Operating manual

Torque reference transducer

TB2

A0885–12 en

HBM

Contents **Page**

Safety instructions

Use in accordance with the regulations

The TB2 reference torque transducer may be used for torque measurement and directly related control and regulation tasks only. 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 Mounting Instructions. 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 technology. In addition, equipment planners, installers and operators should plan, implement and respond to the safety engineering considerations of torque measurement technology in such a way as to minimize remaining dangers. Prevailing regulations must be complied with at all times. Reference must be made to remaining dangers connected with torque measurement technology.

In these Mounting Instructions, remaining dangers are pointed out using the following symbols:

Symbol:  **WARNING**

Meaning: **Potentially 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.

Symbol:  **NOTE**

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

Symbol: CE

Meaning: **CE mark**

The CE mark enables the manufacturer to guarantee that the product complies with the requirements of the relevant EC directives (see Declaration of Conformity at the end of this document).

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.

1 Scope of supply

The scope of supply includes:

1 Torque reference transducer
1 Mounting Instructions
1 Test certificate
1 PVC cable, 3 m long, (6-pin Lemosa connector (male), pigtails)

2 Application

Transducers measure static and dynamic torque in non-rotating operation. Nominal (rated) torques fall within the range 500 N·m to 10 kN·m.

Transfer torque transducer

The main applications are transferring the torque, for example, when calibrating reference transducers in test and calibration machines and comparing the reference standards of different calibration laboratories.

With transfer transducers, it is important to have good reproducibility, as when the torque is transferred on, it is a dimension for the various observers, the test conditions, the laboratories, and the mounting and time conditions. Which is why, when the torque is transferred on, the same mounting conditions as for calibration in the reference standard should be established or relevant adapters should be included in the calibration.

Reference torque transducer

Reference torque transducers are mounted in a calibration device and then the entire calibration machine is qualified or certified by means of a transfer torque transducer, for example. The exact sensitivity of the transducer is therefore only of secondary importance.

General torque measurement in non-rotating operation

Because of their high mechanical load capacity, the permissible vibration bandwidth of 200 % (160 % at 3 to 10 kN·m) of nominal (rated) torque and their compact design, transducers are also eminently suitable for use in test machines for component testing (alternate torsional stress). An IP67 protected version acc. to EN 60529 is optionally available.

3 Structure and mode of operation

The torque reference transducer comprises a measuring body with a flange-shaped torque unit on which SGs have been installed. The SGs are arranged in such a way as to guarantee the optimum flow of torque between the flange and the point of SG installation.

4 Installation

4.1 General mounting information

When mounting the torque reference transducer in test benches, the test bench components (frame, couplings, connecting flanges, screwed joints, etc.), affect the deformation behavior in the shaft train and thus the measurement characteristic (zero point, sensitivity, repeatability). Causes include:

- Additionally occurring parasitic loads such as radial forces, axial forces or bending moments
- Asymmetrical application of torque to the transducer
- Stiffness conditions in the shaft train that differ from the transducer calibration

These test bench reactions on the reference transducer are included in the calibration by adaptable lever-mass systems, for example.

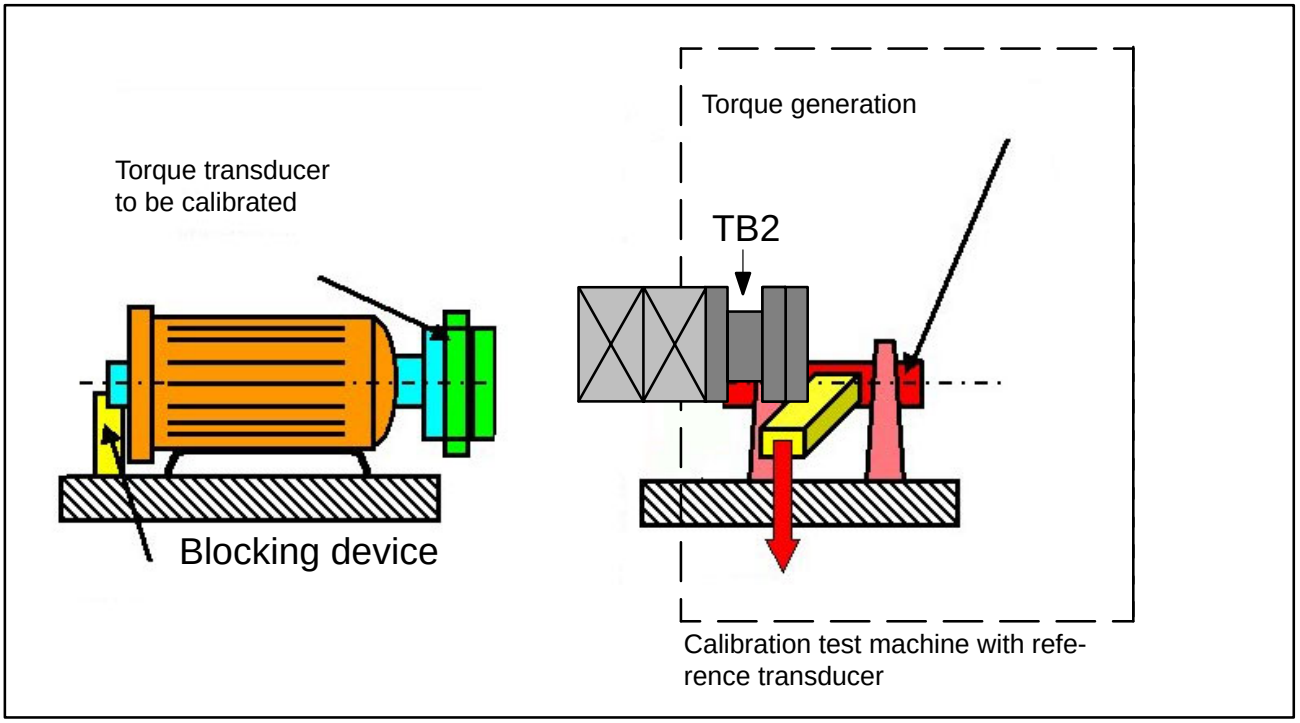


Fig.4.1: Typical calibration test machine mounting

Parasitic loads

Parasitic loads arise from deformation in the shaft train. They result in an additive effect on the zero signal of the torque transducer (see Specifications). If they occur during torque loading, they cause an apparent change in sensitivity.

Countermeasures:

1. Ensure optimum alignment of the shaft train (follow the alignment instructions in the Specifications!).
   Provided that the permissible limits for bending moments, lateral and axial forces are not exceeded, no special couplings or other measures are required to mount the torque reference transducer the effect of parasitic limit loads on the measurement result is less than 0.2 % of the nominal (rated) torque).
2. If you cannot obtain the requisite alignment accuracy, use non-interacting couplings.
3. Keep the weight of the shaft sections acting on the torque reference transducer as low as possible.

Depending on the design of the test bench, you may need decoupling measures with torsionally stiff but flexible torsion bars.

Variant stiffness conditions

If the stiffness conditions in the shaft train (close to the torque transducer) vary from the conditions during calibration in the HBM calibration machine, this can change the application of torque to the torque reference transducer.

Countermeasures:

1. Keep strictly to the prescribed tightening torques for the fastening screws.
2. Use high-strength or hardened adaptation components, particularly near the transducer‘s torque connection (input and output).

Asymmetrical torque distributions

Asymmetrical (axially uneven) torque distribution in the shaft train can lead to deformations that can cause parasitic loads.

Countermeasures:

1. Use all the available screwed joints for the mounting.
2. Keep strictly to the prescribed tightening torques for the fastening screws.
3. Avoid unnecessary bore holes in the adaptation flange.
4. Use clean, flat and if possible ground flange faces.
5. Avoid torque connections (input and output) right on the outside diameter of the transducer.
6. Use adaptation flanges with sufficiently large clearance bores, to avoid locking the screws.

4.2 Installation position

The torque reference transducer can be mounted in any position. With a clockwise torque, a positive output signal is produced in conjunction with HBM measuring amplifiers.

4.3 Conditions on site

The TB2 torque reference transducer is protected to IP54 acc. to EN 60529.

A transducer protected to IP67 acc. to EN60529 is optionally available.

Transducers must be protected against coarse dirt particles, dust, oil, solvents and humidity .

During operation, the prevailing safety regulations for the security of personnel must be observed.

4.4 Mechanical installation

NOTE

Handle the torque reference transducer with care! The transducer might suffer permanent damage from mechanical shock (dropping), chemical effects (e.g. acids, solvents) or thermal effects (hot air, steam).

CAUTION

The screwed joints of the measuring body and the connecting flange marked at the factory with fixing varnish and the slotted screws of the identification plate must not be loosened.

NOTE

Do not apply greater side forces to the cable connection.

When mounting the reference torque transducer as a reference standard in calibration test benches, the torque to be measured must be applied from the measuring side (see Fig.4.2).

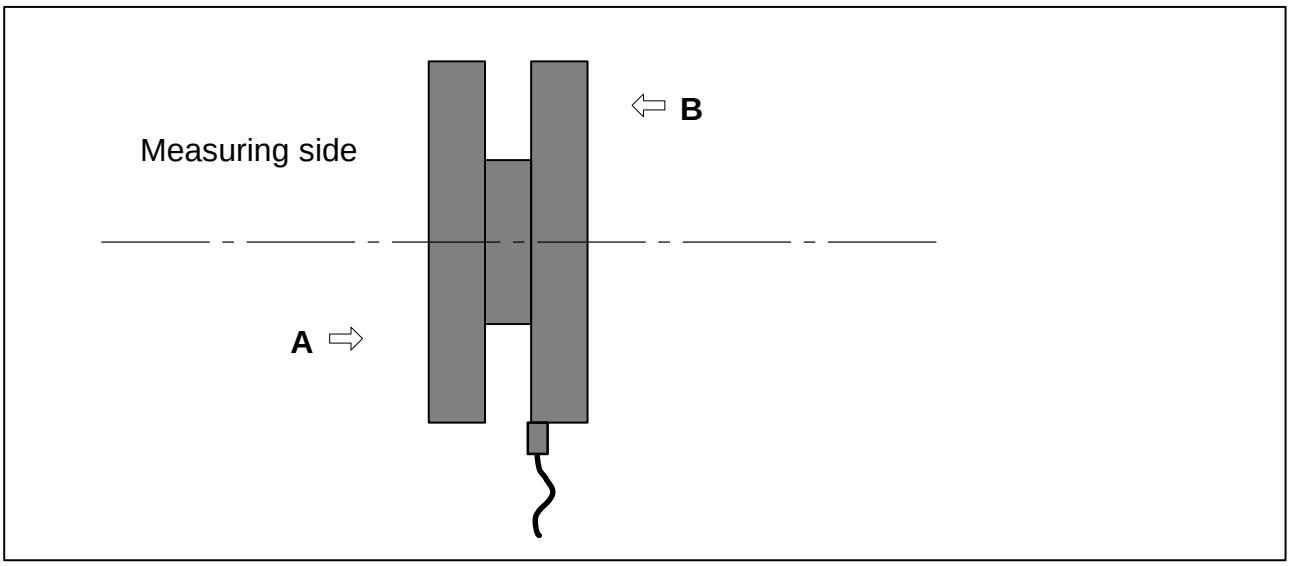


Fig.4.2: Measuring side of the TB2

Assembly sequence:

1. Use clean, flat (run-out tolerance 0.01 mm) and if possible ground (R_a < 0.8) flange faces (minimum material strength > 900 N/mm^2; hardness > 30 HRC).
2. Prior to installation, clean the flange plane faces of the torque transducer and of the counter flanges. For safe torque transfer, the surfaces must be clean and free from grease. Use a piece of cloth or paper soaked with a solvent. When cleaning, make sure that the solvent does not drip into the transducer.
3. Use eight hexagon-socket screws, **DIN EN ISO 4762, property class 10.9 or 12.9**, of the appropriate length (depending on the connection geometry, see Table 4.1) to screw-fasten the measuring body.

WARNING

With alternating loads: use a screw locking device (medium) to glue all the connection screws into the counter thread to exclude a pretension loss due to screw slackening.

4. With a cut thread, the yield point of the adapter material should be at least 900 N/mm^2.

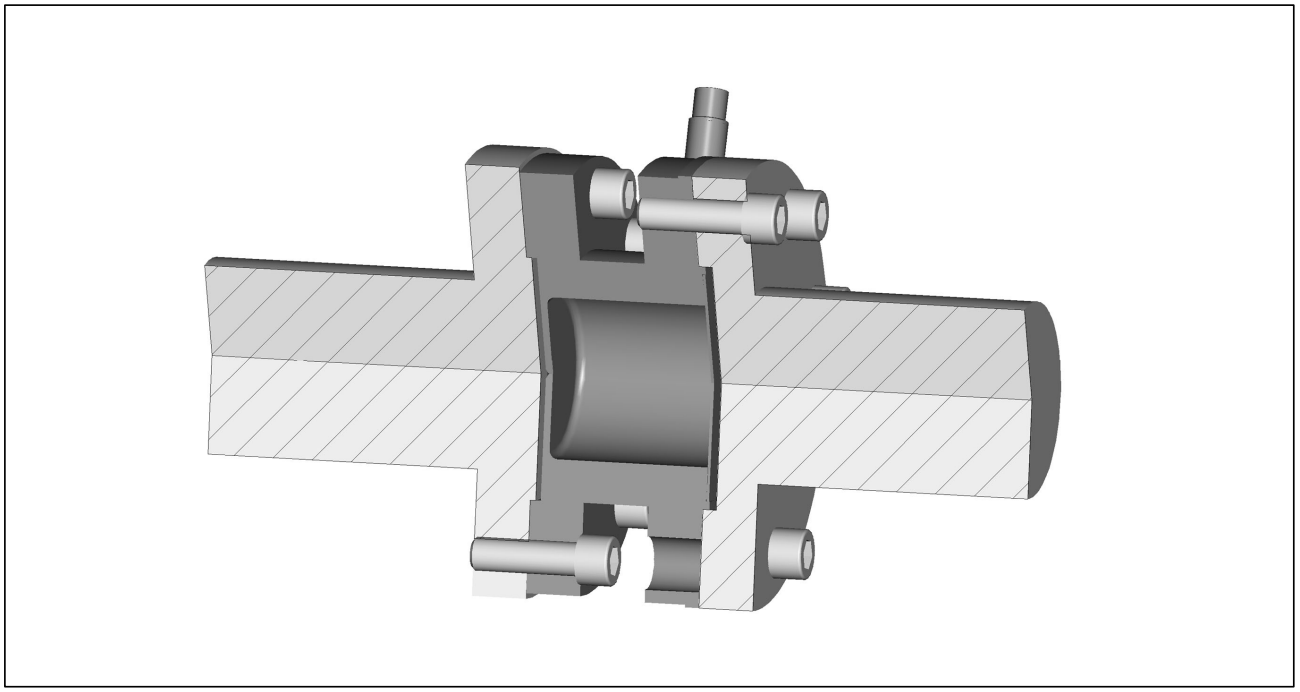


Fig.4.3: Screwed joint of the measuring body

5. Fasten all screws with the specified tightening torque (Table 4.1).
6. For further installation of the shafting, there are eight threaded bores on the connecting flange. Also use screws of property class 10.9 (or 12.9) and fasten them with the tightening torque specified in Table 4.1.

CAUTION

With alternating loads, use screw locking device to glue into place the connection screws. Guard against contamination from varnish fragments.

Nominal (rated) torque (N·m)	Fastening screws (Z)[1)]	Fastening screws Resistance class	Prescribed tightening torque (N·m)
500	M10	10.9	67
1k	M10		67
2k	M12		115
3k	M12	12.9	135
5k	M14		220
10k	M16		340

Table 4.1: Fastening screws

1) DIN 912; black/oiled/μ_{grd} = 0.125

Mounting as a transfer transducer

Transfer transducers must be as immune as possible to all the influences of installation. This can be achieved in construction, for example, by using specially designed adaptation flanges.

The aim is to minimize variations in adaptation conditions in comparison with the initial calibration at the manufacter's facility.

For optimum transmission of sensitivity, observe the following points in addition to the recommendations already made for reference transducers:

- Introduce the torque into the torque transducer from inside (D_I) to outside (D_A), which should give a ratio of $\frac{D_I}{D_A} \leq 0.6$.
- The width of the adaptation flange (B) on the reaction side should be 1.5 – 2 times the diameter of the flange screw.
- The adaptation flangee should not be weakened around the surfaces of torque application by additional bore holes.

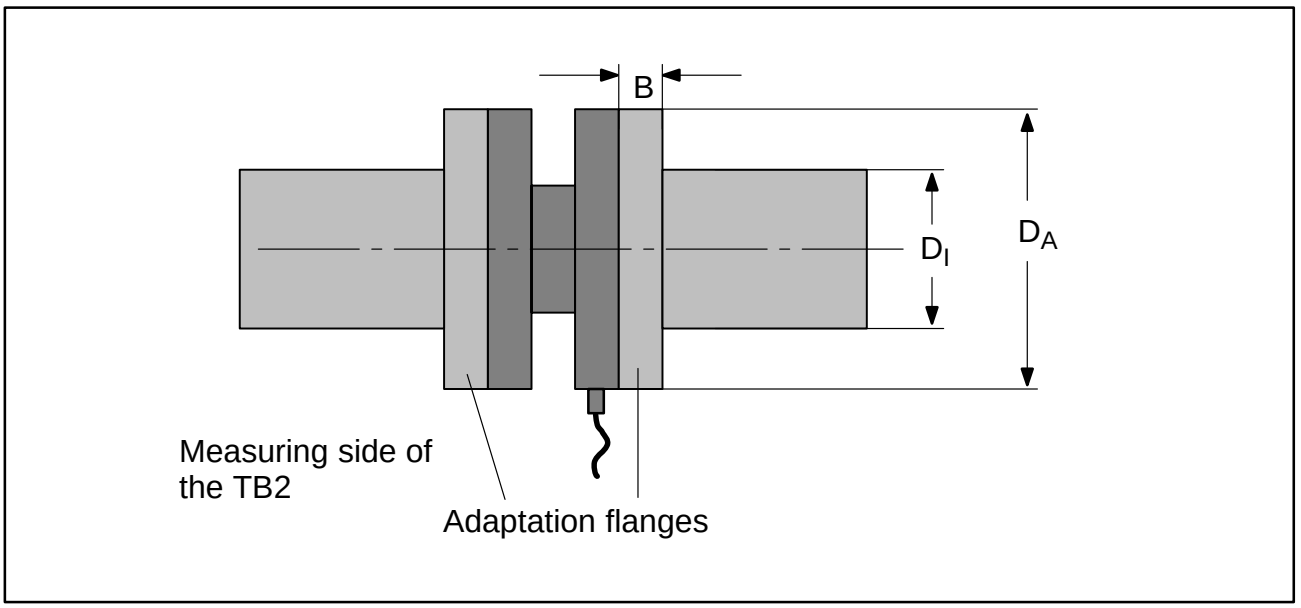


Fig.4.4: Transfer transducer adaptation flange

For optimum transfer measurement results, please use:

- a 225 Hz measuring amplifier
- an extension with a six-wire circuit

4.5 Load-carrying capacity

Torque reference transducers can be used to measure static and dynamic torque.

Please apply the following to the measurement of dynamic torque:

- The calibration carried out for static torque also applies for dynamic torque measurement.
- The natural frequency f_0 for the mechanical measuring system depends on the moments of inertia J_1 and J_2 of the connected rotating masses and the torsional stiffness of the TB2.

Use the below equation to determine the natural frequency f_0 for the mechanical measuring system:

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

f_0 = Natural frequency in Hz
J_1, J_2 = Mass moment of inertia in kgm^2
c_T = Torsional stiffness in N·m/rad

- The maximum permissible amplitude of vibration (peak to peak) may be 200 % (at nominal (rated) torque of 3 to 10 kN·m=160 %) of the TB2's nominal (rated) torque, even with alternating load. In all cases the vibration bandwidth must lie within the loading range defined by $-M_N$ and $+M_N$.

Caution: Even where there is resonance, these mechanical limit values must be followed. The torsional spring stiffness and the moment of inertia for estimating the natural frequency can be found in Chap. 9.

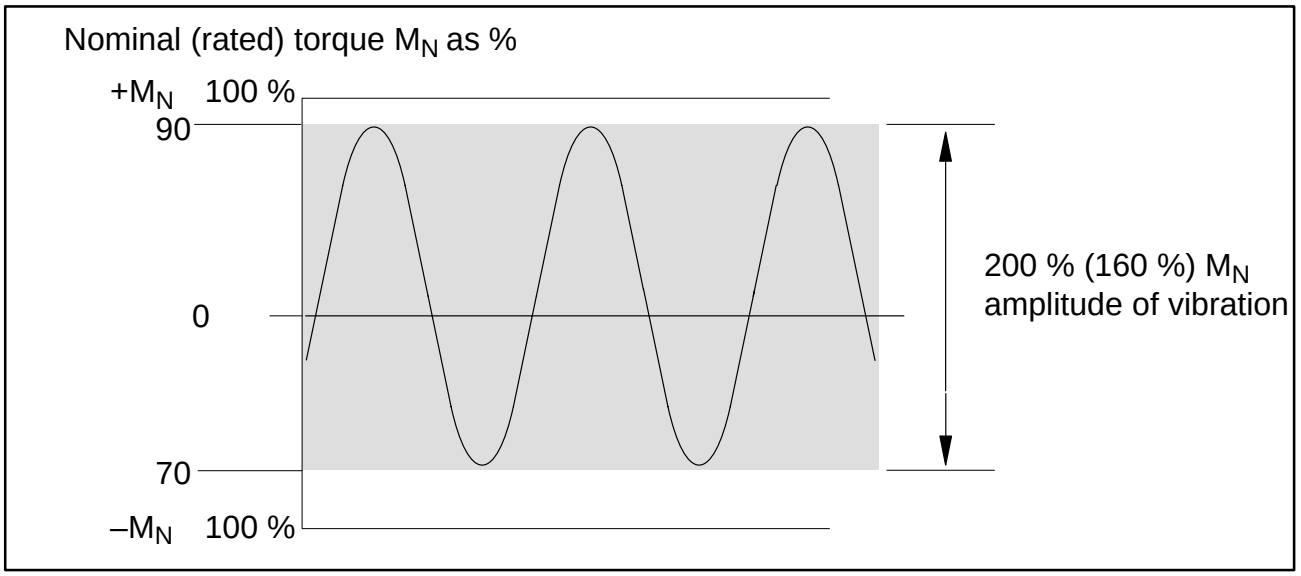


Fig.4.5: Permissible dynamic loading

5 Electrical connection

Torque reference transducers come supplied with a ready-made 6-wire connection cable (six-wire circuit) with pigtails. A plug fitting is also possible on request (see Chap.8.)

Extension cables should be of the shielded, low-capacitance type. HBM provides the 1-KAB0304A-10 cable (ready-made) and the KAB8/00-2/2/2 cable (by the meter, can also be supplied with fitted connecting plug) specifically for this purpose.

The pin assignment for the HBM amplifier can be found in the following table:

Connection	PIN	Wire color	Connecting to a measuring amplifier with	
			15-pin Sub-D connector (male)	MS3106 PEMV connector (male)
Measurement signal (+U_A)	6	WH (white)	8	A
Excitation voltage (–U_B)	1	BK (black)	5	B
Excitation voltage (–U_B)	5	BU (blue)	6	C
Measurement signal (+U_A)	3	RD (red)	15	D
Sensor circuit (–)	2	GY (gray)	12	G
Sensor circuit (+)	4	GN (green)	13	F
Shielding connected to enclosure ground				

Table5.1: Pin assignment

The pin assignments for measuring amplifiers with soldered or clamped connections can be found in the respective amplifier documents.

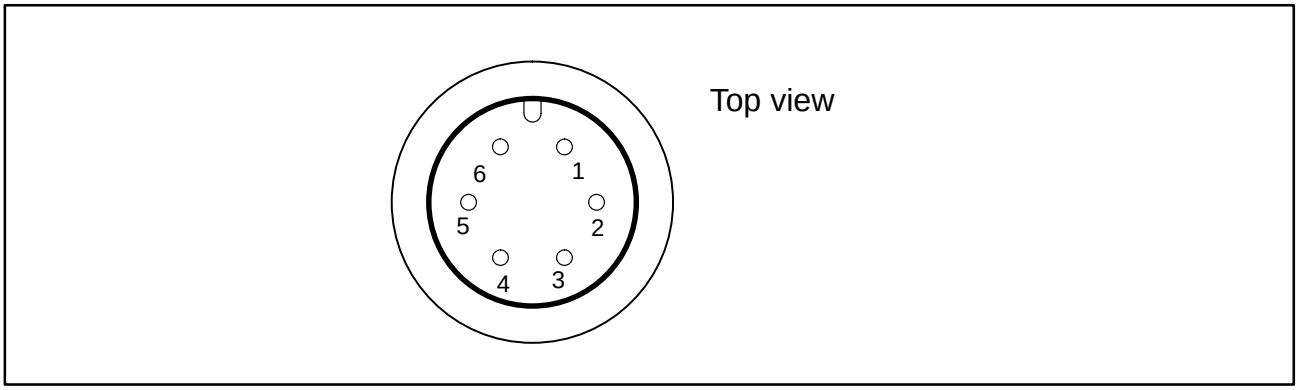


Fig.5.1: Pin assignment Lemosa connector (male)

5.1 Cabling instructions

Electric and magnetic fields often cause interference voltages in the measuring circuit. This interference comes primarily from power lines lying parallel to the measuring leads, but it can also come from nearby contactors or electric motors. Interference voltage can also be coupled galvanically, especially by grounding the measurement chain at a number of points.

Please follow the below instructions:

- Use only shielded and low-capacitance measurement cables from HBM.
- Do not position the measurement cables parallel to power lines or control circuits. If this is not possible (e.g. in cable shafts), protect the measurement cable with armoured steel tubing, for example and keep it a minimum distance of 50cm away from the other cables. Power lines or control circuits should be twisted together (15 twists per meter).
- Guard against stray fields from transformers, motors and contactors.
- Do not ground the transducer, the amplifier and the indicator more than once. All the measurement chain devices must be connected to the same grounded conductor.
- Connect the shield of the connection cable to the transducer housing.
- Connection diagram, grounding concept (Greenline).

Grounding concept (Greenline)

The cable shielding is connected in accordance with the Greenline concept. This encloses the measurement system in a Faraday cage. Any electromagnetic interference active here does not affect the measurement signal.

In the event of interference due to potential differences (equalization currents) the zero operating voltage and the housing ground should be isolated from one another at the amplifier and a potential equalization line should be run between the housing and the amplifier housing (flexible stranded wire, 10 mm^2 conductor cross-section).

6 Maintenance

TB2 reference torque transducers are maintenance free.

7 Option

- IP67 protection acc. to EN 60529

8 Accessories

To be ordered separately:

- MS 3106 PEMV connector, fitted to cable
- 15-pin sub-D connector, fitted to cable
- DKD calibration certificate class 0.05 acc. to DIN 51309 or EA 10/14

9 Specifications

Type		**TB2**					
Accuracy class		0.03					
Nominal (rated) torque M_{nom}	N·m	500					
	kN·m		1	2	3	5	10
Nominal (rated) sensitivity (spread between torque = zero and nominal (rated) torque)	mV/V	1					
Sensitivity tolerance (deviation of the actual output at M_N of the nominal (rated) sensitivity)	%	$< \pm 0.1$					
Effect of temperature per 10 K in nominal (rated) temperature range							
on the output signal, relative to the actual value	%	$< \pm 0.03$					
on the zero signal, relative to the nominal (rated) sensitivity	%	$< \pm 0.02$					
Linearity deviation including hysteresis, relative to the nominal (rated) sensitivity							
Relative standard deviation of repeatability acc. to DIN 1319, relative to the variation of the output signal	%	$< \pm 0.03$					
	%	$< \pm 0.01$					
Input resistance at the reference temperature	Ω	1650 ± 100					
Output resistance at the reference temperature	Ω	1000 – 1400					
Reference excitation voltage	V	5					
Operating range of the excitation voltage	V	2.5...12					
Emission according to (EN 61326–1, Table 4)							
RFI field strength		Class B					
Immunity from interference (EN 61326–1, Table A.1)							
Electromagnetic field (AM)	V/m	10					
Magnetic field	A/m	100					
Electrostatic discharge (ESD)							
Contact	kV	4					
Air	kV	8					
Burst (rapid transients)	kV	2					
Surge (impulse voltages)	kV	1					
Line-related interferences	V	10					
Degree of protection to EN60 529	–	IP54, optional IP67					
Nominal (rated) temperature range	°C	+10...+60					
Operating temperature range	°C	–10...+80					
Storage temperature range	°C	–20...+80					

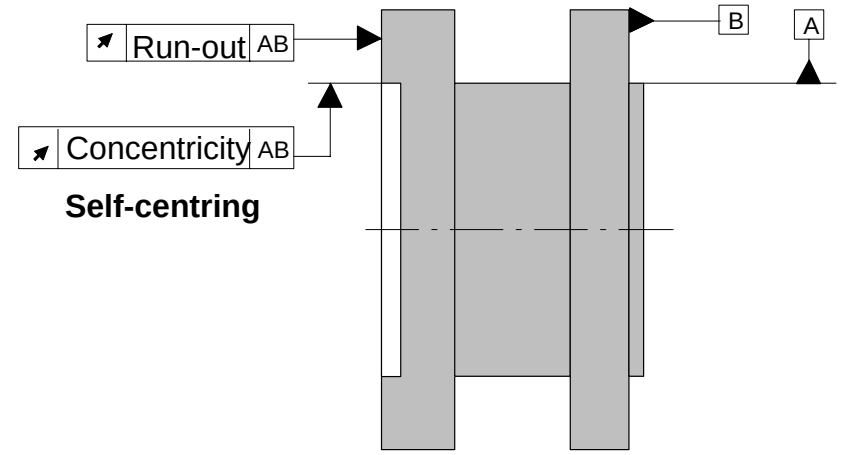
Type		**TB2**					
Accuracy class		0.03					
Nominal (rated) torque M_{nom}	N·m	500					
	kN·m		1	2	3	5	10
Mechanical shock, test severity level acc. to DIN IEC 68; Part 2-27; IEC 68-2-27-1987							
Number	n	1000					
Duration	ms	3					
Acceleration (half-sine)	m/s^2	650					
Vibrational stress							
Test severity level acc. to DIN IEC 68, Part 2-27; IEC 68-2-6-1982							
Frequency range	Hz	5...65					
Duration	h	1.5					
Acceleration (amplitude)	m/s^2	50					
Load limits[1)]							
Limit torque, relative to M_{nom}	%	200			160		
Breaking torque, relative to M_{nom}	%	>400			>320		
Axial limit force	kN	16	19	39	42	80	120
Lateral force limit	kN	4	5	9	10	12	18
Bending limit moment	N·m	200	220	560	600	800	1200
Vibration bandwidth under DIN 50 100 (peak-to-peak)	N·m	1000	2000	4000	4800	8000	16000

1) Each type of irregular stress (bending moment, lateral or axial load, exceeding nominal (rated) 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 (rated) torque must not be exceeded. The permissible bending moments, axial forces and lateral forces can affect the measurement result by approx. 0.2% of nominal (rated) torque.

Mechanical values							
Nominal (rated) torque M_{nom}	N·m	500					
	kN·m		1	2	3	5	10
Torsional stiffness	kN·m/rad	540	900	2300	2600	4600	7900
Torsion angle at M_{nom}	°	0.055	0.066	0.049	0.066	0.06	0.07
Stiffness in the axial direction approx.	kN/mm	900	970	1000	1100	950	1600
Stiffness in the radial direction approx.	kN/mm	700	840	1400	1600	1400	2500
Stiffness during the bending moment round a radial axis	N·m/degree	9500	9800	21700	22400	31400	71000
Maximum excursion at longitudinal force limit	mm	< 0.03		< 0.05		< 0.1	
Additional max. concentric error at lateral force limit	mm	< 0.01					
Additional in-plane deviation at bending moment limit	mm	< 0.04		< 0.06		< 0.1	
Mass moment of inertia (not taking flange screws into account) **of rotor I_V (around longitudinal axis)**	kg·m²	0.0059		0.0192		0.037	0.097
Mass moment of inertia as a percentage (sensor side)	%	57		55		54	
Weight, approx. (without cable)	kg	2.4		4.9		8.3	14.6
Weight IP67-version, approx. (with cable)	kg	2.6		5.1		8.5	14.8

Supplementary information acc. to DIN 51309 or EA 10/14		
Class acc. to DIN 51309 or EA 10/14	%	0.05
Rel. zero error (zero signal return)		< ± 0.008 (typically < 0.003)
Rel. repeatability and reproducibility errors in (0.1 M_{nom} to M_{nom})		
unchanged mounting position	%	< 0.02 (typically < 0.01)
different modified mounting position	%	< 0.03 (typically < 0.02)
Relative reversibility error (0.1 M_{nom} to M_{nom})	%	< 0.06 (typically < 0.03)

Run-out and concentric tolerances



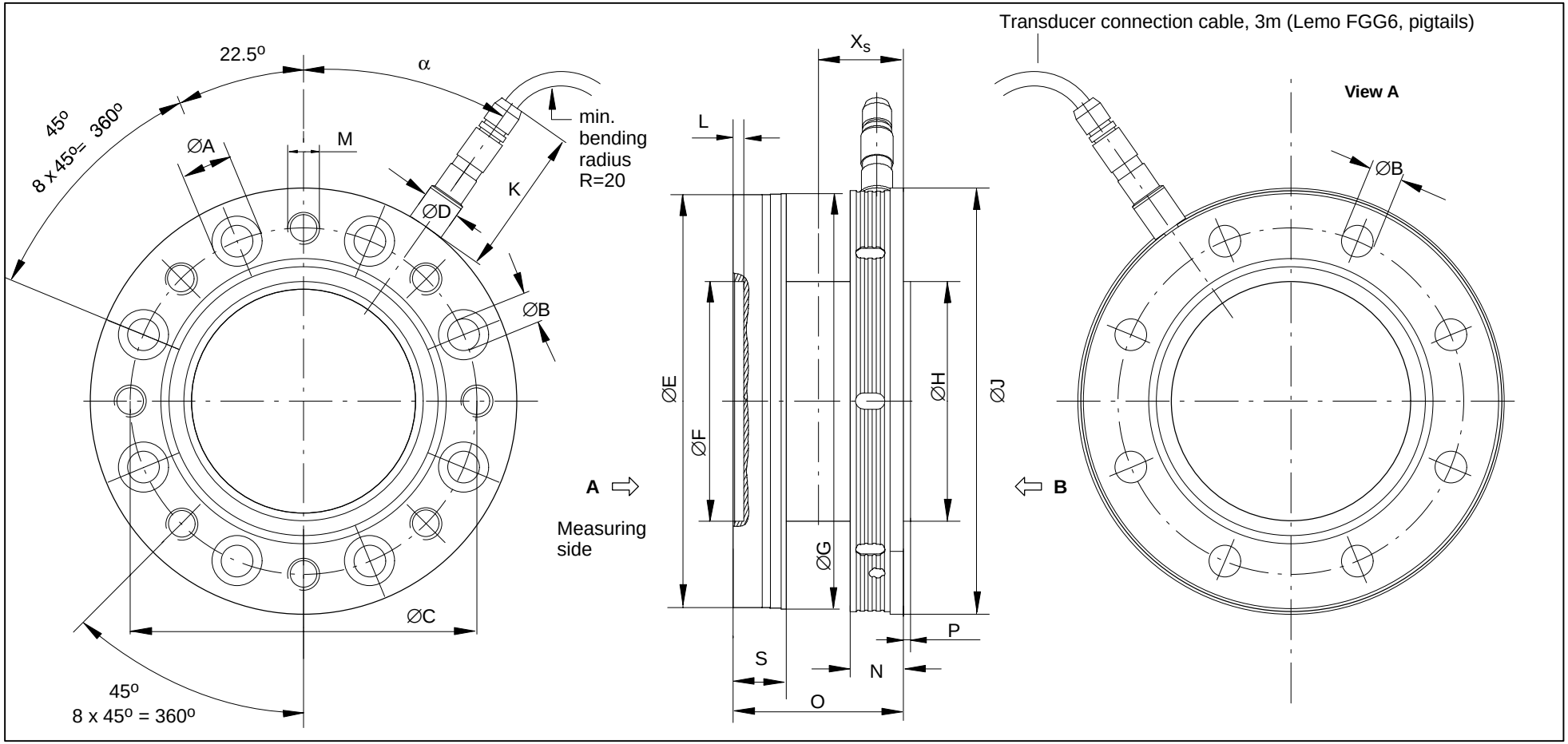
Hardness 46 ... 51 HRc

Surface quality of in-plane and concentric surfaces (A, B and AB) 0.8

Measuring range	Run-out tolerance (mm)	Concentric tolerance (mm)
N·m	0.01	0.01
1kN·m	0.01	0.01
2kN·m	0.02	0.02
3kN·m	0.02	0.02
5kN·m	0.02	0.02
10kN·m	0.02	0.02

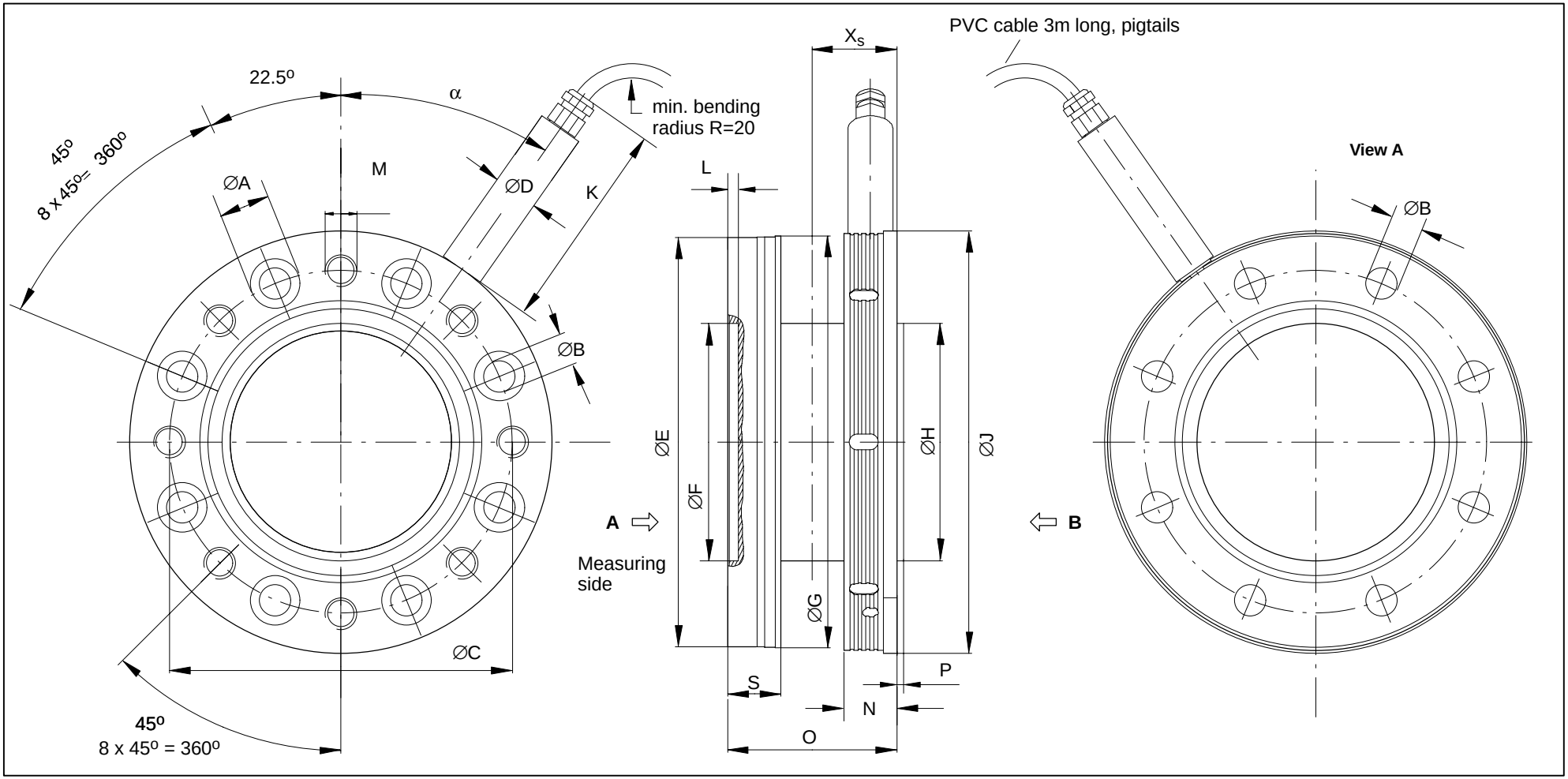
10 Dimensions

Standard version



Nominal (rated) torque	∅A	∅B	∅C	∅D	∅E	∅F	∅G	∅H	∅J	K	α	M	S	L	N	O	P	X_S
500 N·m – 1 kN·m	17	10	101.5	14	120	75^{H6}	121	75^{g5}	123	57	35.8	M10	18	4	18	60	$2^{+0.4}$	30
2 – 3 kN·m	19	12	130	14	155	90	156	90^{g5}	160	57	35	M12	20	4	20	64	$2.5^{+0.4}$	32
5 kN·m	22	14.2	155.5	14	179	110^{H6}	180	110^{g5}	188	57	10	M14	26	3	26	84	2.8	42
10 kN·m	26	17	196	14	221	140^{H6}	222	140^{g6}	230	57	10	M16	30	4	30	92	$3.5^{+0.5}$	46

Option: degree of protection IP67



Nominal (rated) torque	∅A	∅B	∅C	∅D	∅E	∅F	∅G	∅H	∅J	K	α	M	S	L	N	O	P	X_S
500 N·m – 1 kN·m	17	10	101.5	17	120	75^{H6}	121	75^{g5}	123	80	35.8	M10	18	4	18	60	$2^{+0.4}$	30
2 – 3 kN·m	19	12	130	17	155	90^{H6}	156	90^{g5}	160	80	35	M12	20	4	20	64	$2.5^{+0.4}$	32
5 kN·m	22	14.2	155.5	17	179	110^{H6}	180	110^{g5}	188	80	10	M14	26	3	26	84	2.8	42
10 kN·m	26	17	196	17	221	140^{H6}	222	140^{g6}	230	80	10	M16	30	4	30	92	$3.5^{+0.5}$	46

11 Declaration of conformity

Hottinger Baldwin Messtechnik GmbH

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Konformitätserklärung ***Declaration of Conformity*** ***Déclaration de Conformité***

Document: ***195/02.2002***

Wir,	We,	Nous,
Hottinger Baldwin Messtechnik GmbH, Darmstadt		
erklären in alleiniger Verantwortung, dass das Produkt	declare under our sole responsibility that the product	déclarons sous notre seule responsabilité que le produit
Drehmomentmessscheibe		
Typ TB2		
auf das sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder normativen Dokument(en) übereinstimmt (siehe Seite 2) gemäß den Bestimmungen der Richtlinie(n)	to which this declaration relates is in conformity with the following standard(s) or other normative document(s) (see page 2) following the provisions of Directive(s)	auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou autre(s) document(s) normatif(s) (voir page 2) conformément aux dispositions de(s) Directive(s)

89/336/EWG - Richtlinie des Rates vom 3. Mai 1989 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit, geändert durch 91/263/EWG, 92/31/EWG, 93/68/EWG und 93/97/EWG

Die Absicherung aller produktspezifischen Qualitätsmerkmale erfolgt auf Basis eines von der DQS (Deutsche Gesellschaft zur Zertifizierung von Managementsystemen) seit 1986 zertifizierten Qualitätsmanagementsystems nach DIN ISO 9001 (Reg. Nr. DQS-00001). Die Überprüfung der sicherheitsrelevanten Merkmale (Elektromagnetische Verträglichkeit, Sicherheit elektrischer Betriebsmittel) führt ein von der DATech erstmals 1991 akkreditiertes Prüflaboratorium (Reg. Nr. DAT-P-006 und DAT-P-012) unabhängig im Hause HBM durch.	All product-related features are secured by a quality system in accordance with DIN ISO 9001, certified by DQS (Deutsche Gesellschaft zur Zertifizierung von Managementsystemen) since 1986 (Reg. No. DQS-00001). The safety-relevant features (electromagnetic compatibility, safety of electrical apparatus) are verified at HBM by an independent testing laboratory which has been accredited by DATech in 1991 for the first time (Reg. Nos. DAT-P-006 and DAT-P-012).	Chez HBM, la détermination de tous les critères de qualité relatifs à un produit spécifique est faite sur la base d´un protocole DQS (Deutsche Gesellschaft zur Zertifizierung von Managementsystemen) certifiant, depuis 1986, notre système d´assurance qualité selon DIN ISO 9001 (Reg. Nr. DQS-00001). De même, tous les critères de protection électrique et de compatibilité électromagnétique sont certifiés par un laboratoire d´essais indépendant et accrédité depuis 1991 (Reg. Nr. DAT-P-006 et DAT-P-012).

Darmstadt, 2002-02-04

Dr. Michael Altwein *H. Fritz*

QV1051A1.05

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Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften.
Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.

This declaration certifies conformity with the Directives listed above, but is no asseveration of characteristics.
Safety directions of the delivered product documentation have to be followed.

Cette déclaration atteste la conformité avec les directives citées mais n´assure pas un certain charactère.
S.v.p. observez les indications de sécurité de la documentation du produit ajoutée.

Folgende Normen werden zum Nachweis der Übereinstimmung mit den Vorschriften der Richtlinie(n) eingehalten:

The following standards are fulfilled as proof of conformity with the provisions of the Directive(s):

Pour la démonstration de la conformité aux disposition de(s) Directive(s) le produit satisfait les normes:

EN 61326 : 1997 + A1 : 1998 ***Elektrische Betriebsmittel für Leittechnik und Laboreinsatz*** - EMV-Anforderungen; Deutsche Fassung

Messbereich: **500Nm, 1kNm, 2kNm, 3kNm, 5kNm, 10kNm**

CE

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