DATA SHEET

U10F
Force transducer

SPECIAL FEATURES

- Precise and rugged tensile/compressive force transducer for static and dynamic measurement tasks
- Nominal (rated) forces from 50 kN to 1.25 MN
- Flange connection on both sides for very easy installation
- Very good lateral force and bending moment stability
- Special design compensates lateral forces and bending moments
- The numerous possible configurations (e.g. TEDS chip, double-bridge version, various electrical connections) mean that it can be flexibly adapted to a great variety of measurement tasks
- Made of non-rusting materials, degree of protection IP68 if desired
- High natural frequency - ideal for measuring fast processes
- Available as a passive sensor (mV/V output) or active sensor with integrated amplifiers (IO-Link)

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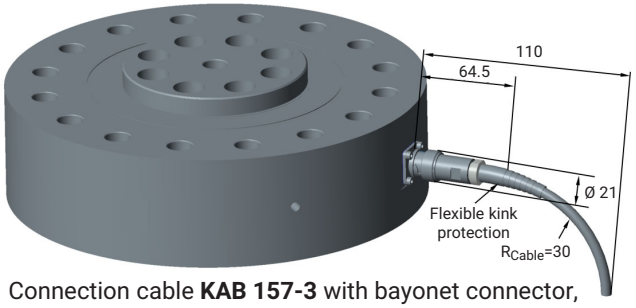
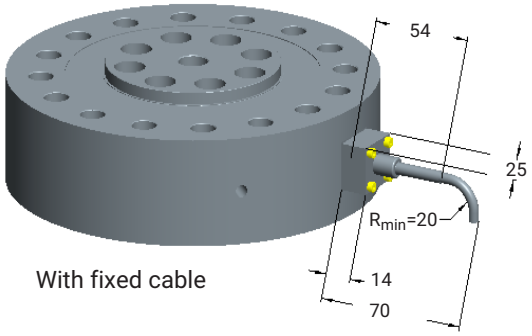
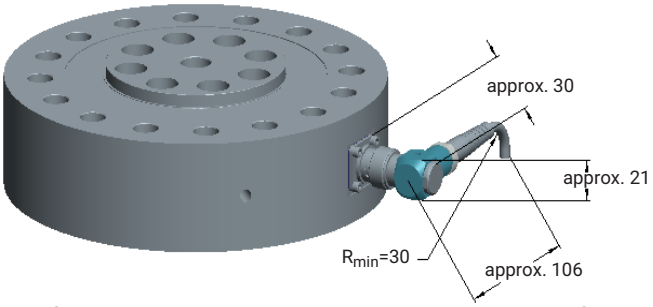
MOUNTING DIMENSIONS OF CONNECTION VARIANTS



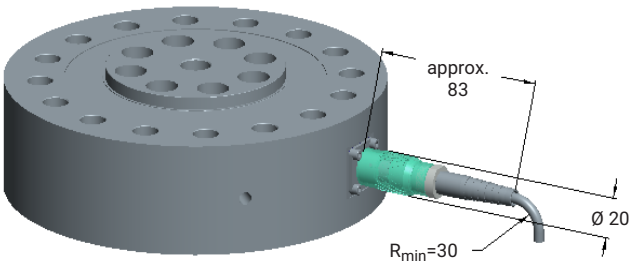
Connection cable **KAB 157-3** with bayonet connector, compatible with a MIL-C-26482 series 1 connector



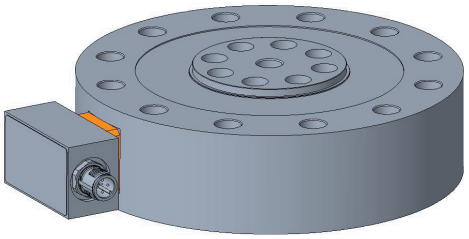
With fixed cable



Configurable connection cable **K-CAB-F** with option of angled bayonet connector, compatible with the MIL-C-26482 series 1 connector

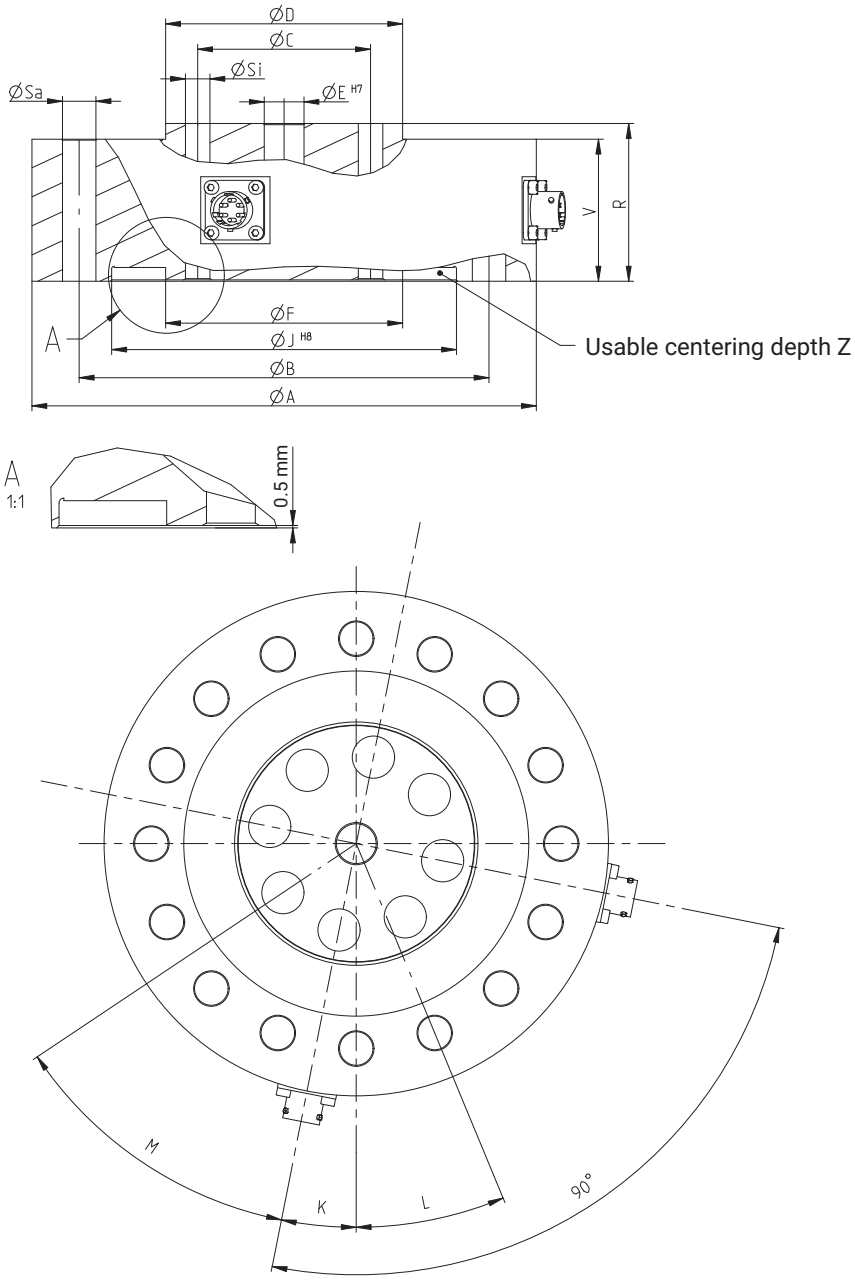


Connection cable **KAB-158** with screw connector, compatible with the MIL-C-26482 series 1 connector



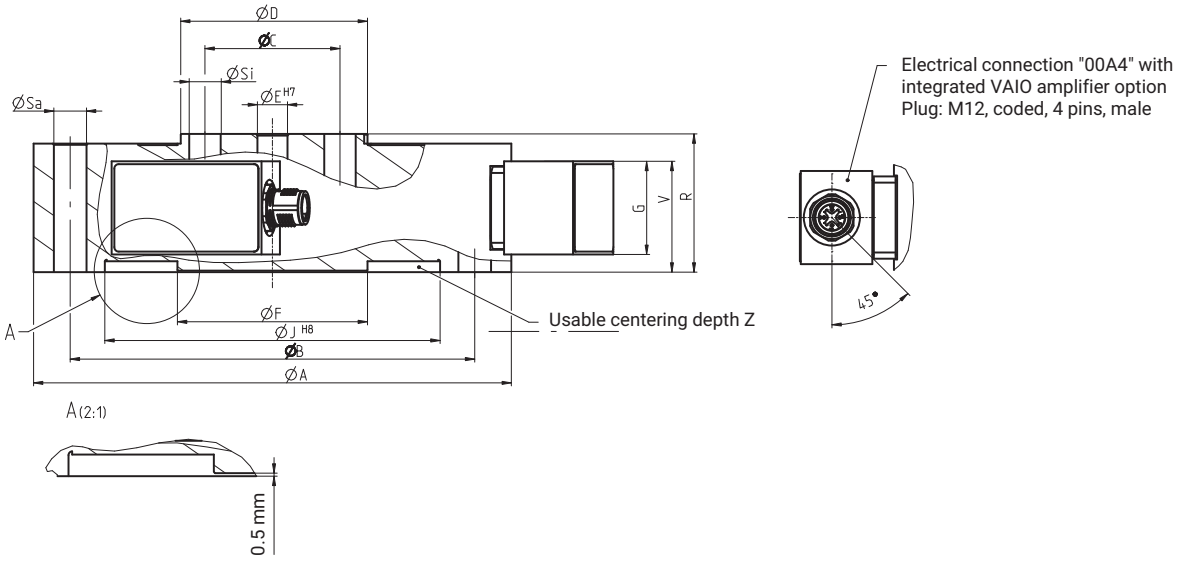
Electrical connection **00A4** with integrated amplifier option (plug: M12, A-coded, 4 pins, male)

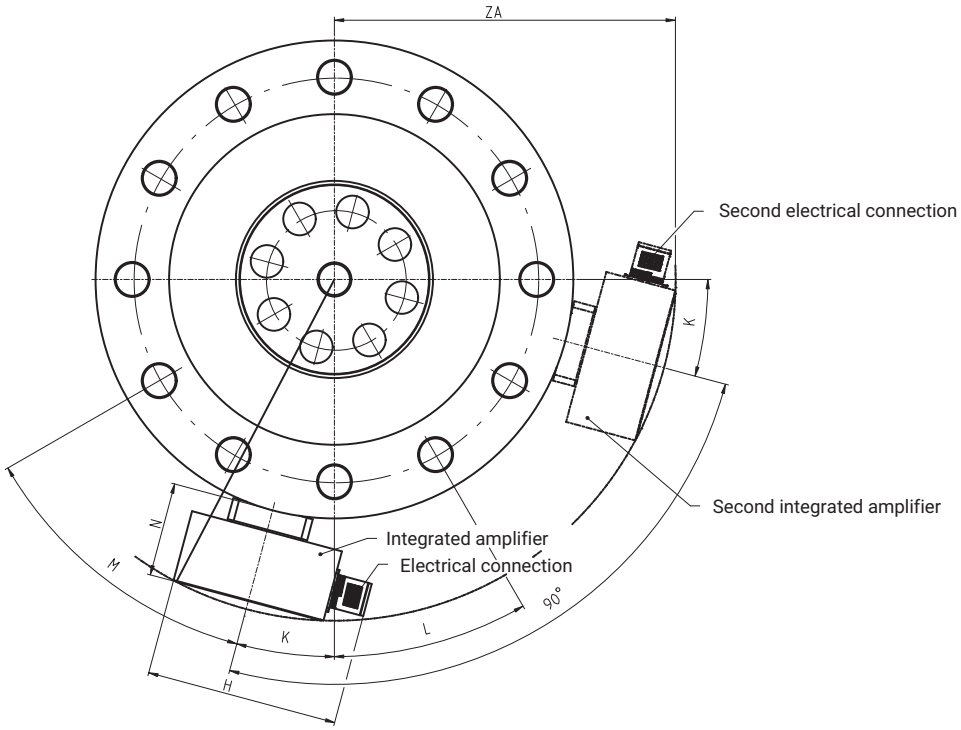
U10F dimensions without amplifier



Nominal (rated) force		øA	V	R	øB	øC	øD	øE (H7)	øF	øJ (H8)	øSa	øSi	M	K	L	Z
50 kN - 125 kN	mm	153.9	41.4	44.5	130.3	45	61.2	10	61.2	108	10.5	10.5	45°	15°	30°	2.5
	inches	6.06	1.63	1.75	5.13	1.77	2.41	0.39	2.41	4.25	0.41	0.41				
250 kN	mm	203.2	57.2	63.5	165.1	71	95.5	16	95.5	138.9	13.5	17	45°	11.25°	22.5°	3.5
	inches	8.00	2.25	2.5	6.5	2.8	3.76	0.63	3.76	5.47	0.53	0.67				
500 kN	mm	279	76.2	88.9	229	88	122.2	16	122.2	172.1	17	21	45°	11.25°	22.5°	3.5
	inches	10.98	3.0	3.5	9.02	3.46	4.81	0.63	4.81	6.78	0.67	0.83				
1.25 MN	mm	390	112	127	322	150	190	20	190	254.4	26	26	45°	7.5°	15°	3.5
	inches	15.35	4.41	5.00	12.68	5.91	7.48	0.79	7.48	10.02	1.02	1.02				

U10F dimensions with amplifier



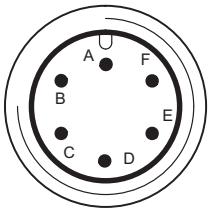


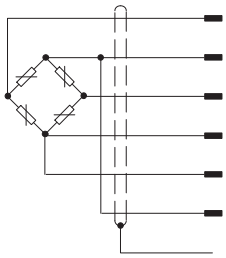
Dimensions in mm

Max. capa -city		øA	V	R	øB	øC	øD	øE (H7)	øF	G	H	øJ (H8)	øSa	øSi	M	N	K	L	Z	ZA
50 kN - 125 kN	mm	153.9	41.4	44.5	130.3	45	61.2	10	61.2	30	62	108	10.5	10.5	45°	30.3	15°	30°	2.5	110
	inches	6.06	1.63	1.75	5.13	1.77	2.41	0.39	2.41	30	62	4.25	0.41	0.41						
250 kN	mm	203.2	57.2	63.5	165.1	71	95.5	16	95.5	30	62	138.9	13.5	17	45°	30.3	11.25°	22.5°	3.5	134.5
	inches	8.00	2.25	2.5	6.5	2.8	3.76	0.63	3.76	30	62	5.47	0.53	0.67						
500 kN	mm	279	76.2	88.9	229	88	122.2	16	122.2	30	62	172.1	17	21	45°	30.3	11.25°	22.5°	3.5	172.5
	inches	10.98	3.0	3.5	9.02	3.46	4.81	0.63	4.81	30	62	6.78	0.67	0.83						
1.25 MN	mm	390	112	127	322	150	190	20	190	30	62	254.4	26	26	45°	30.3	7.5°	15°	3.5	227.9
	inches	15.35	4.41	5.00	12.68	5.91	7.48	0.79	7.48	30	62	10.02	1.02	1.02						

ELECTRICAL CONNECTION

Electrical connection without integrated amplifier (passive)





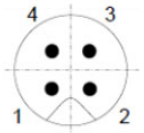
Device plug pin assignment		Cable assignment
B	Measurement signal (+)	wh (white)
D	Excitation voltage (-) (TEDS chip*)	bk (black)
C	Measurement signal (-)	rd (red)
A	Excitation voltage (+)	bu (blue)
F	Sense lead (+)	gn (green)
E	Sense lead (-) (TEDS*)	gy (gray)
	Cable shield, connected to housing	Shield

* Only when option T is selected (transducer identification)

Electrical connection with amplifier VAIO (IO-Link)

Pin	U10F assignment
1	Supply voltage +
2	Digital output (DI/DO pin function)
3	Supply voltage -, reference potential
4	IO-Link data (C/Q), switchover to the digital output (SIO mode) possible

Class A



Male
(device)

SPECIFICATIONS WITH 100% CALIBRATION

Specifications without amplifier

Nominal (rated) force	F_{nom}	kN	50	125	250	500	
		MN					1.25
		US lbf	11.2k	28.1k	56.2k	112.4k	281.0k
Accuracy							
HBK accuracy class			0.04			0.05	
Relative reproducibility and repeatability errors in unchanged mounting position	b_{rg}	%	0.02				
Relative reversibility error (hysteresis) at 0.4 F_{nom}	$v_{0.4}$	%	0.04			0.05	
Non-linearity	d_{lin}	%	0.035			0.05	
Relative zero point return	v_{w0}	%	0.008				
Relative creep	$d_{cr, F+E}$	%	0.02				
Effect of the bending moment at 10% F_{nom} * 10mm	d_{Mb}	%	0.01				
Effect of lateral forces at 10% of F_{nom}	d_Q	%	0.01				
Temperature coefficient of sensitivity	TC_S	%/10K	0.015				
Temperature coefficient of zero signal	TC_0	%/10K	0.015				
Rated electrical output							
Rated output (nominal)	C_{nom}	mV/V	2				
Relative zero signal error	$d_{S,0}$	%	0.08				
Rated output deviation with "adjusted rated output" option	d_C	%	0.1				
Rated output range without "adjusted rated output" option	C	mV/V	2 … 2.5				
Rated output variation for tension/pressure	d_{zd}	%	0.2				
Input resistance	R_e	Ω	> 345				
Range of the output resistance without "adjusted rated output" option	R_a	Ω	280 … 360				
Output resistance with "adjusted rated output" option	R_a	Ω	365 ±0.5				280… 360
Insulation resistance	R_{Iso}	GΩ	> 2				
Operating range of the excitation voltage	$B_{U,G}$	V	0.5 … 12				
Reference excitation voltage	U_{ref}	V	5				
Connection			6-wire circuit				
Temperature							
Reference temperature	T_{ref}	°C	23				
		°F	73.4				
Nominal temperature range	$B_{T,nom}$	°C	-10 … +45				
		°F	14 … 113				
Operating temperature range	$B_{T, G}$	°C	-30 … +85				
		°F	-22 … 185				
Storage temperature range	$B_{T,S}$	°C	-30 … +85				
		°F	-22 … 185				
Characteristic mechanical quantities							
Maximum operating force	F_G	% of F_{nom}	240	210	240	240	200
Force limit	F_L		240	210	240	240	200
Breaking force[2)]	F_B		> 400	> 250	> 280	> 240	> 240
Torque limit without taking into account the properties of the flange screw fitting[2)]	$M_{G\ max}$	N·m	1270	3175	5715	11430	28575
Bending moment limit without taking into account the properties of the flange screw fitting[2)]	$M_{b\ max}$	N·m	1270	3175	5715	11430	28575
Static lateral force limit without taking into account the properties of the flange screw fitting[2)]	F_q	% of F_{nom}	100				
Nominal (rated) displacement	s_{nom}	mm	0.04	0.05	0.06	0.06	0.09
Natural frequency	f_G	kHz	5.7	6.9	5.3	4.1	3

Nominal (rated) force	F_{nom}	kN	50	125	250	500	
		MN					1.25
		US lbf	11.2k	28.1k	56.2k	112.4k	281.0k
Permissible oscillation stress	f_{rb}	% of F_{nom}	200				
Stiffness	c_{ax}	10^5 N/mm	12.5	25	41.7	83.3	140
General information							
Degree of protection as per EN 60529, with bayonet connector (standard version), jack connected to sensor			IP67				
Degree of protection as per EN 60529, with "threaded connector" option			IP64				
Degree of protection as per EN 60529, with "integrated cable" option			IP68[1)]				
Spring element material			Stainless steel				
Measuring point protection			Hermetically-welded measuring body				
Cable (only with "integrated cable" option)			Six-wire circuit, TPE insulation. Outside diameter 5.4 mm				
Cable length		m	6 or 15				
Mechanical shock resistance as per IEC 60068-2-6							
Number		n	1000				
Duration		ms	3				
Acceleration		m/s^2	1000				
Vibrational stress as per IEC 60068-2-27							
Frequency range		Hz	5 … 65				
Duration		min	30				
Acceleration		m/s^2	150				
Weight	m	kg	3.9	4.1	10	29	81
		lbs	8.6	9	22	63.9	179

1) Test condition: 1 m water column, 100 hours
2) Data without taking into account the load limit of the flange screw fitting. Please pay attention to the mounting instructions.

Specifications with VAIO amplifier

Nominal (rated) force	F_{nom}	kN	50	125	250	500	
		MN					1.25
		US lbf	11.2k	28.1k	56.2k	112.4k	281.0k
Accuracy							
HBK accuracy class			0.04			0.05	
Relative reproducibility and repeatability errors in unchanged mounting position	b_{rg}	%	0.02				
Relative reversibility error (hysteresis) at 0.4 F_{nom}	$v_{0.4}$	%	0.04			0.05	
Non-linearity	d_{lin}	%	0.005			0.03	
Relative zero point return	v_{w0}	%	0.008				
Relative creep	$d_{cr, F+E}$	%	0.02				
Effect of the bending moment at 10% F_{nom} * 10mm	d_{Mb}	%	0.01				
Effect of lateral forces (lateral force = 10% of F_{nom})	d_Q	%	0.01				
Temperature coefficient of sensitivity	TC_S	%/10K	0.015				
Temperature coefficient of zero signal	TC_0	%/10K	0.0075				
VAIO electrical characteristics							
Output signal, interface			IO Link standard, COM3				
Min. cycle time		ms	< 0.9				
Sample rate (internal)		S/s	40000				
Cut-off frequency (-3 dB)	F_G	kHz	4				
Nominal (rated) supply voltage	U_{ref}	V	24				
Operating range of the supply voltage	$B_{u,gt}$	V	19 … 30				
Maximum power consumption		mW	3200				
Noise		ppm of nominal force	With Bessel filter 1Hz: 14 With Bessel filter 10 Hz: 38 With Bessel filter 100 Hz: 117 With Bessel filter 200 Hz: 165 Without filter: 1812				
Low-pass filter			Freely adjustable cut-off frequency, Bessel or Butterworth characteristic, 6th order				
Relative rated output variation for tension/pressure	d_{zd}	%	0.03				
Device functions							
Limit value switches			2 limit value switches, invertible, freely adjustable hysteresis, output via process data or digital output				
Digital IO			According to IO-Link Smart Sensor Profile, 1 permanently available digital output, 1 output can be set to data output, then no measurement possible				
Slave pointer function			Yes				
Peak value memory			Yes				
Peak-to-peak memory			Yes				
Warning functions			Warning on exceeding nominal (rated) force/maximum operating force, nominal (rated) temperature/maximum operating temperature				
Temperature							
Reference temperature	T_{ref}	°C	23				
		°F	73.4				
Nominal temperature range	$B_{T,nom}$	°C	-10 … +45				
		°F	14 … 113				
Operating temperature range	$B_{T, G}$	°C	-10 … +60				
		°F	14 … 140				
Storage temperature range	$B_{T,S}$	°C	-25 … +85				
		°F	-13 … 185				

Nominal (rated) force	F_{nom}	kN	50	125	250	500	
		MN					1.25
		US lbf	11.2k	28.1k	56.2k	112.4k	281.0k
Characteristic mechanical quantities							
Maximum operating force	F_G	% of F_{nom}	240	210	240	240	200
Force limit	F_L		240	210	240	240	200
Breaking force[3)]	F_B		> 400	> 250	> 280	> 240	> 240
Torque limit without taking into account the properties of the flange screw fitting[3)]	$M_{G\,max}$	N·m	1270	3175	5715	11430	28575
Bending moment limit without taking into account the properties of the flange screw fitting[3)]	$M_{b\,max}$	N·m	1270	3175	5715	11430	28575
Static lateral force limit without taking into account the properties of the flange screw fitting[3)]	F_q	% of F_{nom}	100				
Nominal (rated) displacement	s_{nom}	mm	0.04	0.05	0.06	0.06	0.09
Natural frequency	f_G	kHz	5.7	6.9	5.3	4.1	3
Permissible oscillation stress	f_{rb}	% of F_{nom}	200				
Stiffness	c_{ax}	10^5 N/mm	12.5	25	41.7	83.3	140
General information							
Degree of protection as per EN 60529, with connected cable			IP67				
Spring element material			Stainless steel				
Material of permanently installed amplifier housing			Stainless steel				
Measuring point protection			Hermetically-welded measuring body				
Mechanical shock resistance as per IEC 60068-2-6							
Number		n	1000				
Duration		ms	3				
Acceleration		m/s^2	1000				
Vibrational stress as per IEC 60068-2-27							
Frequency range		Hz	5 … 65				
Duration		min	30				
Acceleration		m/s^2	150				
Weight	m	kg	4.05	4.25	10.15	29	81
		lbs	8.93	9.37	22.38	63.9	179

3) Data without taking into account the load limit of the flange screw fitting. Please pay attention to the mounting instructions.

VERSIONS AND ORDERING NUMBERS

Code	Measuring range	Ordering number
50K0	50 kN	1-U10F/50kN
125K	125 kN	1-U10F/125kN
250K	250 kN	1-U10F/250kN
500K	500 kN	1-U10F/500kN
1M25	1.25 MN	1-U10F/1.25MN

The ordering numbers shown in gray are preferred types. They can be delivered rapidly.

All preferred types with bayonet plug, single bridge, without rated output adjustment, without plug protection, without amplifier, without TEDS and without firmware.
The ordering number for the preferred types is 1-U10F/...
The ordering number for customized versions is K-U10F-...
The ordering number example **K-U10F-1M25-DB-N-1-S-S-U-00A4-00A4-X-X-VAIO-VAIO-IO03** shown below is a: U10F, nominal (rated) force 1.25 MN with double bridge, without rated output adjustment, 100% calibration, without TEDS, without plug protection and integrated amplifier with IO-Link output.

Nominal (rated) force	No. of measuring bridges	Rated output	Calibration	Transducer identification	Mechanical design	Plug protection	Electrical connection		Plug version for the "fixed mounted cable" option		Integrated amplifier		Firmware
							Bridge A	Bridge B	Bridge A	Bridge B	Bridge A	Bridge B	
50 kN **50K0**	Single bridge **SB**	Not adjusted **N**	100% (dyn.) **1**	Without TEDS chip **S**	Standard **S**	Without **U**	Bayonet connector **B**		Free ends **Y**		Without integrated amplifier **N**		No firmware **N**
125 kN **125K**	Double bridge **DB**	Adjusted **J**		With TEDS chip **T**		With **P**	Threaded connector **G**		D-Sub-D, 15-pin **F**		Digital amplifier: IO-Link **VAIO**		Version 2.0.8 **IO03**
250 kN **250K**							Fixed cable (6 m) **K**		D-Sub-HD, 15-pin **Q**				Version 2.0.10 **IO04**
500 kN **500K**							Fixed cable (15 m) **V**		Plug ME3106PEMV **N**				Version 2.0.12 **IO05**
1.25 MN **1M25**							M12 plug, 4-pin, A-coded **00A4**		ODU plug, 14-pin **P**				
									M12 plug, 8-pin **M**				
									No cable **X**				

Ordering example

K-U10F-1M25-	DB-	N-	1-	S-	S-	U-	004A-	004A-	X-	X-	VAIO-	VAIO-	IO03
U10F, nominal (rated) force 1.25 MN	Double bridge	No rated output compensation	Calibrated at nominal (rated) force (dynamic application)	Without TEDS chip	Standard	Without plug protection	Measuring bridge A: M12 plug, 4-pin, A-coded	Measuring bridge B: M12 plug, 4-pin, A-coded	Measuring bridge A: No cable	Measuring bridge B: No cable	Measuring bridge A: With amplifier, digital IO-Link	Measuring bridge B: With amplifier, digital IO-Link	Firmware 2.0.8

Glossary

No. of measuring bridges	To ensure redundancy, in safety-relevant devices the plausibility of the measurement signal must be checked using a second measuring bridge (installed on the same measuring body). The signals are independently conditioned and evaluated by two separate signal conditioners. It is therefore possible to connect two signal conditioners with different characteristics.
Rated output	The exact rated output (nominal) is stated on the type plate. The transducer can also be adjusted to an exact rated output of 2.00 mV/V. The relative rated output tolerance is then 0.1% of the rated output (nominal). The rated output range of a non-calibrated transducer is between 2 and 2.5 mV/V. See Specifications for details.

Calibration	The force transducer is calibrated at 100% of the nominal (rated) force in any case, so that it can be used for alternating dynamic loads. If you order the U10F with compensated rated output, sensors with nominal (rated) forces from 50 kN to 500 kN inclusive are suitable for connection in parallel. No options available.
Transducer identification	Integration of TEDS (Transducer Electronic Data Sheet) chip as per IEEE1451.4. If the relevant amplifier electronics are provided, the measurement chain will parameterize itself. TEDS only for sensors without integrated amplifier module.
Mechanical design	No options available
Plug protection	Mechanical protection through the installation of an additional square profile around the plug. Approx. dimensions: WxHxD: 30x30x20 mm, a solid round tube at nominal (rated) force 1.25 MN.
Electrical connection, measuring bridge A	The standard version is the device plug with a bayonet connection (compatible with PT02E10-6P). A screw-fitting male device plug (compatible with PC02E10-6P) may also be installed. A third variant where the force transducers are fitted with a fixed cable is also available. In this variant, all U10F connections have degree of protection IP68. Sensors with a digital output (VAIO) are connected via the 4-pin M12 plug.
Electrical connection, measuring bridge B	See Electrical connection, measuring bridge A.
Plug selection with the "fixed cable" option measuring bridge A/B	If you have ordered the U10F with an integrated cable, you can also order a fitted plug at the end of the cable, so that the force sensor can be directly connected to a signal conditioner. Y = Free ends, no plug fitted F = D-sub-HD15, for connection to MGC+ (e.g. AP01), Scout Q = HD-sub-HD15, for connection to many HBK data acquisition systems from the Quantum series (MX410, MX440, MX840) N = MS plug, for connection to HBK data acquisition systems such as MGC+ (AP03), DMP or DK38 P = ODU plug, 14-pin, degree of protection IP68, for connection to all HBK data acquisition systems from the Somat XR series that are suitable for measuring full bridge circuits. M = M12 plug, 8-pin, suitable for measuring amplifiers digiBOX and DSE X = No cable
Integrated amplifier	The force transducer can also be ordered with permanently connected amplifier modules: N = Without integrated amplifier VAIO = Digital amplifier: IO-Link
Firmware	If you order the U10M with the VAIO option, the measurement chain is always shipped with the latest firmware. N = No firmware, for sensors with analog output signal IO03 = Firmware 2.0.8 IO04 = Firmware 2.0.10 IO05 = Firmware 2.0.12

ACCESSORIES

The accessories are not included in the scope of supply.

Description	Ordering number
Connection cable KAB157-3; IP67 (with bayonet connection); 3 m long, outer sheath TPE; 6 x 0.25 mm^2; free ends, shielded, outside diameter 6.5 mm	1-KAB157-3
Connection cable KAB158-3; IP54 (with screw connection), 3 m long, outer sheath TPE; 6 x 0.25 mm^2; free ends, shielded, outside diameter 6.5 mm	1-KAB158-3
Cable, configurable with different plugs and lengths	K-CAB-F
Bayonet connector for cables with an outside diameter of 4 mm to 6.5 mm	1-CON/BS1
Bayonet connector for cables with an outside diameter of 6.5 mm or more	1-CON/BS2
Loose female connector (screw connection)	3-3312.0354
Ground cable (400 mm long)	1-EEK4
Ground cable (600 mm long)	1-EEK6
Ground cable (800 mm long)	1-EEK8

Force transducer		Dimensions	Quantity per set	Ordering number
U10F/50kN	Inner flange	M10 x 1.25; 55 mm long	12	1-SRS/M10/1.25/55
	Outer flange	M10 x 1.25; 55 mm long		
U10F/125kN	Inner flange	M10 x 1.25; 55 mm long		
	Outer flange	M10 x 1.25; 55 mm long		
U10F/250kN	Inner flange	M16 x 1.5; 100 mm long	16	1-SRS/M16/1.5/100
	Outer flange	M12 x 1.25; 80 mm long		1-SRS/M12/1.25/80
U10F/500kN	Inner flange	M20 x 1.5; 120 mm long	8	1-SRS/M20/1.5/120
	Outer flange	M16 x 1.5; 100 mm long	16	1-SRS/M16/1.5/100
U10F/1.25MN	Inner flange	M24 x 2; 170 mm long	12	1-SRS/M24/2/170
	Outer flange	M24 x 2; 150 mm long	24	1-SRS/M24/2/150

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Hottinger Brüel & Kjaer GmbH
Im Tiefen See 45 · 64293 Darmstadt · Germany
Tel. +49 6151 803-0 · Fax +49 6151 803-9100
www.hbkworld.com · info@hbkworld.com