Mounting instructions

Torque transducers

T32FNA

A0376-22 en

HBM

Safety instructions

Appropriate use

The T32 FNA Torque Transducer may be used for torque-measurement and directly related control and regulation tasks, only. Any other use is not appropriate.

To ensure safe operation, the transducer may only be used according to the specifications given in this manual. When using the transducer, the legal and safety regulations for the respective application must also be observed. The same applies if accessories are used.

The transducer is no safety element in the sense of appropriate use. Prerequisites for correct and safe transducer operation are appropriate transportation, storage, installation and mounting, and careful operation.

General dangers in the case of non-observance of the safety instructions

The transducer complies with the state of the art and is operationally reliable. If the transducer is used and operated inappropriately by untrained personnel, residual dangers might develop.

Any person charged with transducer installation, operation, maintenance or repair must in any case have read and understood the operating manual and the notes on safety, in particular.

Residual dangers

The transducer's scope of performance and supply covers a part of the torque measuring-technology, only. The plant designer/constructor/operator must in addition design, realize and take responsibility for the torque measuring-system's safety such that potential residual dangers are minimized. The respective regulations must in any case be observed. Residual dangers regarding the torque measuring-system must be specified explicitly.

In this manual, the below symbols are used to refer to residual dangers:

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: **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 guidelines (see Declaration of Conformity at the end of this document).

Reconstruction and modifications

HBM's express consent is required for modifications regarding the transducer's construction and safety. HBM does not take responsibility for damage resulting from unauthorized modifications.

Qualified personnel

The transducer may be used by qualified personnel, only; the technical data and the special safety regulations must in any case be observed. When using the transducer, the legal and safety regulations for the respective application must also be observed. The same applies if accessories are used.

Qualified personnel means: personnel familiar with the installation, mounting, start-up and operation of the product, and trained according to their job.

Prevention of accidents

According to the prevailing regulation to prevent accidents a cover has to be fitted after the mounting of the torque transducers T32 FNA as follows:

- the cover must be stationary
- the cover shall avoid any danger of squeezing and provide protection against parts that might come loose
- the cover shall be installed at a minimum distance from moving pats or shall be of a nature that a hand cannot be put through
- the cover shall be fitted even if moving parts are installed outside the usual access area of persons.

Above regulations could only be disregarded if there is already sufficient protection of machine parts owing to the design of the machine or due to other precautions.

1 General description, field of application

Mechanical power transmission through rotating machine parts often requires extensive investigations of machine parts that transmit or generate power. Furthermore, continuous monitoring is often required. This, in turn, makes it necessary to have transducers to sense the physical quantities torque and speed of rotation.

The torque transducers type T32 FNA from HBM which are without sliprings and bearings, provide torque sensing as well as speed measurement. The torque transducers are suitable to determine static as well as dynamic torque in stationary and rotating shafts. Speed of rotation can be determined as well as the sense of rotation. The multiplication of both factors gives the shaft power.

Torque transducers are available for nominal torque ratings from 50 N·m up to 25 kN·m. The maximum speed rating is 20000 min^{-1} *), depending on the actual type.

A frequency modulation system with non-contacting, inductive transfer of the signal and the excitation voltage provides a system for the sensing of static and dynamic torque which is free from wear and maintenance.

Owing to the bearing-free design preventive maintenance and lubrication is not required. Friction losses and heating will not occur.

The field of use of the T32 FNA is to measure the required power or the efficiency, or applications on process control as well as continuous monitoring of machines.

*) Type series of 50 N·m, 100 N·m and 200 N·m rated torque

2 Construction and function

2.1 Construction

The T32FNA torque transducers consist of a rotor which forms the measurement body and is surrounded by a housing (stator).

The flanges provided on the rotor ends are used to screw the torque transducer to the shaft ends of the test object or to intermediate couplings. The hollow shaft which forms the rotor has been equipped with strain gages (SG). Inside the hollow shaft there is the electronic circuitry for the bridge excitation voltage and for the transmission of the measurement signals. The measurement body's sleeve has been equipped with 15 teeth for speed measurement and with transmission elements for the inductive transmission of the supply voltage to the rotor and of the measurement signals to the stator.

Four inductive measuring heads have been fitted inside the stator. They measure the pulses that are proportional to the rotational speed and create two pulse voltage series which serve to detect the speed and the sense of rotation. The stator also carries the connection box with one 7−pin connector each for the torque and the speed signal. The stator mounting plate with four M 8 threaded holes is opposite to the connection box. This plate is used for mounting and supporting the stator.

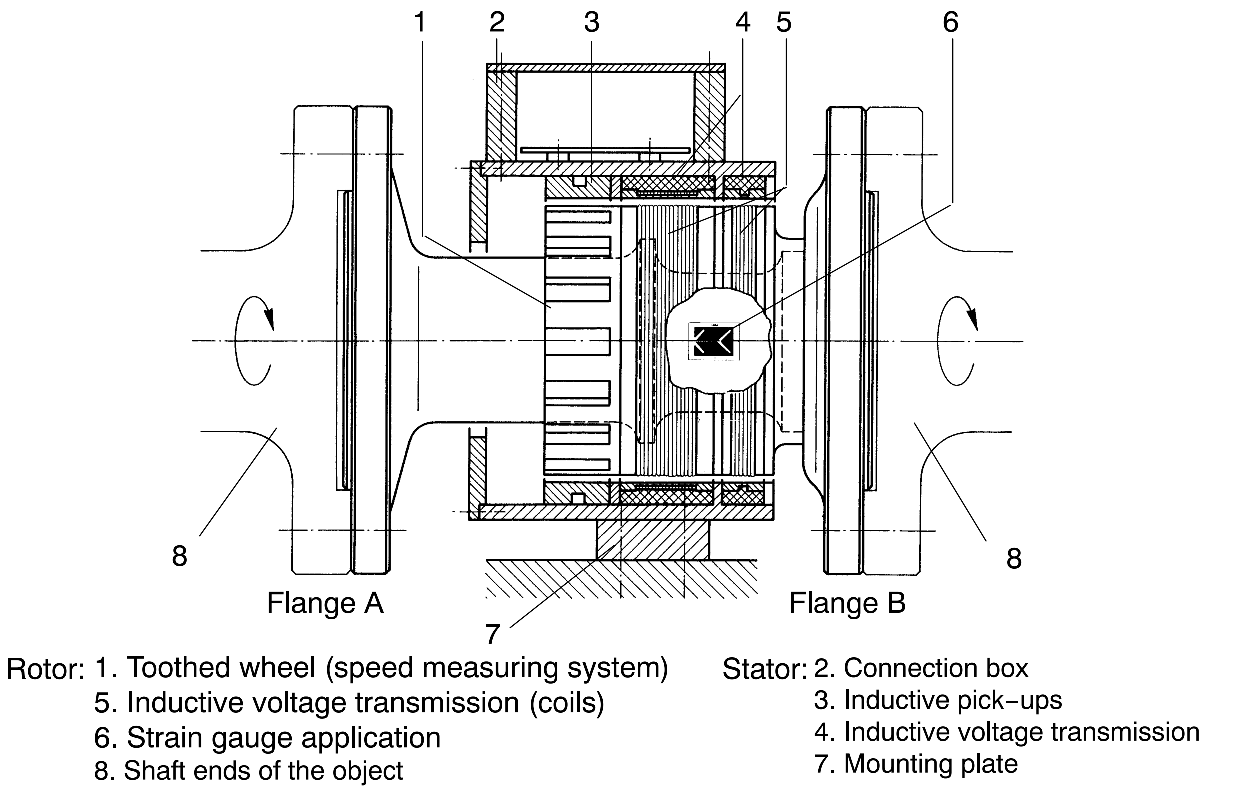


Fig. 2.1: Mechanical construction

Stator and rotor part are not connected by ball bearings. To ensure concentric positioning of the rotor part in the housing three fixing elements are provided at both ends which serve as safeguard during transport and as mounting aid. They enable to adjust the radial and axial play between rotor and stator part of the torque transducer. After mounting the torque transducer the fixing elements must be removed.

2.1.1 Torque measurement system

In the torque transducers T32 FNA there are strain gauges for torque measurement mounted on the rotor in the direction of the main stress. They are connected as a Wheatstone bridge so that only torque will unbalance the bridge. Temperature effects are also compensated by means of further balancing elements. Additional axial and lateral forces as well as bending moments within the permitted limits will have only a slight influence (see section ”8. Technical Data”).

A 15kHz voltage of 54V peak-to-peak for bridge excitation is transmitted by inductive means. The frequency-to-voltage converter in the rotor forms out of this a stable bridge excitation voltage. The torque acting on the sensing element deforms it and also the strain gauges. The strain gauges change their resistance proportional to the strain thus detuning the Wheatstone bridge. The output voltage of the bridge which is proportional to the torque is then fed to a voltage-to-frequency converter. This, in turn, produces pulses through integration, the frequency of which is proportional to the bridge output voltage. The pulses are inductively transmitted to the stator. They are then transformed in a preamplifier into a pulse frequency of 12V peak-to-peak in the frequency range from 5kHz to 15kHz. In the no-load state the output signal is 10kHz. Depending on the sense of the torque the output signal at the ”MD” plug will be either 15kHz or 5kHz at rated torque.

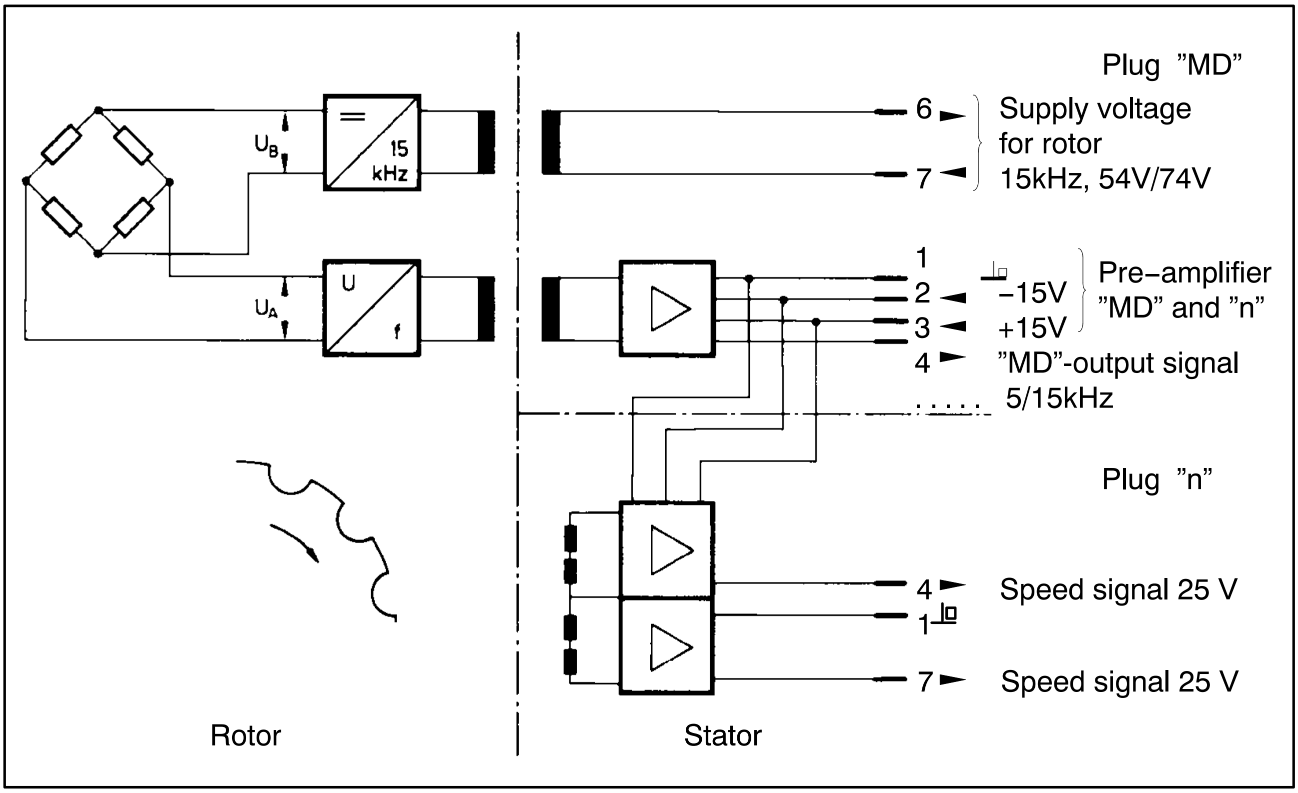


Fig. 2.2: Schematic circuit diagram

2.1.2 Speed measurement system

The rotor carries a toothed wheel with 15 teeth for the determination of speed. On the stator there are evenly distributed, four inductive pick-ups. During one revolution of the rotor 15 voltage pulses are produced the frequency of which is proportional to speed. The pick-ups are displaced in such a way that two pulse trains appear with a phase shift of 90°. The phase shift serves as the information on the sense of rotation of the shaft.

A pre-amplifier serves to transform the two pulse trains into square waves of 25V peak-to-peak. The speed proportional square wave is available at the ”n” plug for further processing.

Experience has shown that smooth, vibration-free running and a concentric rotor are essential for accurate measurement of speed.

Vibration is permitted up to a maximum vibration amplitude falling with increasing speed (see Fig. 2.3, Curve A).

If there is static eccentricity of the stator to the rotor, the possible maximum vibration amplitude displacement (relative vibration displacement is reduced. Curves B, C and D are examples of this relationship for eccentricities of 0.5 mm, 1 mm and 2 mm.

Note: The limit values given for the speed measurement system are not identical to the physical stress limits for the system which can be considerably lower.

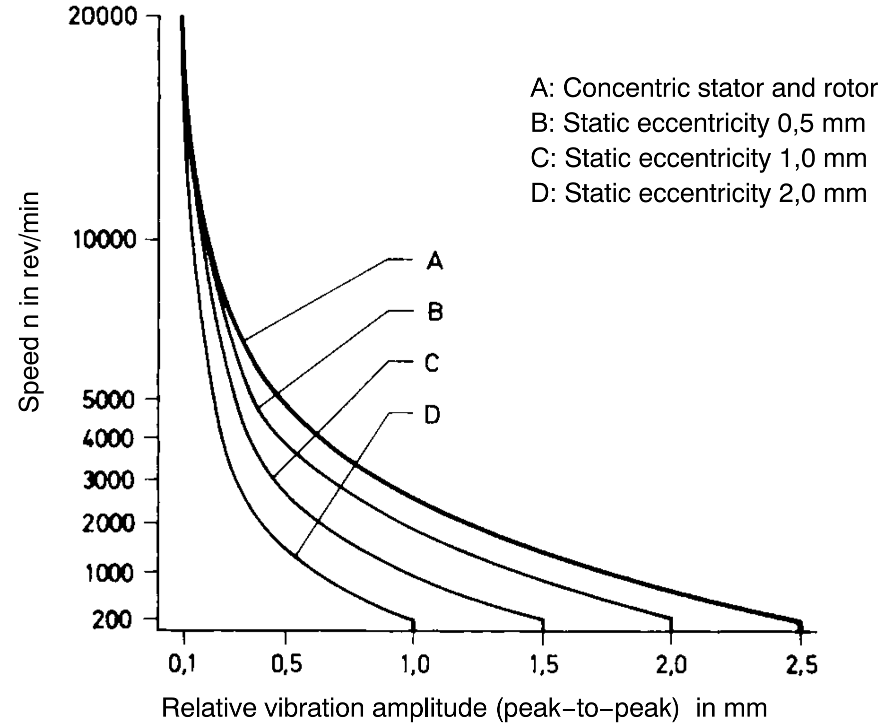


Fig. 2.3: Maximum permitted vibration amplitude

3 Installation

3.1 General hints

- The torque transducers are screwed to the free shaft ends or to the couplings via flanges at both ends. Dimensions of connections see section ”9. Dimensions”.
- Align shaft ends precisely. In order to avoid mechanical overloading HBM recommend to use couplings at both sides. Thus adverse loadings as bending moments, lateral and axial forces will be excluded and cannot act on the torque transducer.
- Stator and rotor are not mechanically connected. The stator should be fixed to an external support construction by means of the mounting plate.

  The support should be designed in such a way that the permitted mechanical tolerances are maintained. Axial and radial displacements with respect to the rotor should only occur within the specified limits (see Technical Data)

NOTE

The zero point that has been balanced at the factory can be offset by ±3% of the nominal (rated) torque due to installation. This does not affect the specifications (see page 20).

3.2 Precautions

The torque transducers T32 FNA are protected to IP 54 according to EN 60 529. Torque transducers shall be protected against coarse dirt particles, dust, oil, solvents and humidity.

3.3 Mounting

The torque transducers T32 FNA may be mounted in a train of shafts **without** couplings. However, **it is imperative** that error loads due to deviations from plane running, smooth running and concentricity shall have no effect on the torque transducer. Contact HBM, if details on the permissible radial and angular displacement of the transducers are required.

Since this is very difficult to realise HBM **recommend** to mount T32 FNA torque transducers with intermediate couplings e.g. tooth couplings.

For the selection of suitable couplings the following criteria should be applied:

- Couplings should be dimensioned in accordance with the torque and speed hat are expected.

- When estimating the possible loads one should take care of acceleration and deceleration moments as well as the passing through critical speeds of rotation. Periodic peaks of torque could be considerably higher than the average calculated from nominal (rated) power and speed. If the coupling is overdimensioned as well as the torque transducer this will bring safety against mechanical overloading.
- Couplings should be selected so that any additional force or moment is within the ratings, or cannot act on the torque transducer.
- Couplings can be self centering. Angular displacements, parallel and axial shifts shall be cancelled.
- Mounting surfaces for the connection of the coupling housing shall be clean and free from grease.
- Stability class and fastening torque for nuts and bolts to be used in the two connecting flanges:

Nominal (rated) torque T32 FNA	**Cheese-head screw*) as machined, lubricated** μ_{tot} = 0.125	**Hexagon nut as machined, lubricated** μ_{tot} = 0.125	**Screws and nuts per flange evenly distributed**	**Tightening torque**
50 N·m	M 6 x 25 DIN EN ISO 4762-12.9	M 6 DIN 934-12	4	16 N·m
100 N·m	M 6 x 25 DIN EN ISO 4762-12.9	M 6 DIN 934-12	4	16 N·m
200 N·m	M 6 x 25 DIN EN ISO 4762-12.9	M 6 DIN 934-12	8	16 N·m
500 N·m	M 10 x 35 DIN EN ISO 4762-10.9	M 10 DIN 6924-10	5	67 N·m
1 kN·m	M 10 x 35 DIN EN ISO 4762-10.9	M 10 DIN 6924-10	10	67 N·m
2 kN·m	M 10 x 35 DIN EN ISO 4762-10.9	M 10 DIN 6924-10	15	67 N·m
10 kN·m	M 16 x 50 DIN EN ISO 4762-10.9	M 16 DIN 6924-10	18	290 N·m
25 kN·m	M 16 x 1.5 x 50 DIN EN ISO 4762-12.9	M 16 x 1.5 DIN 934-12	18	360 N·m

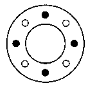
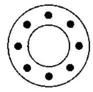
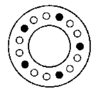
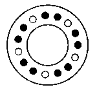
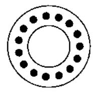
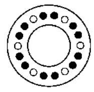
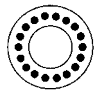
*) The screw length belongs to the combination T32 FNA-Tacke GLB-Curved Tooth Couplings®

The information given above applies under the following conditions:

Surface condition of the flanges in the area of the friction fit surfaces and of the contact surface of screwhead or nuts $R_A \leq 3.2\mu m$.

Flange material: steel, tensile strength $\geq$ 900N/mm^2.

Arrangement of the screws [●] on the flange:

T32 FNA 50N·m ... 200N·m			
T32 FNA 500N·m ... 2 kN·m			
T32 FNA 10 kN·m ... 25 kN·m			

3.3.1 Mounting with curved tooth couplings

Selfcentering curved tooth couplings made by Messrs. Tacke are proved in combination with HBM torque transducers. They are torsionally stiff and take care of the introduction even of dynamic torque to the torque transducer in the correct way. In addition, angular displacement and parallel or axial shift are compensated with small restoring force.

HBM can supply suitable couplings that are well matched to the type of torque transducer and the intended use. Special requirements of the customer are taken care of and the shaft connections are made to the specified dimensions.

The torque transducer and the coupling housing are assembled at HBM and are dynamically balanced (balancing quality level G 2.5). Therefore, the mounted assembly should not be disassembled again. If this cannot be avoided one should mark all parts in such a way that they can be assembled afterwards in exactly the same way. Upon reassembly, the original balancing quality can only be obtained by renewed balancing.

Coupling hubs are balanced individually and the keyways are made after balancing. Further information will be found in the various data sheets provided by HBM.

3.4 Fixing of the housing

The stator housing is fitted around the rotor without bearings or without any mechanical connection. When delivered there are fixing elements at the sides of the stator that serve as safeguard during transport and as mounting aid for radial and axial positioning and ensure that stator and rotor axes are properly aligned.

Important:

- The fixing elements must be screwed in during mounting and dismounting, and during transportation of the torque transducer. This prevents any damage to the signal transmitting devices on the stator and rotor.

- During operation fixing elements must be removed!

Follow these points when mounting:

(see section ”9. Dimensions”)

- The T32 FNA shall be mounted in the train of shafts as delivered so that the mounting plane of the stator is seated on the prepared support plane without play or stress. The two connection flanges shall be connected to the shaft ends or couplings respectively.
- Any possible height difference shall be adjusted by shims. Screw in fixing screws; do not yet tighten to avoid jamming of the fixing elements.
- Mark position of the stator or adjust respective stops.
- Remove fixing elements from the torque transducer.
- Check dimension Z (see section ”9. Dimensions”).
- Tighten fixing screws. Stator must stay in marked position or at stops. Rotor must rotate freely.
- Check if radial and axial tolerances are kept.
- Check smooth running of the torque transducer, beginning with low speeds.

In the case of elastically suspended machines larger radial and axial movements may occur. If the occurring movements exceed the permitted limits of ±2.5mm, or ±3mm resp. one must take care that the stator can follow the motions of the rotor, or the motions shall be properly decoupled.
If couplings are mounted a possible axial and radial play should be considered as well.

3.5 Mounting position

The T32 FNA can be mounted in any position. If mounted with couplings the relevant restrictions of the couplings shall be observed regarding slanted or vertical operation.

For the determination of the sense of rotation the following holds:

An arrow is marked on the stator for the unambiguous determination of the sense of rotation. If the torque transducer rotates **in the direction of the arrow** the connected amplifier outputs a **positive** signal (0...+10 V).

For the determination of the sense of the torque the following holds:

If **clockwise** torque is applied the output frequency is 10...15 kHz. In conjunction with HBM amplifiers there will be a **positive** output signal (0...+10 V).

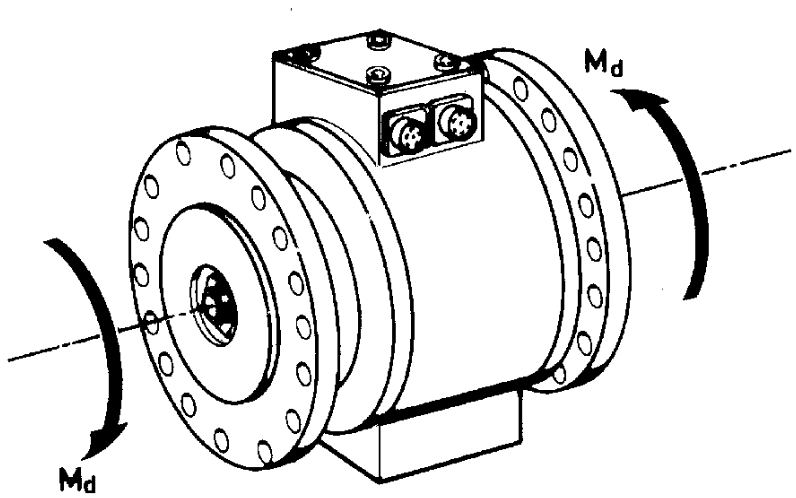


Fig. 3.1: Direction of torque

3.6 Limits of application

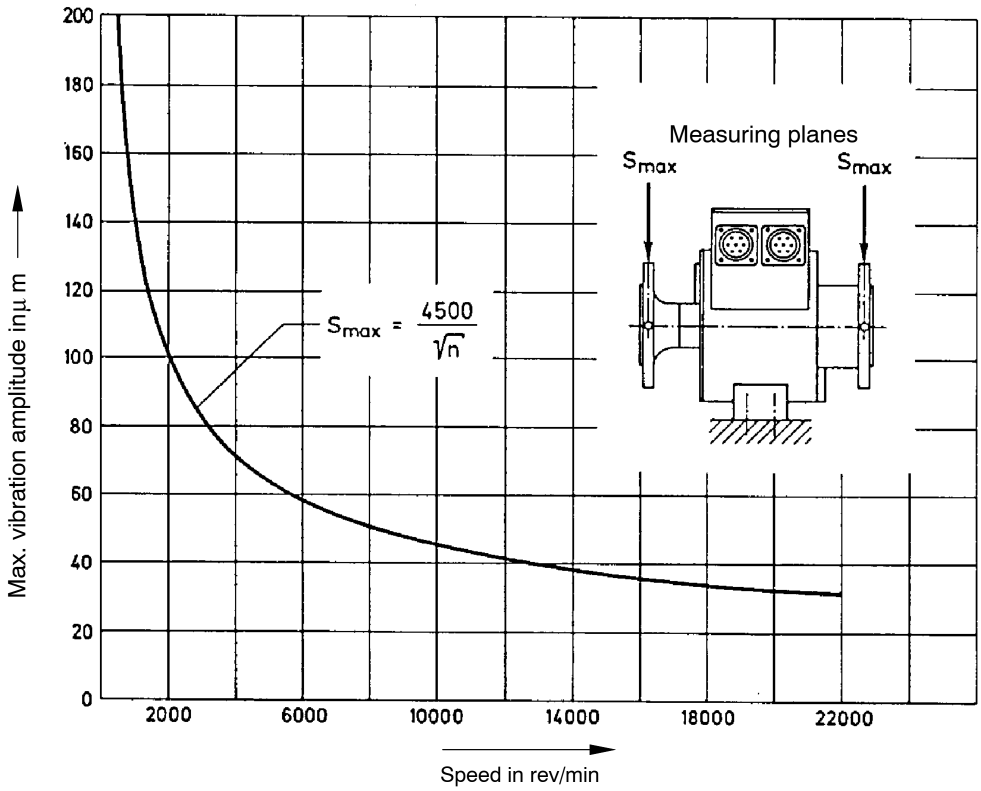
The nominal (rated) speed of the torque transducer is given on the type plate. It refers to the permitted continuous speed of the torque transducer when installed and represents the maximum load due to the kinetic energy of rotation that the transducer can tolerate.

Practical experience has shown that the running smoothness of the torque transducers is very dependent on the overall construction of the testbed. Thus, vibration can occur whose amplitude may be influenced by the mass of the resonating housing and foundation, the stiffness of the bearings or supports and the proximity of resonance. Since HBM can have no responsibility for such factors, diagram 1 shows the stated limit values of maximum deflection of the relative shaft vibration s_{max} in relation to the speed for T32 FNA torque transducers.

- Transducers without couplings
- The maximum speed is the nominal (rated) speed given on the type plate.
- The torque transducer supplied has been tested on a testbed and fulfils the requirements of diagram.

- Transducers with couplings
- With GLB couplings: nominal (rated) speed as for torque transducer according to diagram 1.
- With SBG couplings: the maximum speed is the lower rated speed of the couplings being used (see section ”8. Technical Data”)
- The vibration characteristics of the combined torque transducer and coupling supplied by HBM have been tested on a testbed and fulfil the requirements of diagram 1.

In the diagram shown, the maximum permitted vibration amplitude s is plotted against the speed.



The maximum values must not be exceeded during normal operation. They refer only to the T32 FNA torque transducer and not to any connected machinery. s_{max} is defined accordingly to DIN 45670 and VDI 2059.

Diagram 1: Vibration amplitude versus the speed

Using a T32 FNA torque transducer in conjunction with SBG curved-tooth couplings allows the advantages of the T32 FNA to be utilized for low speeds in combination with cheap couplings. In this combination the continuous speeds are lower than with the GLB curved-tooth couplings normally used.

4 Electrical connections

4.1 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.

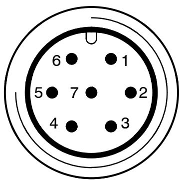
4.2 Connection plugs and cables

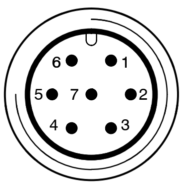
The type T32 FN / T32 FNA torque transducers differ only in the type of connector:

T32FN . . . . MS 3102A16S−1P

T32FNA . . . . Binder 423

The two 7-pole instrument plugs Binder 423 (MS 3102 A 1 6S−1 P for T32 FN) mounted at the housing are marked ”MD” for the torque signal and ”n” for the speed signal.

Plug MD 	1	Operating voltage zero	<WH>
	2	Preamplifier supply voltage (−15V)	<BK>
	3	Preamplifier supply voltage (+15V)	<BU>
	4	Torque output signal ($12V_{pp}$; 5...15kHz)	<RD>
	5	Not connected	
	6	Rotor supply voltage ($54V/74V_{pp}$; 15kHz)	<GN>
	7	Rotor supply voltage (0V)	<GY>

Plug n 	1	Operating voltage zero	<WH>
	2	Not connected	
	3	Not connected	
	4	Rotation rate signal ($25V_{pp}$; 15 pulses/revolution)	<RD>
	5	Not connected	
	6	Not connected	
	7	Rotation rate signal ($25V_{pp}$; 15 puls./rev.); phase shifted by 90° <GY>	

The lead screen is laid flat on the connector case. This means that the complete measurement system is enclosed in a Faraday cage, reducing any electromagnetic interference.
With interference caused by potential differences (equalisation currents) the system zero-voltage and the housing ground should be isolated from one another and a potential equalisation conductor located between the housings of the transducer and the amplifier (flexible stranded wire, 10 mm^2 conductor cross-section).

4.3 Instruments that can be connected

The basic requirements for the trouble-free operation of torque transducers are:

- Adequate power supply for the non-contact telemetry
- Supply for the preamplifier built into the transducer

HBM has various amplifiers available for numerous applications and these can supply the transducers and process the torque and torque-proportional signals. The connection details can be found in the operating manual for the relevant electronic measurement system.

5 Calibration signal

The torque transducers T32 FNA deliver an additive electrical calibration signal that can be called from the amplifier.

When pressing a push button on the front panel of the amplifier the supply voltage is increased from 54V to 74V. The torque transducer responds with the output of a calibration signal of approximately 12.5kHz ≙ 50% of the rated torque. The precise value is given on the nameplate of the T32 FNA. The amplifier has to be adjusted to the precise calibration signal of the connected unloaded torque transducer in order to achieve calibration of the measurement chain.

6 Load limits

The nominal (rated) torques may be exceeded statically by max. 50 %. Within the nominal (rated) torque exceeded, no additional irregular loads such as longitudinal and transverse forces and bending moments are permissible. The limit values are specified in the chapter ”8. Technical Data”.

Measurement of static and dynamic torque

Torque transducers T32 FNA are suitable for the measurement of static and dynamic torques. When dynamic torque is measured one should note the following:

- The static calibration of the T32 FNA is also valid for dynamic torque measurements.

  Note: The frequency of dynamic torque must not exceed the natural frequency of the mechanical measuring installation.

- The natural frequency f_0 of the mechanical measuring installation depends on the moments of inertia J_1 and J_2 of the coupled rotating masses and depends on the torsional stiffness c_T of the T32 FNA.

The natural frequency of the arrangement can be calculated with 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 of the measurement arrangement (Hz)

J_1, J_2 = mass moment of inertia of the connected rotating masses ($kg \cdot m^2$)

c_T = torsional stiffness of the torque transducer (N·m/rad)

- The amplitudes (peak-to-peak) must never exceed 70 % of the nominal (rated) torque for the specific type, even with oscillating torque. In all cases the amplitudes must lie within the load range limits of $-M_{nom}$ and $+M_{nom}$.

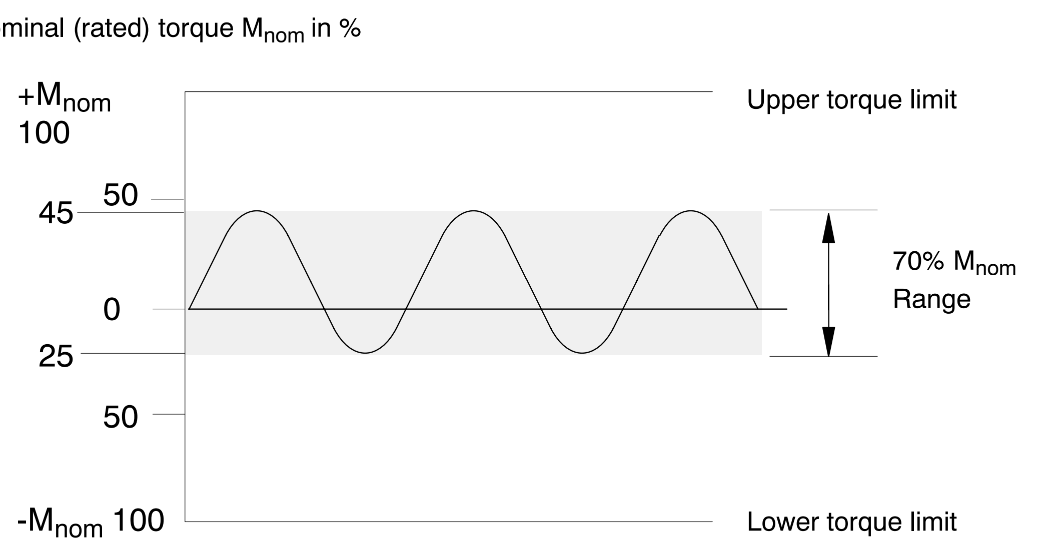


Fig. 6.1: Amplitudes of dynamic torque

7 Maintenance

Torque transducers type T32 FNA are maintenance-free owing to their design without bearings and with non-contacting transfer of the energising voltages and of the measured signal.

8 Technical Data

Accuracy class		0.3	0.2		0.1				
Torque measuring system									
Nominal (rated) torque M_{nom}	N·m kN·m	50	100	200	500	1	2	10	25
Measuring system Excitation voltage – and measuring signal transmission		strain gauge full bridge Inductive							
Excitation voltage Square-wave voltage (peak-to-peak) Current consumption Frequency	V mA kHz	54 ± 5 % 800 ± 5 % approx. 15							
Voltage for preamplifier	V	-15 / 0 / +15							
Preamplifier, max. current consumption	mA	-20 / 0 / +20							
Calibration signal, value given on name plate		approx. 50 % von M_{nom}							
Tolerance of calibration signal related to M_{nom}	%	< ± 0,05							
Release of calibration signal Current consumption	V mA	80 ± 5 % 1000 ± 5 %							
Torque output signal		pulse train							
Nominal (rated) torque output signal with positive M_{nom} with negative M_{nom} Load resistance	kHz kHz kΩ	15 (12V peak-to-peak) 5 (12V peak-to-peak) ≥ 2							
Nominal (rated) sensitivity (nominal (rated) signal span between torque = zero and nominal (rated) torque)	kHz	± 5							
Sensitivity tolerance (deviation of the actual signal span to the nominal (rated) signal span at M_{nom})	%	< ± 0.1							
Temperature error per 10 K at nominal (rated) temperature range of **output signal,** related to the actual value of signal span	%	< ± 0.1							
zero signal, related to the nominal (rated) sensitivity	%	< ± 0.1			< ± 0.05				
Linearity deviation including hysteresis, related to the nominal (rated) sensitivity	%	<±0.3	< ± 0.2		< ± 0.1				
Relative standard deviation of the reproducibility according to DIN 1319	%	< ± 0.03							

Speed measuring system									
Nominal (rated) torque	N·m kN·m	50	100	200	500	1	2	10	25
Measuring system		brushless, inductive							

Output signal for speed		pulse train							
Pulse voltage (peak-to-peak)	V	25							
between plug contacts 1 and 4		15 pulses per revolution							
between plug contacts 7 and 1		15 pulses per revolution, displaced by 90°							
Load resistance	kΩ	≥ 5							
Minimum speed	min^{-1}	2							
Mechanical Data									
Nominal (rated) temperature range	°C	+ 10 ... + 60							
Service temperature range	°C	– 10 ... + 60							
Storage temperature range	°C	– 50 ... + 70							
Load limits									
Torque limit, related to M_{nom}	%	150							
Destruction torque, related to M_{nom}	%	> 300							
Lateral limit force[1)]	N	50	100	190	410	1.1k	1.6k	5.7k	14k
Axial limit force[1)]	kN	1.3	2.5	5	7	14	27	100	200
Bending limit moment[1)]	N·m	6	12	23	60	115	230	1150	2.8k
Vibration amplitude to DIN 50 100 (peak-to-peak)	N·m	35	70	140	350	700	1.4k	7k	17.5k
Mechanical impact test[2)] degree of precision according to IEC 68-2-27-1987									
Number									
Duration	n	1000							
Acceleration	ms	3							
	m/s^2	500							
Vibration stressing test[2)], degree of precision according to IEC 68-2-6-1985									
Frequency range									
Duration	Hz	5 - 65							
Acceleration	h	1.5							
	m/s^2	50							
Torsional stiffness c_T	kN·m/ rad	10.5	19.5	34.3	142	242	369	2910	6480
Torsion angle at M_{nom}	grad	0.27	0.29	0.33	0.2	0.24	0.31	0.19	0.22
Mass moment of inertia (axially)	gm^2	1.85			16			149	154
Nominal (rated) speed (without coupling)	min–1	20 000			15 000			11 000	
Nominal (rated) speed[3)] with									
SBG-Coupling	min^{-1}	3000							
GLB-Coupling	min^{-1}	20 000			15 000			10000	7600

1) Each type of irregular stress can only be permitted with its given limit value (bending moment, side load or axial load, exceeding the nominal (rated) speed) if none of the others can occur. Otherwise the limit values must be reduced. If for instance 30% of the bending moment and also 30% of the side load are present, only 40% of the axial load are permitted, provided that the nominal (rated) torque is not exceeded. With maximum additional loading, measuring errors of the order of 1% of the nominal (rated) torque can occur.

2) The technical data did not change after impact and vibrational stressing test.

3) The maximum permissible continuous speed for the T32 FNA-coupling mounted and balanced by HBM given on the plate.

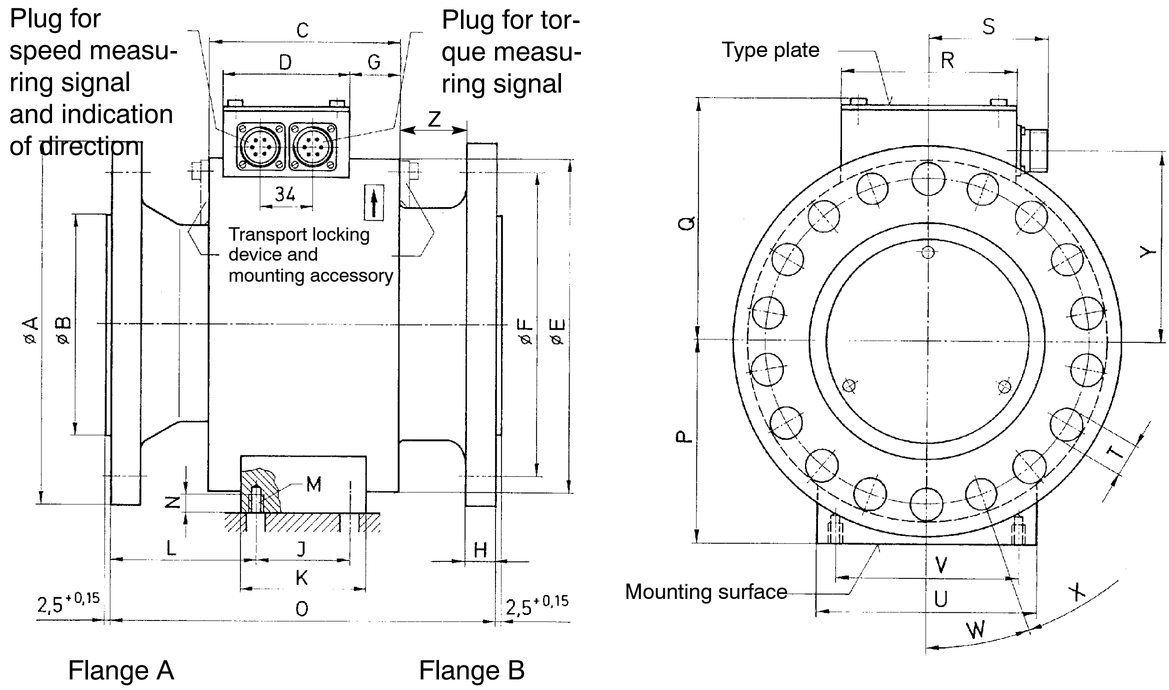
Nominal (rated) torque	N·m kN·m	50	100	200	500	1	2	10	25
Quality grade[4)] according to VDI 2060		G 2.5							
Permissible residual unbalance per unit weight of inertial body per plane	gnm/kg	0.5			0.7			0.8	
Weight									
Rotor	kg	2.5			7.1	7.2	7.3	31.6	32
Stator	kg	2.8			3			11	

Total	kg	5.3	10.1	10.2	10.3	42.6	43
Protection class according to EN 60 529		IP 54					
Maximum permissible **static eccentricity** of the rotor (radially) (centering with fixing elements)	mm	± 2.5	± 2.0			± 3	
Maximum permissible **amplitude** (peak-to-peak) of the rotor							
with speed measurement	mm	2.5 5)					
with torque measurement	mm	5					
Permissible **axial displacement** between shaft and housing (centering with fixing elements)	mm	± 3					

4) The balance quality grades include the coupling housing if it has been mounted on the shaft by HBM.

5) Accurate measurement of speed depends on the relation between the static eccentricity and the maximum vibration amplitude of the rotor (see para. ”2.1.2 Speed measurement system”).

9 Dimensions



Permissible deviation of pitch ± 5'

Dimensions without tolerances to DIN 7168-m

Nominal (rated) torque	Dimensions in mm											
	A	$B_{-0.005}$	C	D	E	$F_{\pm 0,1}$	G	H	J	K	L	M	N
50 to 200 N·m	90	60	84	70	107	72	6	8.5	15	38	76	M5	8
500 N·m to 2 kN·m	$157_{\pm 0.2}$	100	102	80	124	130	17	13	22	38	90.5	M8	12
10 to 25 kN·m	235	140	122	80	216	196	33.5	18.5	60	80	90	M8	14

Nominal (rated) torque	Dimensions in mm										
	$O_{-0.5}$	$P_{-0.2}$	Q	R	S	T^{H12}	U	V	W	X	Y	Z
50 to 200 N·m	161.5	66.5	87.5	105	69	6.4	70	30	45°	8x45°	58.8	28
500 N·m to 2 kN·m	171.5	75	96	105	69	10.5	70	54	24°	15x24°	67	17
10 to 25 kN·m	244.6	123	140.8	105	69	17	130	110	20°	18x20°	113	42.6

10 Copy of Declaration of Conformity

HOTTINGER
BALDWIN
MESSTECHNIK

HBM

HOTTINGER BALDWIN MESSTECHNIK GMBH
Im Tiefen See 45 - D-64293 Darmstadt
Tel. ++49/6151/803-0, Fax. ++49/6151/894896

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

Document: ***076/05.1996***

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

Drehmoment-Meßwelle T32 FNA

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 Mitgliedsstaaten über die elektromagnetische Verträglichkeit, geändert durch 91/263/EWG, 92/31/EWG und 93/68/EWG

Die Absicherung aller produktspezifischen Qualitätsmerkmale erfolgt auf Basis eines von der DQS (Deutsche Gesellschaft zur Zertifizierung von Qualitätsmanagementsystemen) seit 1986 zertifizierten Qualitätsmanagementsystems nach DIN ISO 9001 (Reg.Nr. DQS-10001).
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 Qualitätsmanagementsystemen) since 1986 (Reg. No. DQS-10001). 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 Qualitätsmanagementsystemen) certifiant, depuis 1986, notre système d´assurance qualité selon DIN ISO 9001 (Reg.Nr. DQS-10001).
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, 10.05.96

QV1051A1.03

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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.

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

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.

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

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.

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

EN 50082-2 : 1995 ***Elektromagnetische Verträglichkeit (EMV); Fachgrundnorm Störfestigkeit;*** Teil 2: Industriebereich; Deutsche Fassung

EN 55011 : 1991 ***Funk-Entstörung von Elektrischen Betriebmitteln und Anlagen;*** Grenzwerte und Meßverfahren für Funkstörungen von industriellen, wissenschaftlichen und medizinischen Hochfrequenzgeräten (ISM-Geräten) (CISPR 11 : 1990, modifiziert); Deutsche Fassung

... und:
EN 55022 : 1994 ***Elektromagnetische Verträglichkeit von Einrichtungen der Informationsverarbeitungs- und Telekommunikationstechnik;*** Grenzwerte und Meßverfahren für Funkstörungen von informationstechnischen Einrichtungen (IEC CISPR 22: 1993; Deutsche Fassung

QV1051A1.03

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