

Torque transducer

## T20WN

Terminal box

## VK20





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## Safety instructions

### Use in accordance with the regulations

Torque transducer T20WN is used exclusively for torque and rotation speed measurement tasks and control and adjustment tasks directly connected thereto. Use for any additional purpose shall be deemed to be **not** in accordance with the regulations.

In the interests of safety, the transducer should only be operated as described in the Operating Manual. It is also essential to observe the appropriate legal and safety regulations for the application concerned during use. The same applies to the use of accessories.

The transducer is not a safety element within the meaning of its use as intended. Proper and safe operation of this transducer requires proper transportation, correct storage, assembly and mounting and careful operation.

### General dangers of failing to follow the safety instructions

The transducer corresponds to the state of the art and is fail-safe. The transducer can give rise to remaining dangers if it is inappropriately installed and operated by untrained personnel.

Everyone involved with the installation, commissioning, maintenance or repair of the transducer must have read and understood the Operating Manual and in particular the technical safety instructions.

### Remaining dangers

The scope of supply and performance of the transducer covers only a small area of torque measurement technique. In addition, equipment planners, installers and operators should plan, implement and respond to the safety engineering considerations of torque measurement technique in such a way as to minimise remaining dangers. Prevailing regulations must be complied with at all times. Reference must be made to remaining dangers connected with torque measurement technology.

In this Operating Manual remaining dangers are pointed out using the following symbols:



Symbol: **DANGER**

*Meaning:* **Maximum danger level**

Warns of an **imminently** dangerous situation in which failure to comply with safety requirements **will** result in death or serious physical injury.



Symbol: **WARNING**

*Meaning:* **Dangerous situation**

Warns of a **potentially** dangerous situation in which failure to comply with safety requirements **can** result in death or serious physical injury.



Symbol: **CAUTION**

*Meaning:* **Potentially dangerous situation**

Warns of a potentially dangerous situation in which failure to comply with safety requirements **could** result in damage to property or some form of physical injury.

Symbols indicating application notes and useful information:



Symbol: **NOTE**

Means that important information about the product or its handling is being given.



Symbol:

*Meaning:* **CE mark**

The CE mark enables the manufacturer to guarantee that the product complies with the requirements of the relevant EC directives (the declaration of conformity is available at <http://www.hbm.com/support/dokumentation>).

## Conversions and modifications

The transducer must not be modified from the design or safety engineering point of view except with our express agreement. Any modification shall exclude all liability on our part for any damage resulting therefrom.

## Qualified personnel

The transducer must only to be installed and used by qualified personnel, strictly in accordance with the specifications and with safety requirements and regulations. It is also essential to observe the appropriate legal and safety regulations for the application concerned during use. The same applies to the use of accessories.

Qualified personnel means persons entrusted with the installation, fitting, commissioning and operation of the product who possess the appropriate qualifications for their function.



## WARNING

**In accordance with the health and safety regulations relevant to accident prevention, once the operator has fitted the torque transducer, a cover or cladding must be attached as follows:**

- **The cover or cladding must not be free to rotate.**
- **The cover or cladding must prevent access to any areas where crushing or shearing could occur, and must provide protection against any parts that may come loose.**
- **Covers and cladding must be positioned at a suitable distance or so arranged that it prevents access to any moving parts within.**
- **Covers and cladding must also be attached if the moving parts of the torque transducers are installed outside the area in which people are moving about and working.**

The only permitted exceptions to the above requirements are if the various parts and assemblies of the machine are already fully protected by the design of the machine or by existing safety precautions.

## 1 Application

Torque transducer T20WN measure static and dynamic torque and rotation speeds or angles of rotation for turning or static machine parts in any direction of rotation. It is designed for small to medium-sized torque, such as that measured on performance or function test benches for domestic or business machines.

## 2 Installation

### 2.1 Installation position

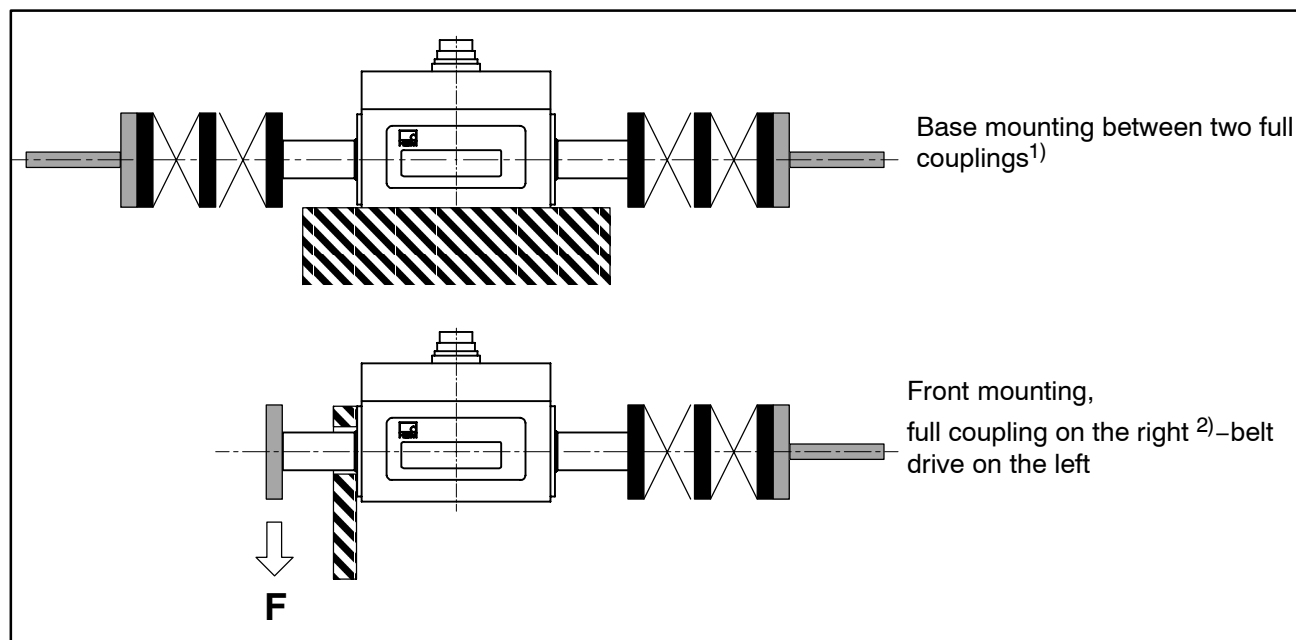
Any installation position can be chosen for torque transducer (see Chapter 2.3.1).

### 2.2 Installation options



#### CAUTION

The permissible load limits given in the specifications (see Page 15) are mandatory.



**Fig. 2.1:** Installation options with couplings

1) HBM accessories: bellows-type couplings. You will need two of these couplings.

2) HBM accessories: bellows-type couplings. You will need one of these couplings.

## 2.3 Couplings

HBM supplies bellows-type couplings for the installation of torque transducers. When prepared for delivery, the couplings and the torque transducer are kept separate. The following points must be observed during installation:

- Only tighten the clamping screws of the couplings once the shafts are installed in the coupling hubs!
- The bellows-type coupling must not be overstretched beyond the specified permissible flexibility.
- Drive and output shafts must be without burr.
- Run the shaft diameter with j6 tolerance, to produce the preferred fit H7/j6.

### 2.3.1 Installation position with couplings

With the bellows-type couplings, the T20WN torque transducer can be operated in any installation position (horizontal, vertical or diagonal). With vertical and diagonal operation, make sure that additional frames are adequately supported.

### 2.3.2 Installation

1. Degrease the hub bore of each coupling half member and the shaft ends with solvent (for example, acetone).
2. Push the hub onto the shaft, set the reference gap L (making use of the full clamping length of the coupling) and align the shafts.
3. Tighten the clamp element clamping screws with a torque wrench (for the required tightening torque, see Table1).



### CAUTION

**When installing the coupling, you must not exceed the permissible axial and lateral forces or bending limit moments (see Page 17) of the torque transducer!**

**When tightening the clamping screws, hold the coupling on the clamp element.**

Measuring range (N·m)	Tightening torque (N·m)
0.1	0.35
0.2	
0.5	
1	0.75
2	
5	
10	1.5
20	
50	
100	14
200	35
	75
	120

**Table1:** Tightening torque of the clamping screws

## 3 Electrical connection

### 3.1 General instructions

We recommend to use shielded, low-capacitance cable from HBM for the electrical connection between torque transducer and measuring amplifier.

With cable extensions it is important to ensure that a good connection is provided, with minimum contact resistance and good insulation. All plug connections or cap nuts have to be tightened firmly.

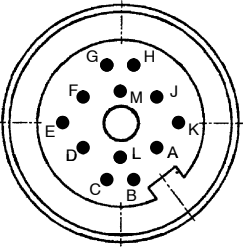
Do not route measurement cables in parallel to power lines and control circuits. If this is not possible (for example in cable ducts), maintain a minimum distance of 50 cm and protect the cable with a steel tube.

Avoid transformers, motors, contactors, thyristor controllers and similar sources of stray fields.

## 3.2 Connector

The transducer is equipped with a permanent housing connector.

It can be connected to the relevant measurement electronics by using the transducer connection cable (accessories, see Page 18). The pin assignment for the transducer connection cable can be found in the following table:

	Pin	Pin assignment	Wire colour	Release calibration signal (without VK20)  Bridge   Switch (NO)
	A	No function	BK	
	B	Measurement signal speed/angle of rotation 5 V	RD	
	C	Measurement signal torque $\pm 10$ V	BN	
	D	Measurement signal torque 0 V	WH	
	E	Ground (supply+speed/angle of rotation)	YE	
	F	Supply voltage +12 V	VT	
	G	Measurement signal speed/angle of rotation 5 V, 90° phase shifted	GN	
	H	No function	PK	
	J	No function	GY	
	K	Calibration signal (to pin D)	GY/PK	
	L	No function	BU/RD	
	M	Cable shield	BU	

## 3.3 Cable extension

Extension cables must be the shielded, low-capacitance type. We recommend the use of HBM cables that comply with these requirements.

When using cable extensions, ensure that the connection is perfect, with the lowest possible contact resistance and good insulation. For this reason all connections should be soldered, or at the very least should use firmly fixed terminals or screwed connectors.

Measurement cables should not be laid parallel to high-voltage lines or control circuits (and therefore should not be laid in common cable shafts). If this is not possible, protect the measurement cable with, for example, armoured steel tubing and keep them as far away as possible from other cables. Avoid the stray fields of transformers, motors and contactors.

### 3.4 Shielding design

The cable shielding is connected in accordance with the Greenline concept. This encloses the measurement system in a Faraday cage. It is important that the shield is laid flat on the housing ground at both ends of the cable. Any electromagnetic interference active here does not affect the measurement signal. Please comply with the connection notes in Chapter 9.1.1, starting on Page 20.

In the case of interference caused by differences in potential (compensating currents), separate the connections between the zero operating voltage and the housing ground on the measuring amplifier and connect a potential equalisation line between the transducer housing and the amplifier housing (copper wire, 10 mm<sup>2</sup> conductor cross-section).

## 4 Load-carrying capacity

The torque transducer T20WN is suitable for measuring static and dynamic torque.

Nominal torque can be exceeded statically up to the limit torque. If nominal torque is exceeded, additional irregular loading is not permissible. This includes longitudinal forces, lateral forces and bending moments. Limit values can be found in the "Specifications" chapter, Page 15.

### 4.1 Measuring dynamic torque

The following applies to the measurement of dynamic torque:

- The calibration carried out for static torque also applies for dynamic torque measurement.



#### NOTE

The frequency of the dynamic torque must be lower than the natural frequency of the mechanical measuring system.

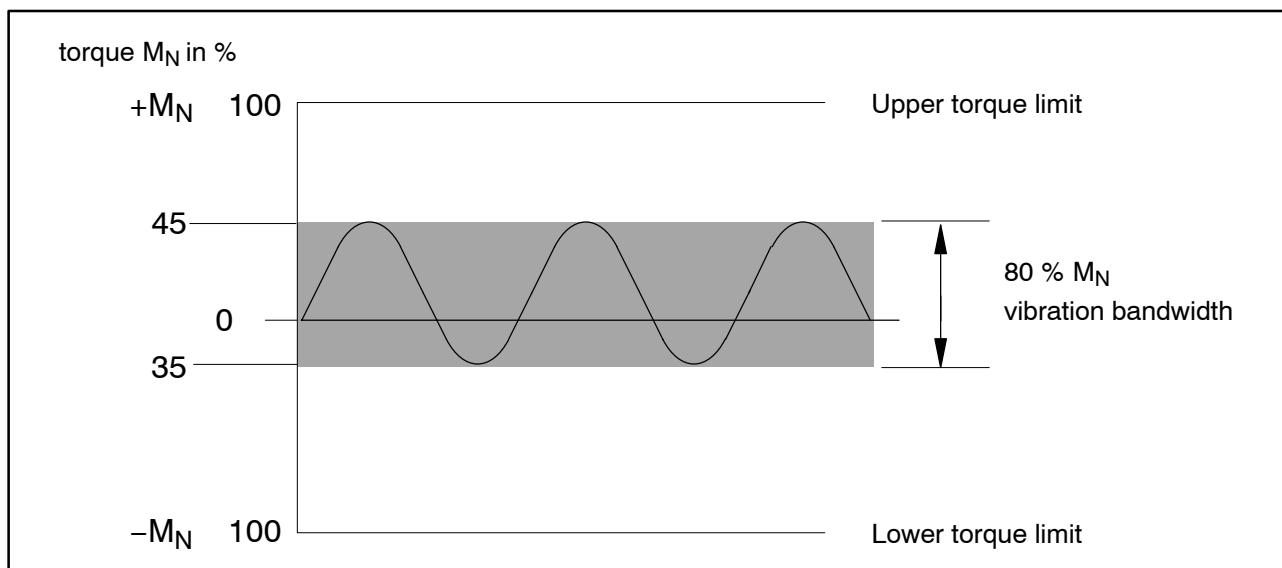
- The natural frequency  $f_0$  of the mechanical measuring system depends on the moments of inertia  $J_1$  and  $J_2$  of the coupled rotating masses and depends on the torsional stiffness of the transducer.

The natural frequency  $f_0$  of the mechanical measuring system can be determined from the following equation.

$$f_0 = \frac{1}{2\pi} \cdot \sqrt{c_T \cdot \left( \frac{1}{J_1} + \frac{1}{J_2} \right)}$$

$f_0$  = Natural frequency in Hz  
 $J_1, J_2$  = Moment of inertia in  $\text{kg}\cdot\text{m}^2$   
 $c_T$  = Torsional stiffness in  $\text{N}\cdot\text{m}/\text{rad}$

- The vibration bandwidth (peak-to-peak) must not exceed 80 % of the nominal torque identified for the torque transducer, even at alternating load. In all cases the vibration bandwidth must lie within the loading range defined by  $-M_N$  and  $+M_N$ .



**Fig. 2.2** Permissible dynamic loading

## 4.2 Maximum rotation speed

Torque transducer T20WN allows torque measurements up to a rotation speed of  $10\,000\text{ min}^{-1}$  and rotation speed measurements up to  $3000\text{ min}^{-1}$ .

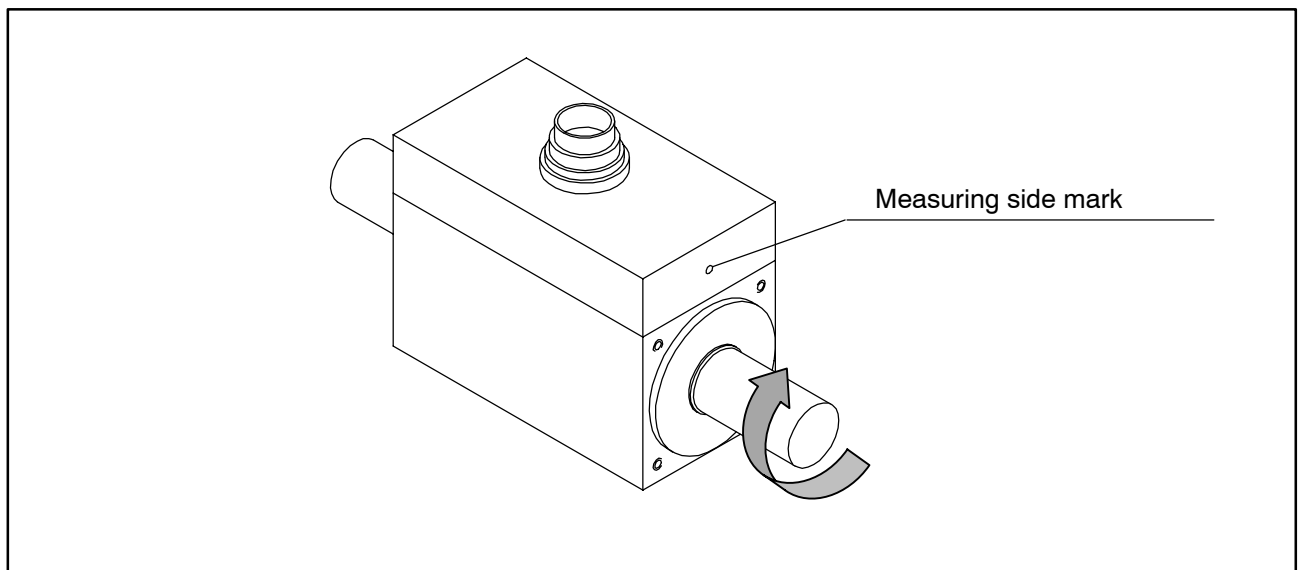
## 5 Displaying torque and direction of rotation

### Torque

If a right-hand torque (clockwise) is initiated, there is a positive output signal (0...+10 V).

### Direction of rotation

The sign on the display indicates the direction of rotation. With HBM measuring amplifiers, the output voltage or display is positive, if the transducer shaft is turning clockwise, looking at the measuring side.

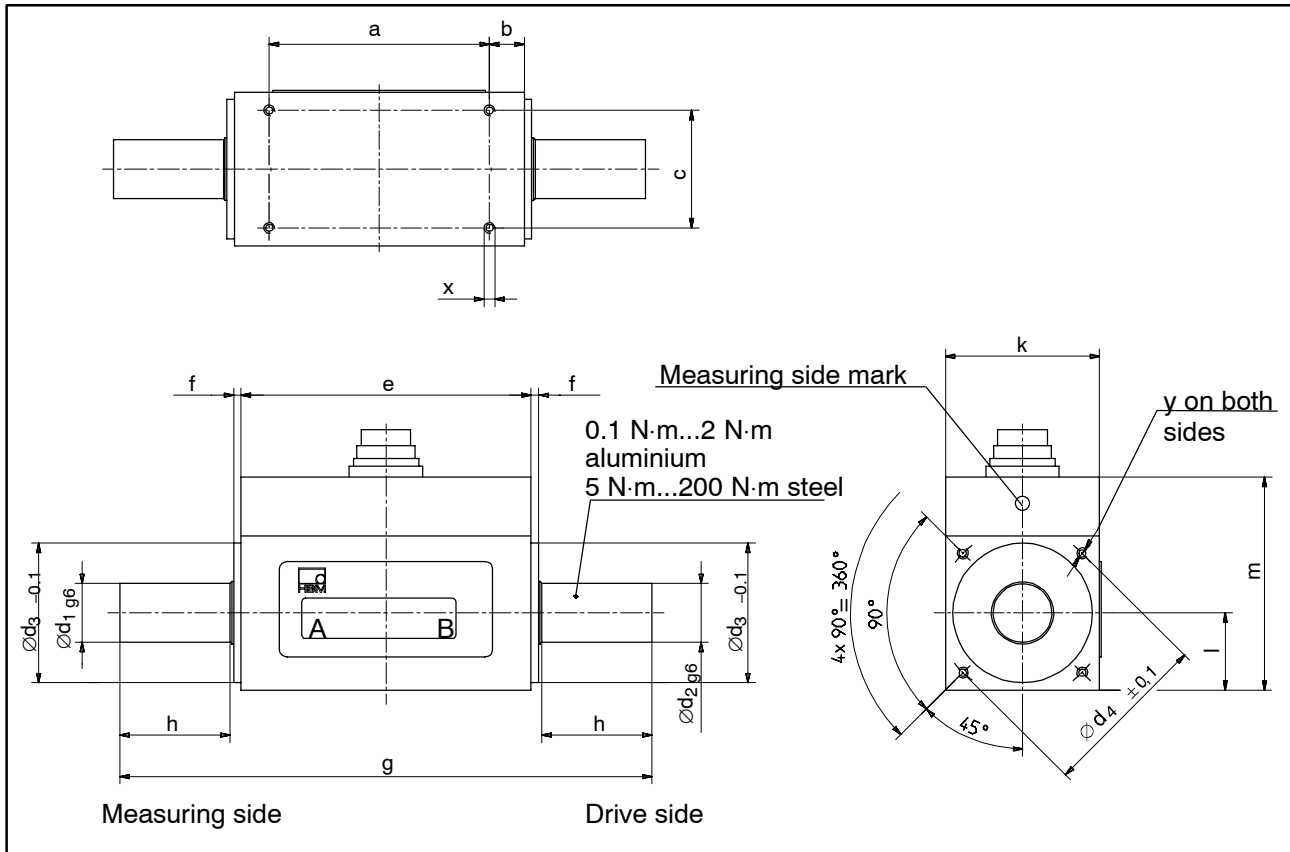


**Fig.10.1:** Direction of rotation for positive display

## 6 Maintenance

Torque transducer T20WN is largely maintenance free. We recommend that the low-friction special bearing should be replaced at the Darmstadt factory, after approx. 20 000 working hours. The calibration will also be checked at this time.

## 7 Dimensions



Meas. range (N·m)	Dimensions (in mm)															
	a	b	c	$e_{\pm 1}$	f	g	h	k	l	m	$\varnothing d_1$	$\varnothing d_2$	$\varnothing d_3$	$\varnothing d_4$	$y^1)$	$x^1)$
0.1	40	11	22	62	2	95	14	28	14	48.5	6	8	27	32	M3/6	M3/5
0.2	40	11	22	62	2	95	14	28	14	48.5	6	8	27	32	M3/6	M3/5
0.5	40	11	22	62	2	95	14	28	14	48.5	6	8	27	32	M3/6	M3/5
1	40	11	22	62	2	95	14	28	14	48.5	6	8	27	32	M3/6	M3/5
2	40	11	22	62	2	95	14	28	14	48.5	6	8	27	32	M3/6	M3/5
5	60	9.5	32	79	2	145	30	42	21	58	16	16	38	46	M3/6	M3/6
10	60	9.5	32	79	2	145	30	42	21	58	16	16	38	46	M3/6	M3/6
20	60	9.5	32	79	2	145	30	42	21	58	16	16	38	46	M3/6	M3/6
50	42	15	40	72	3	170	45	56	28	73	26	26	54	65	M4/8	M4/8
100	42	15	40	72	3	170	45	56	28	73	26	26	54	65	M4/8	M4/8
200	42	15	40	72	3	170	45	56	28	73	26	26	54	65	M4/8	M4/8

<sup>1)</sup> Size of thread/depth of thread

## 8 Specifications

Type	T20WN												
Accuracy class	0.2												
Torque measuring system													
Nominal torque $M_N$	N·m	0.1	0.2	0.5	1	2	5	10	20	50	100	200	
<b>Nominal sensitivity</b> (Nominal signal range between torque = zero and nominal torque)	V	10											
<b>Characteristic tolerance</b> (deviation of the actual output at $M_N$ of the nominal signal range)	%	$\pm 0.2$											
<b>Output signal for torque = zero</b>	V	$0 \pm 0.2$											
<b>Nominal output signal</b> at positive nominal torque	V	+10											
at negative nominal torque	V	-10											
<b>Load resistance</b>	M $\Omega$	> 1											
<b>Long-term drift over 48 h</b>	mV	$< \pm 50$											
<b>Cut-off frequency (-3 dB)</b>	Hz	200											
<b>Residual ripple</b>	mV <sub>PP</sub>	< 80											
<b>Effect of temperature per 10 K in nominal temperature range on the output signal, relative to the actual value of the signal span</b>	%	$\pm 0.1$											
<b>on the zero signal, relative to the nominal sensitivity</b>	%	$\pm 0.2$											
<b>Power supply</b> Nominal supply voltage (separated extra-low voltage (SELV))	V	12 (DC); (10.8...13.2)											
Release of calibration signal	V	5...13.2											
Current consumption in measuring mode	A	< 0.2											
Nominal power consumption	W	< 2.4											
<b>Linearity deviation including hysteresis, related to the nominal (rated) sensitivity</b>	%	$< \pm 0.1$											
<b>Rel. standard deviation of the reproducibility, according to DIN 1319, by reference to variation of the output signal</b>	%	$< \pm 0.05$											
<b>Calibration signal</b>	V	$10 \pm 0.2$ %											
<b>Nominal speed</b>	rpm	10 000											

Speed/angle of rotation measurement system												
Nominal torque $M_N$	N·m	0.1	0.2	0.5	1	2	5	10	20	50	100	200
<b>Measurement system</b>		Visual										
<b>Pulses per rotation</b>	No.	360										
<b>Output signal</b>	V	5 (asymmetric); two square wave signals, approx. 90° phase shifted										
<b>Minimum speed for sufficient pulse stability</b>	rpm	0										
<b>Load resistance</b>	kΩ	> 10										
<b>Maximum measurable rotation speed</b>	rpm	3000										
General specifications												
<b>EMC</b>												
<b>Immunity from interference</b> (DIN EN50082-2)												
Electromagnetic field												
RF enclosure	V/m	10										
Wiring	V <sub>PP</sub>	10										
Magnetic field	A/m	100										
Burst	kV	2/1										
DSE	kV	4/8										
<b>Emission (EME) (EN55011)</b>												
RFI voltage		Class B										
RFI field strength		Class B										
<b>Degree of protection to EN 60529</b>		IP40										
<b>Weight, approx.</b>	kg	0.17					0.34			0.6		
<b>Nominal temperature range</b>	°C [°F]	+5...+45[41...113]										
<b>Operating temperature range</b>	°C[°F]	0...+60[32...140]										
<b>Storage temperature range</b>	°C[°F]	-5...+70[23...158]										
<b>Impact resistance, test severity level according to DIN IEC 68; Part 2-27; IEC 68-2-27-1987</b>												
Number	n	1000										
Duration	ms	3										
Acceleration (half-sine)	m/s <sup>2</sup>	650										
<b>Vibration resistance, test severity level according to DIN IEC 68, Part 2-6: IEC 68-2-6-1982</b>												
Frequency range	Hz	5...65										
Duration	h	1.5										
Acceleration (amplitude)	m/s <sup>2</sup>	50										

Nominal torque $M_N$	N·m	0.1	0.2	0.5	1	2	5	10	20	50	100	200
<b>Load limit</b> <sup>3)</sup>												
<b>Limit torque, relative to <math>M_N</math></b>	%	200 <sup>4)</sup>										
<b>Breaking torque, relative to <math>M_N</math></b>	%	> 280										
<b>Axial limit force</b>	kN	0.2	0.2	0.2	0.34	0.5	1.1	1.75	2.75	5.3	7.6	12.5
<b>Lateral limit force</b>	N	3.6	3.6	3.6	5.7	8.3	18.2	29	46	88	127	207
<b>Bending limit moment</b>	Nm	0.12	0.12	0.12	0.23	0.4	0.93	1.9	3.7	10	17	36
<b>Vibration bandwidth to DIN 50 100 (peak-to-peak)</b> <sup>5)</sup>	%	80										
<b>Mechanical values</b>												
<b>Torsional stiffness <math>c_T</math></b>	kNm/rad	0.03	0.03	0.03	0.05	0.07	0.91	1.9	3.25	14	21.9	32.6
<b>Torsion angle at <math>M_N</math></b>	Deg.	0.2	0.38	0.96	1.1	1.7	0.32	0.3	0.35	0.2	0.26	0.35
<b>Max. limits for relative shaft vibration (peak-to-peak)</b> <sup>6)</sup>	$\mu\text{m}$	$s_{\text{max}} = \frac{4500}{\sqrt{n}}$ n in rpm										
<b>Effect. vibration velocity</b> in the area of the housing in accordance with VDI 2056	mm/s	$v_{\text{eff}} = \frac{\sqrt{n}}{3}$ n in rpm										
<b>Mass moment of inertia of the rotor (around the axis of rotation) with the speed measuring system</b> ( $\times 10^{-3}$ )	gm <sup>2</sup>	0.06	0.06	0.06	0.063	0.068	6.1	6.13	6.23	53.7	54.6	57.2

<sup>3)</sup> Each type of irregular stress (bending moment, lateral or axial load, exceeding nominal torque) can only be permitted up to its specified limit value provided none of the others can occur at the same time. If this condition is not met, the limit values must be reduced. If 30 % of the bending limit moment and lateral force limit occur at the same time, only 40 % of the axial limit force is permissible and nominal torque must not be exceeded. The permissible bending moments, axial forces and lateral forces can affect the measurement result by approx. 1 % of nominal torque.

<sup>4)</sup> Please comply with the maximum torque ( $T_{K\text{max}}$ ) of the couplings.

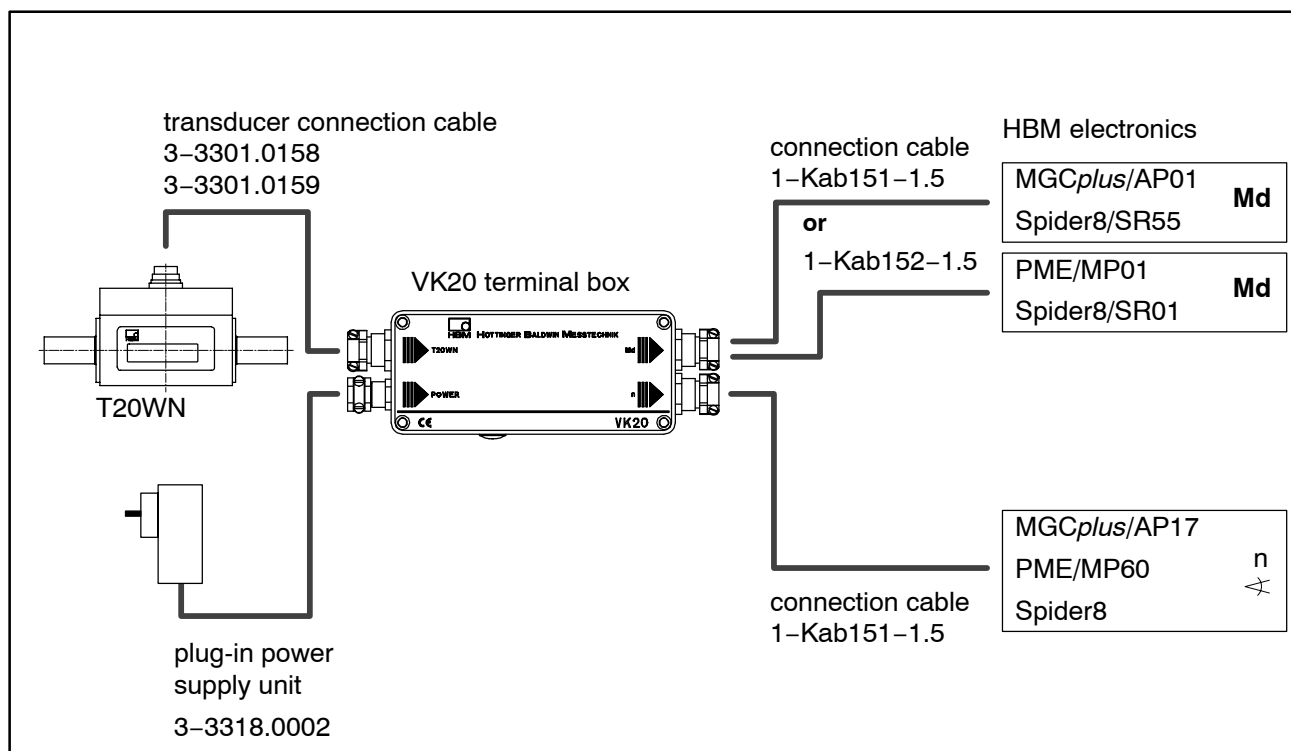
<sup>5)</sup> Nominal torque must not be exceeded.

<sup>6)</sup> Relative undulation following DIN 45670/VDI 2059.

## 9 Accessories

Accessories include the following components:

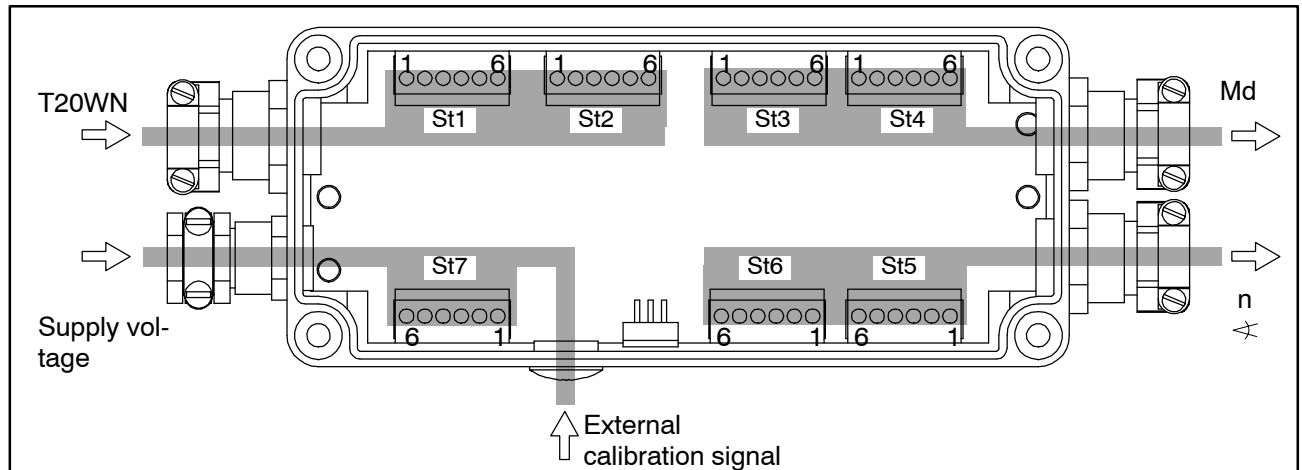
- transducer connection cable, 5 m long, order no. 3-3301.0158
- transducer connection cable, 10 m long, order no. 3-3301.0159
- cable socket, 12-pin (linkage), order no. 3-3312.0268
- terminal box, order no. 1-VK20
- mains device (14.4 V=/300 mA), order no. 3-3318.0002
- connection cable, 1.5 m long (D-Sub, 15-pin – free ends), order no. 1-Kab151-1.5
- connection cable, 1.5 m long (SUBCON5 – free ends), order no. 1-Kab152-1.5
- bellows-type couplings



**Fig.9.1:** Accessories for electrical connection

## 9.1 VK20 terminal box

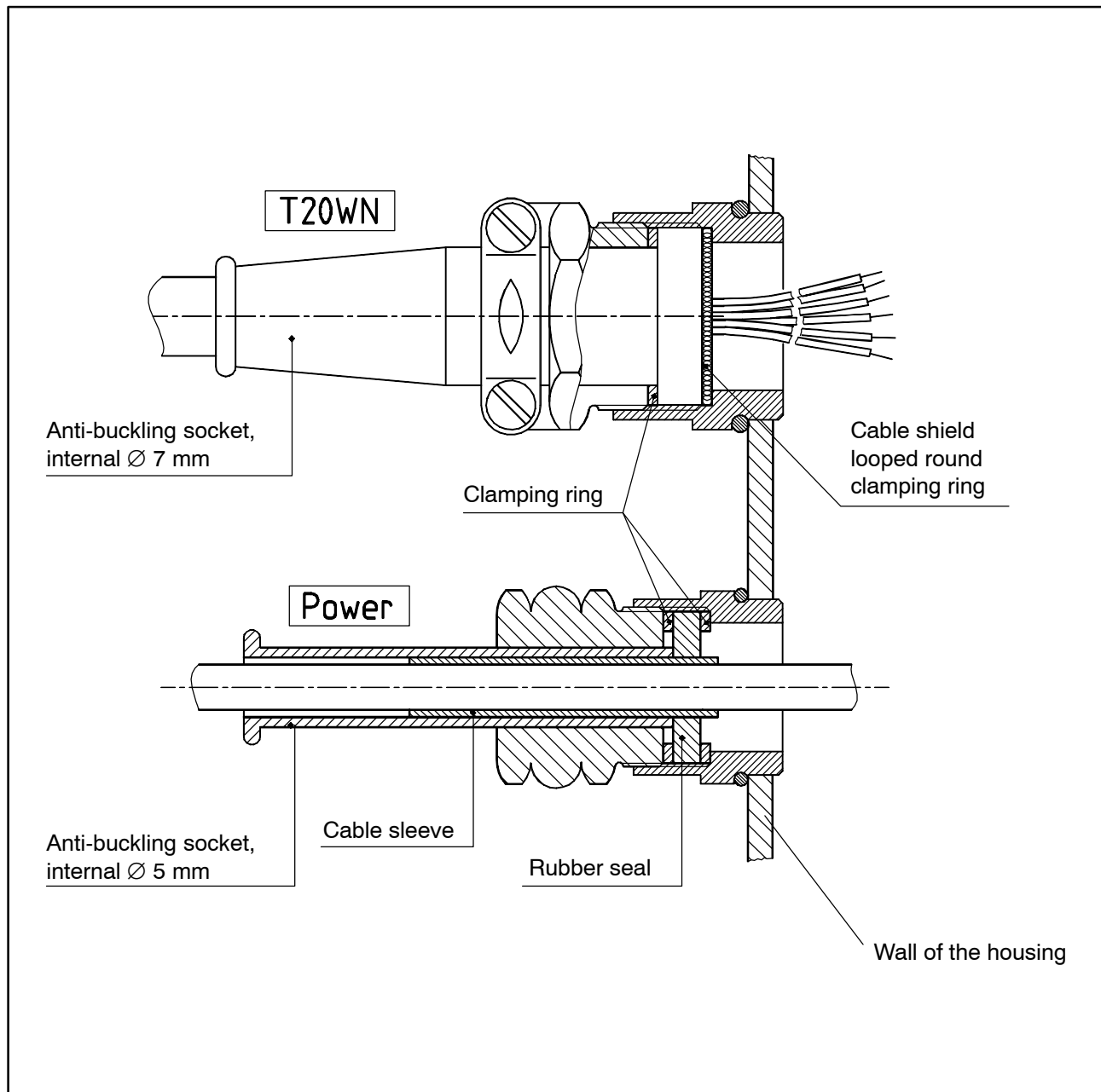
You can connect the torque transducer T20WN to the HBM measurement electronics by using the VK20 terminal box. If the measurement electronics do not include supply voltage, you can connect the power supply unit (14.4 V= /300 mA) or another 24 V power source (14 V...30 V) to St7.



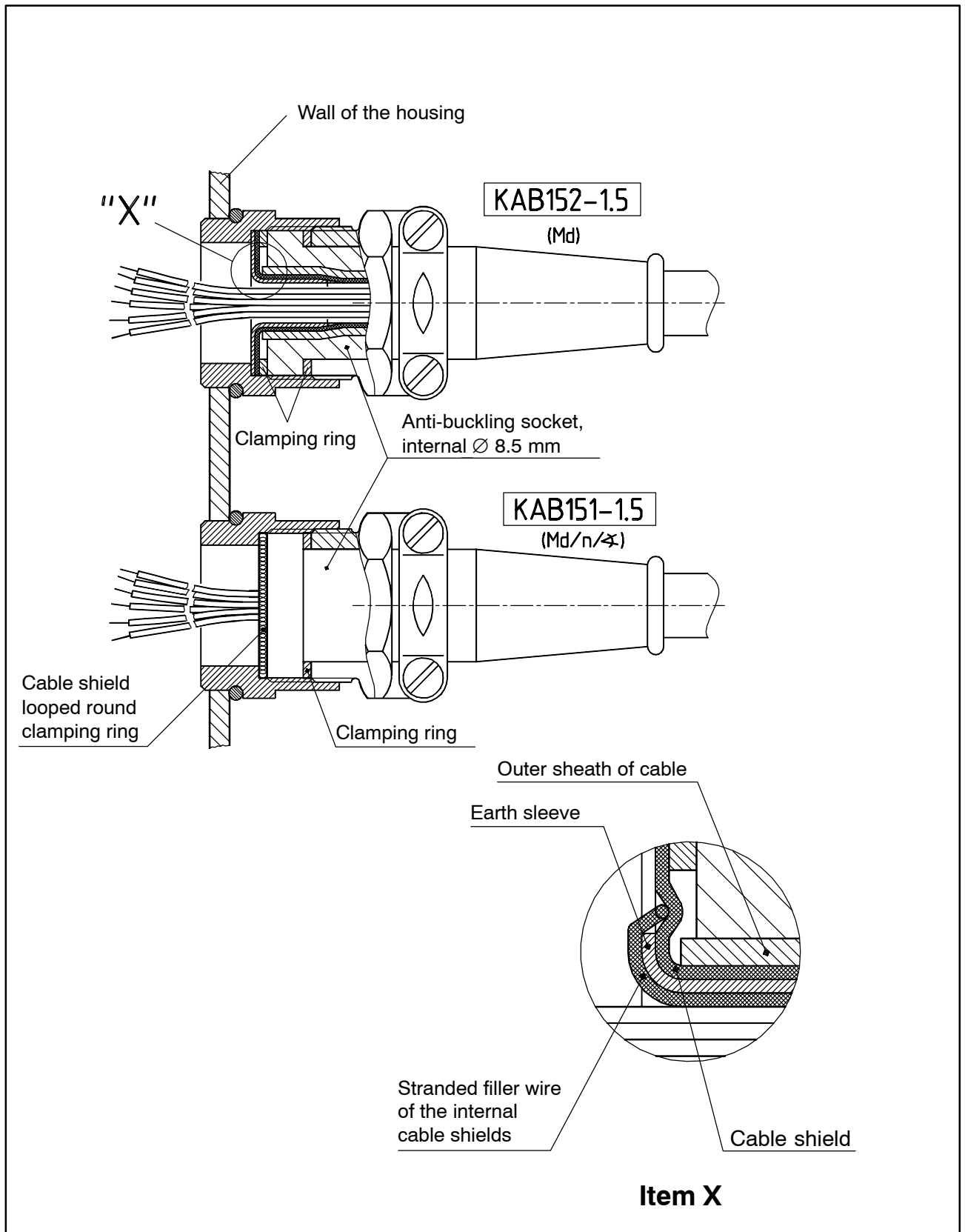
**Fig.9.2:** Connection clamps in the opened VK20 terminal box

### 9.1.1 Mechanical connection of the connector cables

The terminal box includes a set of cable sleeves, intended for bushing the transducer connection cable, the voltage supply and the Md/n outputs. The side hole for the external calibration signal is closed with a screw for delivery. If need be, use a suitable PG7 screwed joint with an anti-buckling socket.

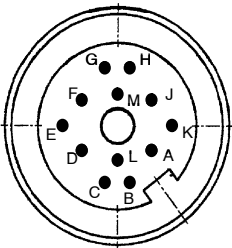




**Fig.9.3:** Cable bushing "T20WN" and "POWER" at the terminal box






**Fig.9.4:** Cable bushing "Md" and "n" at the terminal box

### 9.1.2 Electrical connection T20WN (St1 and St2)

	Pin	Wire colour	Strip terminal/ terminal VK20	Function	I/O <sup>*)</sup>
	A	BK	<b>St1</b> /1	None	–
	B	RD	/2	Measurement signal speed/angle of rotation	I
	C	BN	/3	Measurement signal torque	I
	D	WH	/4	0 V; 	I
	E	YE	/5	Supply voltage 0 V 	O
	F	VT	/6	Supply voltage 12 V	O
	G	GN	<b>St2</b> /1	Measurement signal speed/angle of rotation (90° phase shifted)	I
	H	PK	/2	None	–
	J	GY	/3	None	–
	K	GY/PK	/4	Trigger calibration signal	O
	L	BU/RD	/5	None	–
	M	BU	/6	None	–

**Table9.1:** Transducer connection

### 9.1.3 Electrical connection of the voltage supply (St7)

Strip terminal/ terminal	Function	I/O <sup>*)</sup>
<b>St7</b> /1	0 V;  <sup>1)</sup>	O
/2	Calibration signal (external trigger 0 V; ) 	I
/3	Calibration signal (external trigger 5 V...30 V)	I
/4	24 V <sup>2)</sup>	O
/5	Supply voltage VK20 24 V (14...30 V) <sup>3)</sup>	I
/6	Supply voltage 0 V; 	I

**Table9.2:** Connector pin assignment St7



<sup>\*)</sup> O=Output; I=Input

<sup>1)</sup> Linked internally with St7/Pin6. Can be bridged with St7/Pin2 if necessary.

<sup>2)</sup> Linked internally with St7/Pin5. Can be used for triggering the calibration signal if necessary.


<sup>3)</sup> in conjunction with MGCplus over St3/1.

### 9.1.4 Electrical connection output torque (Md)

Strip terminal/ terminal	Function	I/O <sup>*)</sup>
<b>St3</b> /1	Supply voltage 14 V...30 V (alternative to St7/5)	I
/2	None	-
/3	None	-
/4	None	-
/5	None	-
/6	None	-
<b>St4</b> /1	None	-
/2	Supply voltage 0 V; 	I
/3	Measurement signal torque 0 V; 	O
/4	None	-
/5	None	-
/6	Measurement signal torque $\pm 10$ V	O

**Table9.3:** Connector pin assignment St3 and St4

### 9.1.5 Electrical connection output speed/angle of rotation (n/↺)

Strip terminal/ terminal	Function	I/O <sup>*)</sup>
<b>St5</b> /1	Measurement signal speed/angle of rotation 0 V; 	O
/2	None	-
/3	None	-
/4	Measurement signal speed/angle of rotation 5 V (+)	O
/5	Measurement signal speed/angle of rotation 5 V (-)	O
/6	Measurement signal speed/angle of rotation 5 V (-); 90° phase shifted	O
<b>St6</b> /1	Measurement signal speed/angle of rotation 5 V (+); 90° phase shifted	O
/2	None	-
/3	None	-
/4	None	-
/5	None	-
/6	None	-

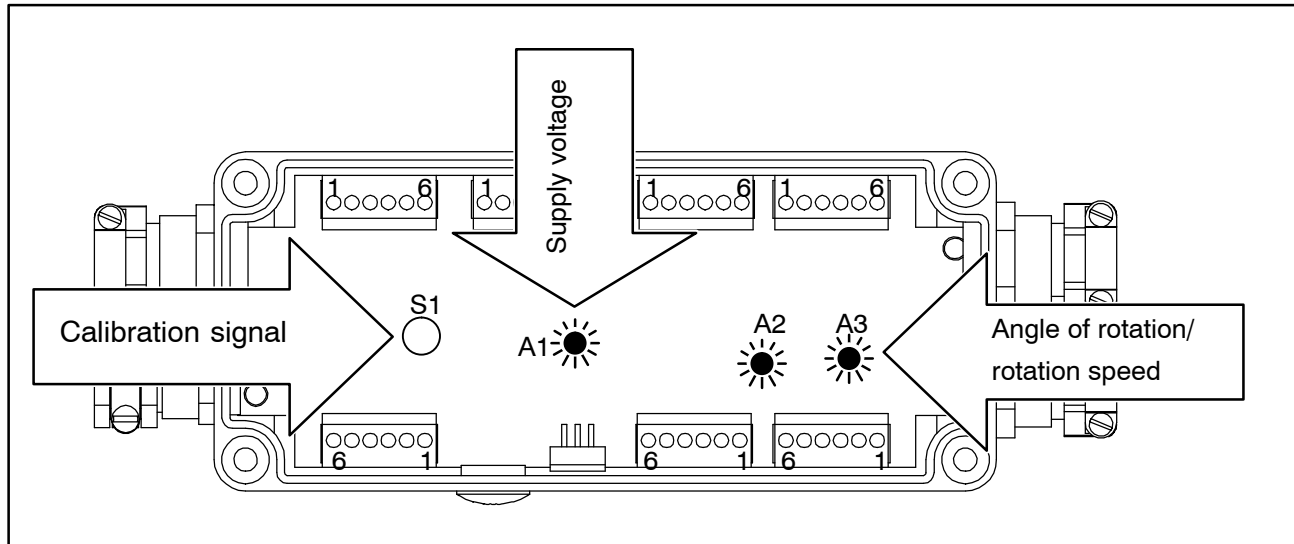
**Table9.4:** Connector pin assignment St5 and St6

<sup>\*)</sup> O=Output; I=Input

### 9.1.6 Functional check

Three green control diodes for checking the wiring and a calibration signal probe are integrated in the terminal box.

Diode A1 comes on whenever a stabilised supply voltage of 12 V is made available to the torque transducer. LEDs A2 and A3 flash whenever the input shaft turns slowly.

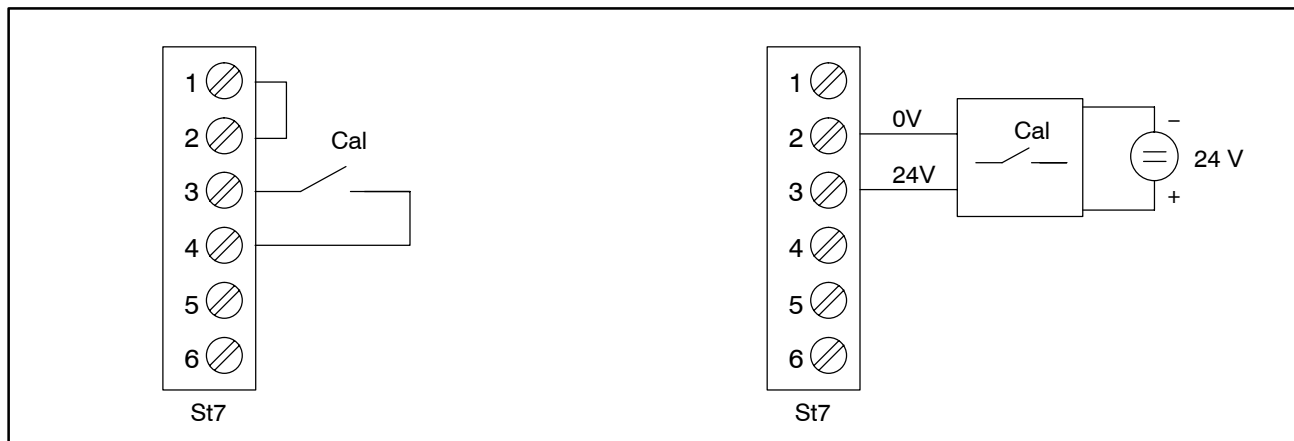


**Fig.9.5:** Control LEDs and calibration signal probe

### 9.1.7 Calibration signal

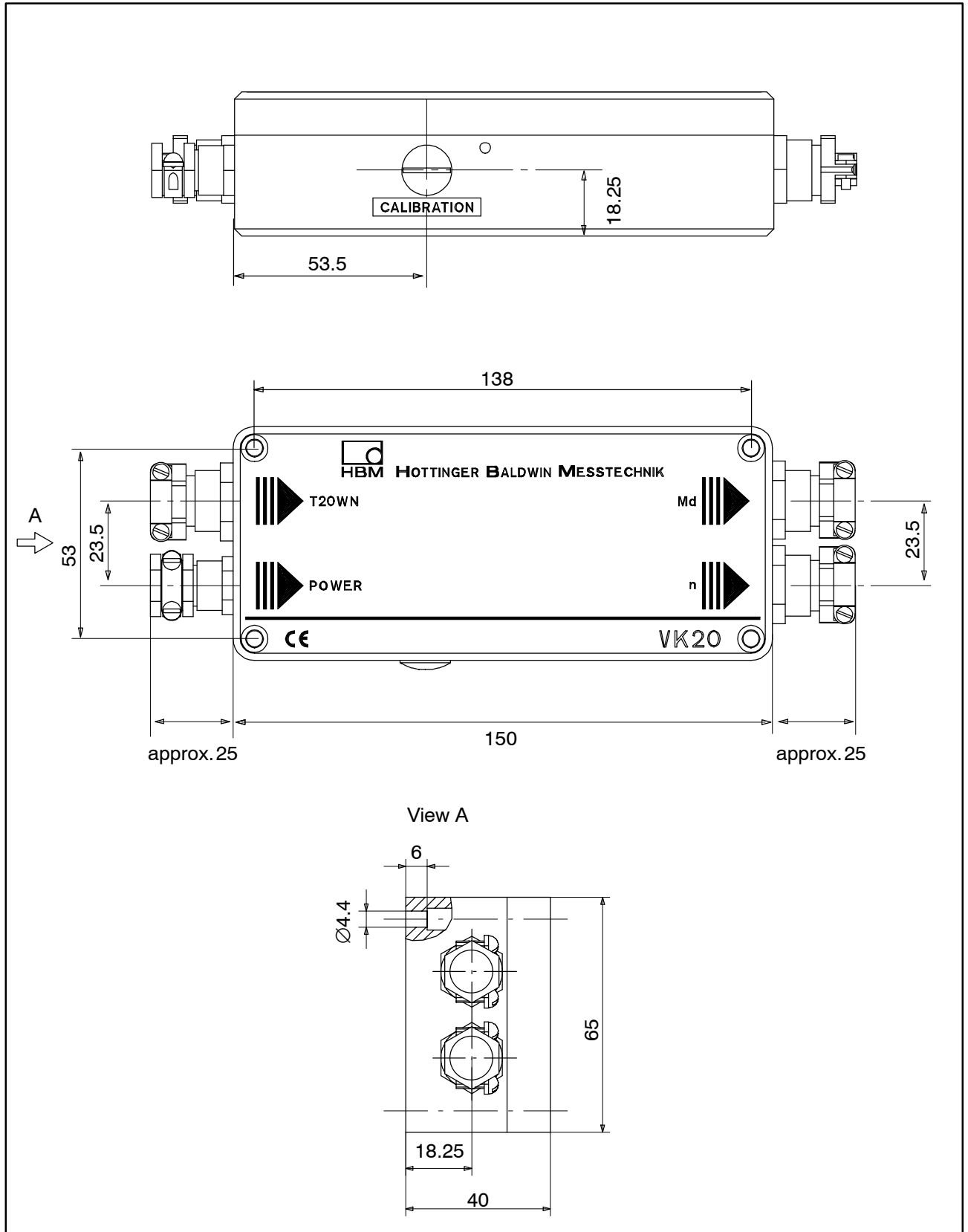
You can trigger a calibration signal of +10 V ( $\pm 0.2\%$ ):

- with probe S1 on the board (as long as this is pressed; see Fig.9.5).
- with an external probe or relay point on strip terminal St7, terminals 3 and 4 (Fig.9.6).
- with an external voltage (5 V...30 V) at strip terminal St7, terminals 2 and 3 (Fig.9.6). The input is potential-free by using optical couplers.



**Fig.9.6:** External calibration signal trigger

9.1.8 Dimensions VK20 (in mm; 1 mm $\approx$ 0.03937 inches)



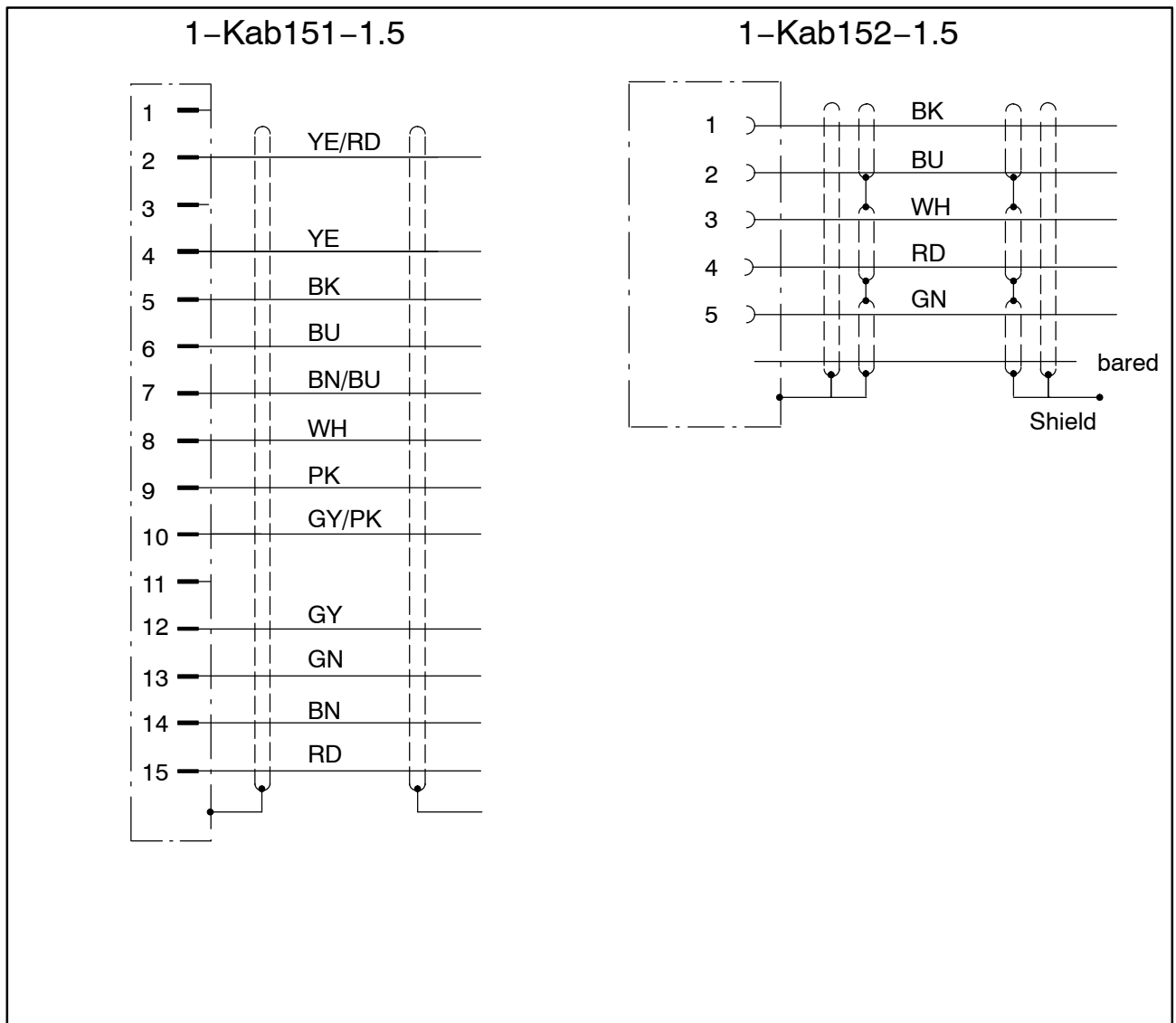
### 9.1.9 Specifications VK20

Type		VK20
<b>Supply voltage</b>	V	24
<b>Supply voltage range</b>	V	14 ... 30
<b>Current consumption</b>	mA	max. 300, type 150
<b>Power consumption</b>	W	max. 9
<b>Transducers that can be connected</b> max. length of cable to the transducer	m	T20WN 50
<b>Outputs</b>		
<b>Torque</b>	V	-10..+10 V
<b>Load-carrying capacity</b>		see T20WN
<b>Accuracy</b>		see T20WN
<b>max. cable length</b>	m	500
<b>Speed/angle of rotation</b>		2 impulse signals 90° phase shifted for detection of direction of rotation 0/5 (complementary signals RS422)
Level	V	
Load-carrying capacity	mA	max. 20
max. cable length	m	500
<b>External calibration signal trigger</b>		
Off	V	less than 2 V (0 V...2 V)
On	V	greater than 4 V (4 V...30 V)
<b>Internal calibration signal trigger</b>		by probe
<b>Nominal temperature range</b>	°C [°F]	-10...60 [14...140]
<b>Operating temperature range</b>	°C [°F]	-10...60 [14...140]
<b>Storage temperature range</b>	°C [°F]	-20...70 [-4...158]
<b>Degree of protection acc. to EN 60 529</b>		IP65
<b>Interference suppression</b>		under EN 55011, class B
<b>Electromagnetic compatibility</b>		under EN 50082-2
<b>Weight</b>	g	approx. 500

## 9.2 Connection cable for evaluation electronics

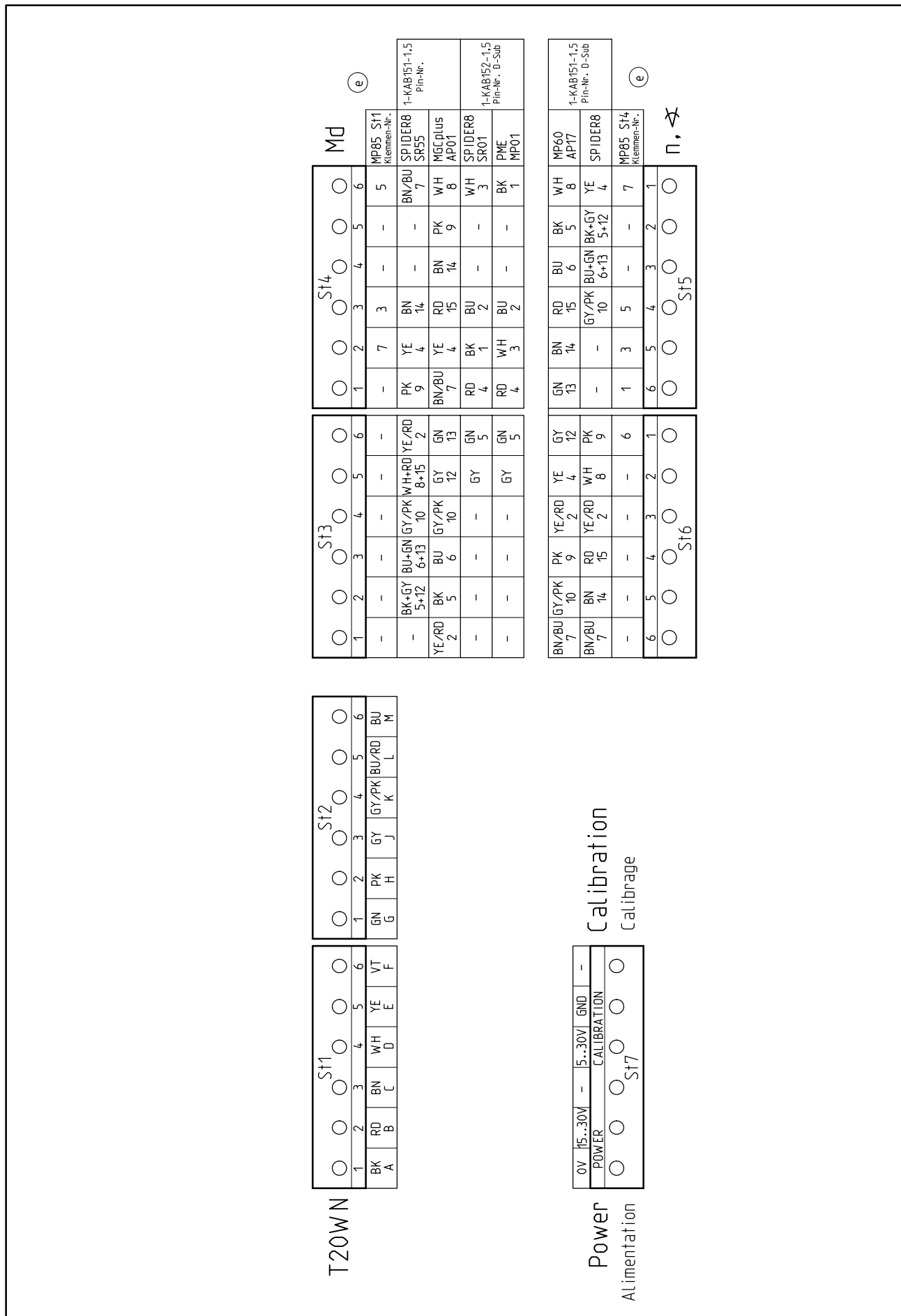
HBM provides the following connector cables for connecting the T20WN through the VK20 terminal box to the evaluation electronics:

- 1-Kab 151-1.5 (15-pin D-sub connector (male) – free ends)
- 1-Kab 152-1.5 (terminal plug 5-pin – free ends)



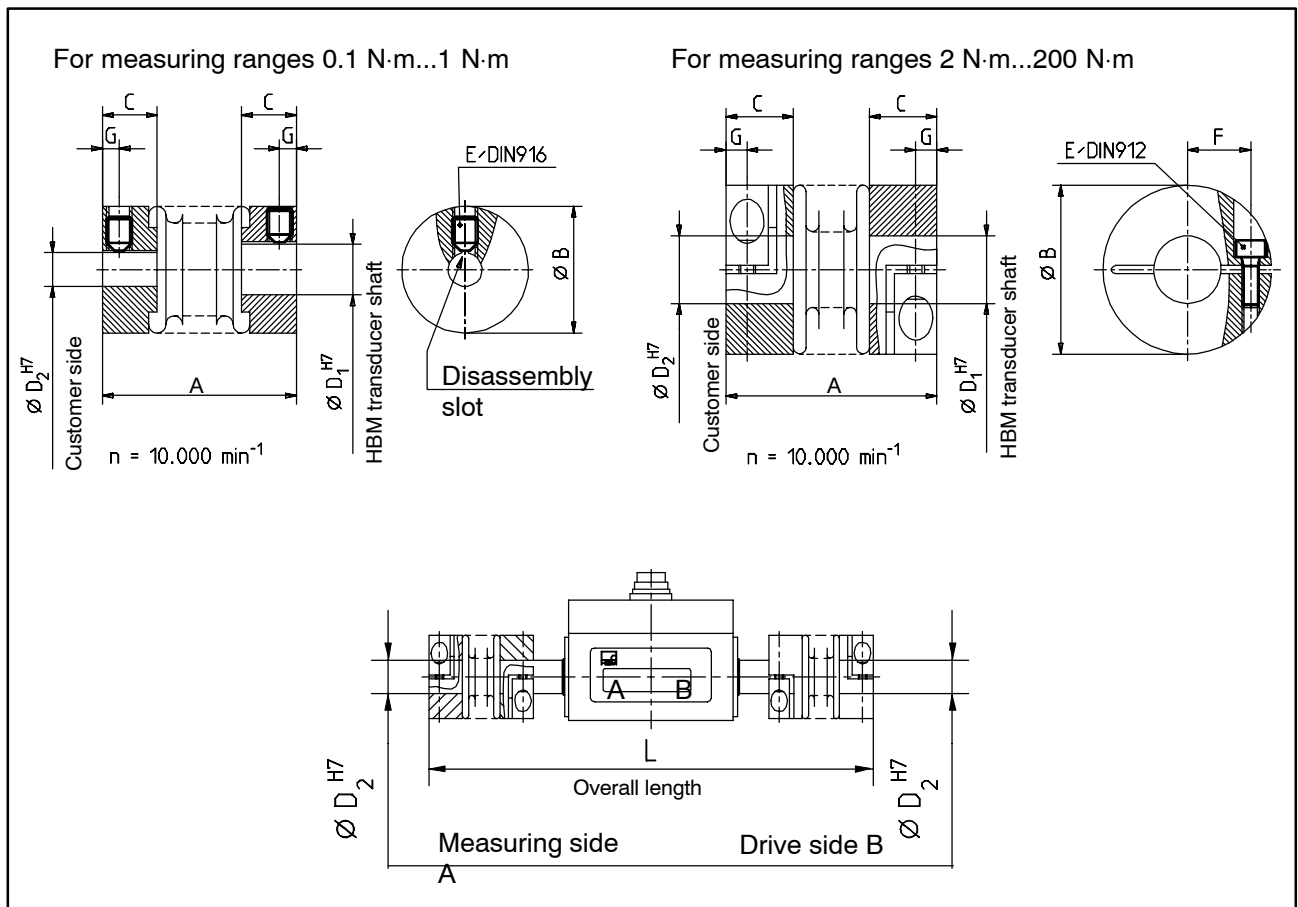
**Fig.9.7:** Cable for connecting to the evaluation electronics

The cable configuration is adjusted to the system device to be connected. In the terminal box housing, there is an instruction leaflet with the connection diagram for the various HBM system devices (see Fig.9.8).




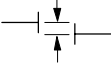
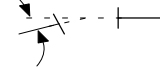
## 9.3 Bellows-type couplings

### 9.3.1 Dimensions for the bellows-type couplings (in mm)



Meas. range (N·m)	Part Nos.	A	ØB	C	ØD <sub>1</sub> Side		ØD <sub>2</sub> variable min...max	E	F	G	L
					A	B					
0.1	3-4412.0001	23 <sub>-1</sub>	15	6.5	6	8	3...9	M3	-	2	128
0.2											
0.5											
1	3-4412.0002	25 <sub>-1</sub>	15	6.5	6	8	3...9	M3	-	2	132
2	3-4412.0003	40 <sub>-1</sub>	25	13	6	8	3...12.7	M3	8	4	149
5	3-4412.0004	50 <sub>-1</sub>	40	16	16	16	5...22	M4	15	5	213
10											
20	3-4412.0005	69 <sub>-2</sub>	56	21	16	16	10...32	M6	19	7.5	241
50	3-4412.0006	80 <sub>-2</sub>	66	23.5	26	26	12...32	M8	23	9.5	283
100	3-4412.0007	93 <sub>-2</sub>	82	28	26	26	19...40	M10	27	11	300
200	3-4412.0008	109 <sub>-2</sub>	110	35	26	26	24...56	M12	39	13	318

### 9.3.2 Specifications for bellows-type couplings

Measuring range (N·m)	Torque coupling $T_{Kmax}$ (N·m)	Mass moment of inertia (kg·cm <sup>2</sup> )	Weight (g)	Torsional stiffness (kN·m/rad)	Max. permissible offset		
					axial (mm) 	radial (mm) 	angular (degree) 
0.1	0.5	0.012	6	0.21	0.5	0.2	1.5
0.2							
0.5							
1	1	0.018	7	0.38	0.5	0.2	1.5
2	2	0.27	38	1.3	0.6	0.2	1.5
5	10	1.6	120	9.05	1	0.2	1.5
10							
20	30	1.2	300	31	1	0.15	1.5
50	60	2.0	400	72	1.5	0.15	1.5
100	150	20	1600	141	2	0.15	1.5
200	300	40	3800	157	2	0.15	1.5

Measuring range (N·m)	Spring stiffness		Material hub and fixing ring	Tightening torque clamping screws (N·m)
	axial (N/mm)	radial (N/mm)		
0.1	13.4	47.7	Aluminium	0.35
0.2				
0.5				
1	27.4	84.3		0.75
2	20.6	88		0.75
5	33.3	389		1.5
10				
20	50	366		14
50	67	679	35	
100	77	960	75	
200	124	2940	120	
			Steel	



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