**2.5**	**5**	**12.5**	**25**	**50**	**125**	**250**	**500**
Nominal (rated) sensitivity	C_{nom}	mV/V	1 … 1.5 [1]			2 … 2.5 [1]					
Accuracy class			0.03			0.04			0.05		0.06
Relative repeatability error in an unmodified mounting position	b_{rg}	%	0.025								
Relative zero signal error	$d_{s,0}$	%	1								
Relative reversibility error [2] (at $0.4 \cdot F_{nom}$)	$v_{0.4}$	%vl %vc	< 0.075 0.03			< 0.1 0.04		< 0.125 0.05			< 0.125 0.05
Relative linearity error	d_{lin}	%	< ±0.03			< ±0.04					< ±0.06
Relative creep over 30min	d_{crf+E}	%	< ±0.04			< ±0.025					
Effect of temperature on sensitivity/10K	TK_C	%	< ±0.015								
Temperature effect on the zero signal/10K	TK_0	%	< ±0.015								
Bending moment influence (at $10\% \cdot F_{nom} \cdot 10$ mm)	d_Q	%	< 0.01								
Output resistance	R_o	Ω	280 … 360								
Input resistance	R_i	Ω	> 345								
Insulation resistance	R_{is}	GΩ	> 2								
Reference excitation voltage	U_{ref}	V	5								
Operating range of excitation voltage	$B_{U,G}$	V	0.5 to 12								
Reference temperature	T_{ref}	°C [°F]	+23 [73.4]								
Nominal (rated) temperature range	$B_{T,nom}$	°C [°F]	-10 … +45 [+14 … +113]								
Operating temperature range	$B_{T,G}$	°C [°F]	-30 … +85 [-22 … +185]								
Storage temperature range	$B_{T,S}$	°C [°F]	-30 … +85 [-22 … +185]								
Max. operating force	(F_G)	% v. F_{nom}	240								
Breaking force	(F_B)	% v. F_{nom}	> 400								
Static lateral limit force [3]	(F_Q)	% v. F_{nom}	100								
Bending limit moment	$M_{b\ perm}$	N·m	30	60	125	315	635	1270	3175	5715	11430
Limit torque	M_L	N·m	30	60	125	315	635 [4]	1270	3175	5715	11430
Nominal (rated) 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
Rigidity	F/S	10^5 N/mm	0.625	1.25	2.5	4.17	8.33	16.7	31.3	50.0	83.3
Permissible vibrational stress (Vibration bandwidth per DIN 50100)	F_{rb}	% v. F_{nom}	200								
Weight (without cable) With adapter Without adapter		kg lbs kg lbs	1.2 2.65 0.5 1.1			3 6.61 1.3 2.87		10 22.05 5 11.02		23 50.71 11 24.25	60 132.28 28 61.73
Immunity from interference (EN 61326-1, Table A.1)			Industrial environment								
Electromagnetic field (AM)		V/m	10								
Magnetic field		A/m	30								
Electrostatic discharge (ESD)											
Contact discharge		kV	4								
Air discharge		kV	8								
Burst (rapid transients)		kV	1								
Surge (impulse voltages)		kV	1								
Grid-bound interferences (AM)		V	3								

Nominal (rated) force	F_{nom}	kN	1.25	2.5	5	12.5	25	50	125	250	500
Mechanical shock (Test severity level IEC 68-2-29-1987)											
Number		n	1000								
Duration		ms	3								
Acceleration		m/s^2	1000								
Vibrational stress (Test severity level per DIN IEC 68; Part 2-6; IEC68-2-6-1982)											
Frequency range		Hz	5 … 65								
Duration		min	30								
Acceleration		m/s^2	150								
Degree of protection per DIN EN 60529			IP64 / IP67 / IP68 [5]								

1) Option: Adjustment of sensitivity to 2 mV/V (or 1 mV/V).

2) Reversibility error at 200% is typically the same as at nominal (rated) force.

3) Pure lateral force relating to the link centre of the transducer.

4) For transducer with adapter: 370 N · m.

5) IP67 for version with bayonet locking (and inserted plug) and for versions with fixed cable and nominal (rated) force ≦ 5 kN. The versions with fixed cable and nominal (rated) force ≧ 12.5 kN are IP68, all other versions are IP64.

Versions and order numbers U10M

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	Not adjusted	100 % (dyn.)	Without TEDS	With adapter	Without	Bayonet connector	Bayonet connector	Without
SB	**N**	**1**	**S**	**W**	**U**	**B**	**B**	**O**
Double bridge	Adjusted	200 % (stat.)	With TEDS	Without adapter	With	Threaded connector	Threaded connector	With
DB	**J**	**2**	**T**	**N**	**P**	**G**	**G**	**L**
						Fixed cable (6 m) **K**	Fixed cable (6 m) **K**	

K-U10M-	12k5	DB	J	2	T	W	P	B	G	O

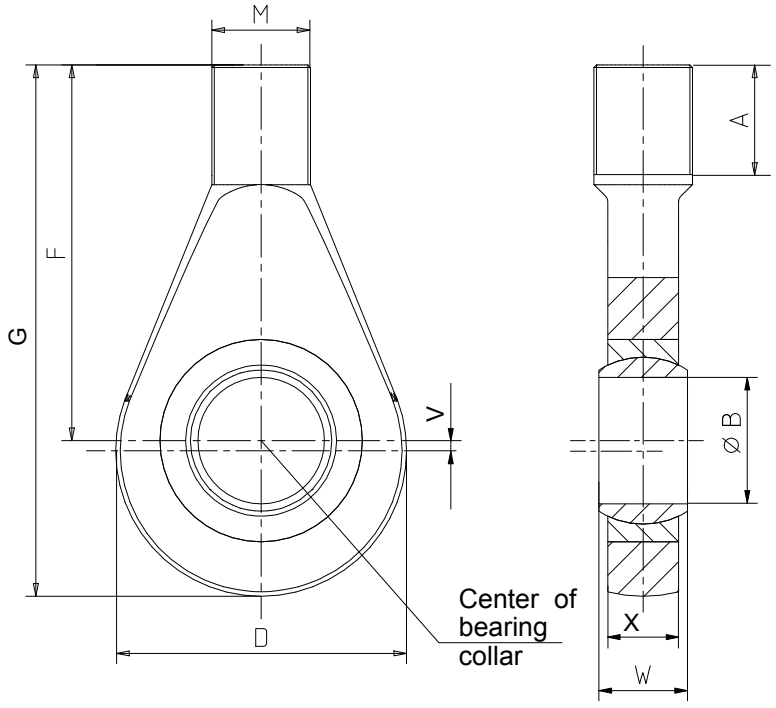
Number of measuring bridges	For reasons of redundancy, in devices relevant to safety it is necessary to check the plausibility of the measurement signal with a second measuring bridge (installed on the same measuring element). The signals are independently conditioned and evaluated using two separate measuring amplifiers.
Characteristic value	The exact nominal (rated) sensitivity is specified on the identification plate. The transducer can also be adjusted to a whole number sensitivity of 1.0m V/V or 2.0m V/V (if 200% calibration selected: 2 mV/V or 4 mV/V). The rel. sensitivity error (compression) is then 0,1% of the nominal (rated) sensitivity. The sensitivity range of a unadjusted transducer lies between 1 and 1.5 or 2 and 2.5mV/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	TEDS integration (integrated electronic data sheet) in accordance with IEEE1451.4
Mechanical design	The sensitivity is determined at the factory with the bolted-on adapter. The bolted-on adapter ensures the best-possible screw-fastening conditions and allows the transmission of axial force through a central internal thread. If the adapter is not used, a sensitivity deviation of $< 1\%$ must be taken into account.
Plug protection	Mechanical protection through the installation of an 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 (rated) 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 these connection variants are often used for differentiation 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 (rated) force equal to or greater than 12.5 kN.
Force application	Mounted force application. Standard is without force application, if requested, we can mount a force application bolt. Dimensions, see Page 4.

Accessories - Knuckle eyes

ZGUW / ZGAM

Dimensions in mm; 1 mm = 0.03937 inch



Nominal (rated) force	Order no. Knuckle eye	A	∅ B	D	F	G	M	V	W	X	Weight
1.25 kN - 25 kN	1-Z4/20kN/ZGUW	41.7	$16^{+0.018}$	42	67.7	88.7	M16	0	21	15	0.2 kg
50 kN - 125 kN	1-ZGAM33F	35	$50^{-0.012}$	115	118	182.5	M33x2	7	35	28	2.5 kg
250 kN	1-ZGAM42F	45	$60^{-0.015}$	126	134	202	M42x2	5	44	36	3.8 kg
500 kN	1-ZGAM72F	45	$90^{-0.02}$	190	178	280	M72x2	7	60	50	12.6 kg

Knuckle eyes are only suitable for static tensile loads.

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