Mounting instructions

Torque flange

T10FM

B 23.T10FM.10 en

Content **Page**

Safety instructions

Use in accordance with the regulations

Torque flanges T10FM are 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 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 Mounting Instructions 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 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 this Mounting Instructions 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.

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 (see Declaration of conformity at the end of this Mounting Instructions).

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 ex–clude 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 re-gulations 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.

Prevention of accidents

According to the prevailing regulation to prevent accidents a cover has to be fitted after the mounting of the torque transducers T10FM as follows:

- The cover or cladding must not be free to rotate.
- The cover shall avoid any danger of squeezing and provide protection against parts that might 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 flange are installed outside peoples' movement and operating range.

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.

Warranty

In the case of complaints, a warranty can only be given if the torque flange is returned in the original packaging.

1 Scope of supply

- Rotor
- Stator
- Mounting Instructions
- Test report
- Option: Speed kit (slotted disc, screwdriver, screw locking device, screws)

2 Application

T10FM torque flanges record static and dynamic torques on fixed or rotating shafts and establish the rotation speed whilst indicating the direction of rotation. Test beds can be extremely compact because of their very short construction. They offer a very wide range of applications.

In addition to conventional test-rig applications (motor, roller and gear test-rigs) new solutions for torque measurements partly integrated into the machines are possible.

Designed without bearings and with non-contacting transmission of excitation voltage and measured values, the torque measuring system of the gaging flanges is maintenance-free. This means that effects due to friction or the heating of bearings simply do not arise.

Torque flanges are supplied for nominal (rated) torques from 15 kN·m to 80 kN·m. Depending on the nominal (rated) torque, maximum speeds of up to 6000 rpm are permissible.

The T10FM torque flanges are protected from electromagnetic interferences. They have been tested with regard to EMC according to the relevant European standards, and carry the CE mark.

3 Structure and mode of operation

The torque flange consists of two separate parts: the rotor and the stator.

Strain gages (S.G.) have been mounted on the rotor. The rotor electronics for excitation-voltage and measuring-signal transmission are located centrally in the flange. Coils for the non-contact transmission of excitation voltage and measuring signal are located on the outer circumference of flange B. The si-

gnals are transmitted and received by a divisible antenna ring. The antenna ring is mounted on a housing that includes the electronic system for voltage adaptation and signal conditioning.

The connector for the torque signal, the voltage supply and the speed signal (option) are located on the stator. The antenna ring should be mounted concentrically around the rotor (see chapter 4).

In the case of speed measuring system option, the speed sensor is mounted on the stator, the customer attaches the associated slotted disc on the rotor. Rotation speed measurement is made visually in accordance with the principle of the infrared transmitted light method.

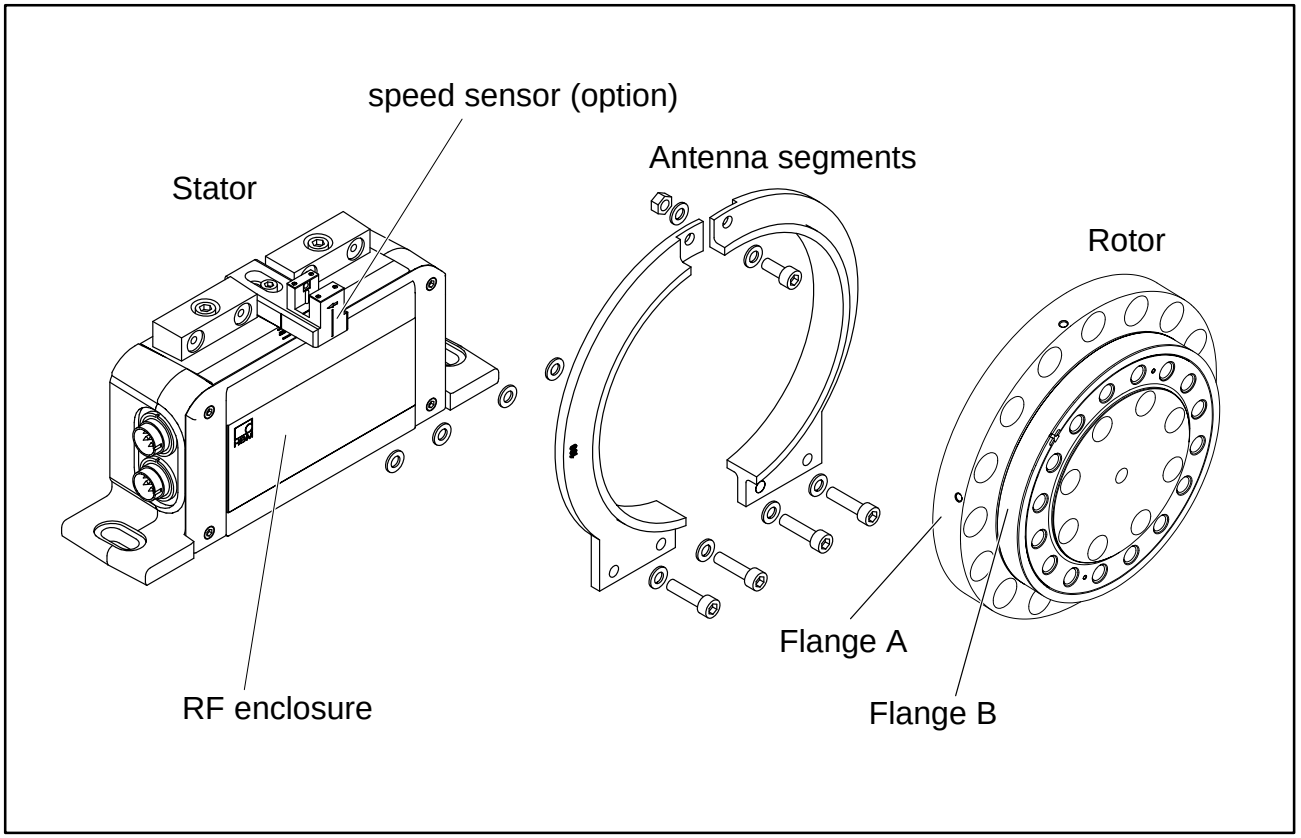


Fig. 3.1: Mechanical structure, explosive representation

4 Mechanical installation

WARNING

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

With alternating loads, you should use a screw locking device (medium) to glue the rotor connection-screws into the counter thread to exclude a pretension loss due to screw slackening.

An appropriate shaft flange enables the T10FM torque flanges to be mounted directly. It is possible to mount a cardan shaft or relevant compensating element directly on flange B (using an intermediate flange when required). Under no circumstances must the permissible limits specified for bending moments, transverse and longitudinal forces be exceeded. Due to the T10FM torque flanges' high torsional stiffness, dynamic changes on the shaft run are minimized.

CAUTION

Do in any case check the effect on critical speeds and natural torsional vibrations to avoid an overloading of the gaging flanges due to resonance step-up.

NOTE

For regular operation do in any case observe the mounting dimensions (see page 40).

NOTE

Even if the unit is installed correctly, the zero point adjustment made at the factory can shift by approx. ±100 Hz. If this value is exceeded, we advise you to check the mounting conditions.

4.1 Conditions on site

The T10FM torque flanges are protected to IP54 according to EN 60529. They 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 (see ”Safety instructions”).

The output- and zero signals of the T10FM torque flange are compensated for the effects of temperature variations between wide limits (see specifications on page 42). This compensation is carried out at static temperatures. This guarantees that the circumstances can be reproduced and the properties of the transducer can be reconstructed at any time.

If there are no static temperature ratios, for example, because of the temperature differences between flange A and flange B, the values given in the specifications can be exceeded. Then for accurate measurements, static temperature ratios must be obtained by cooling or or heating depending on the application. Alternatively, temperature decoupling must be checked, e.g. by heat radiating elements such as laminated couplings.

4.2 Mounting position

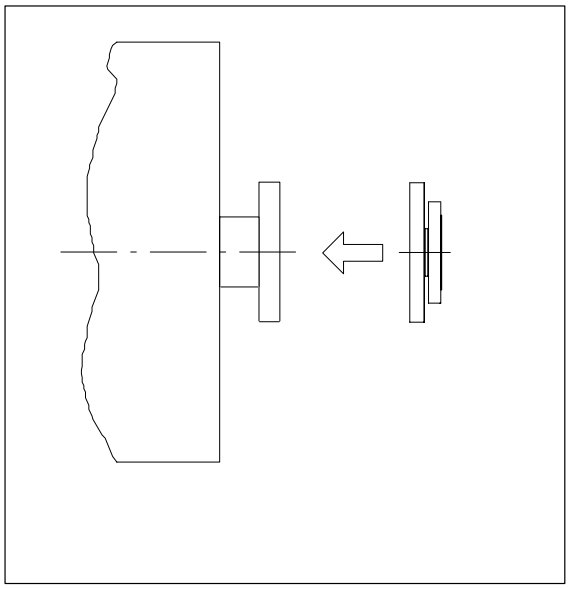
The gaging flange can be mounted in any position. With clockwise torque, the output frequency is 10 – 15 kHz. With HBM amplifiers or when using the voltage output, a positive output signal (0 V to +10 V) is present.

In the case of the speed measuring system, an arrow is attached to the head of the sensor to clearly determine the direction of rotation. If the gaging flange moves in the direction of the arrow, the connected HBM measuring amplifiers give off a positive output signal (0 V...+10 V).

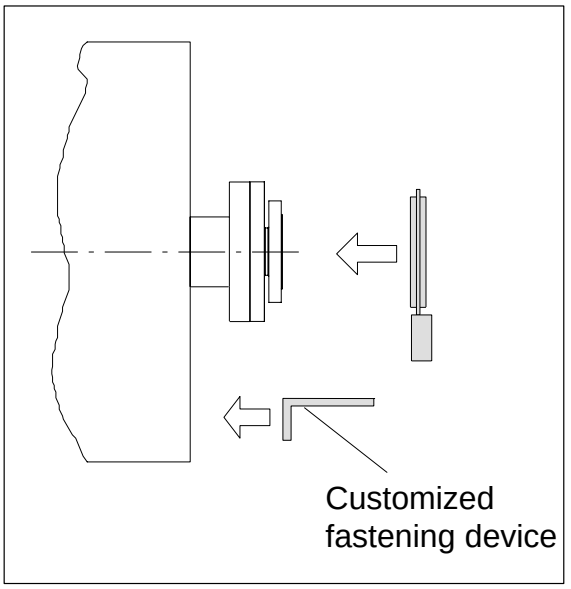
4.3 Installation possibilities

On principle, there are two possibilities for torque flange mounting: with antenna ring complete or disassembled. We recommend to proceed as described in chapter 4.3.1 . If mounting in accordance with 4.3.1 is not possible, (e.g. in the case of a subsequent stator replacement or mounting with the speed measuring system), you will have to undo the antenna ring. It is essential in this case to comply with the notes on assembling the antenna segments (see ”Installing the stator” and “Installing the slotted disc”).

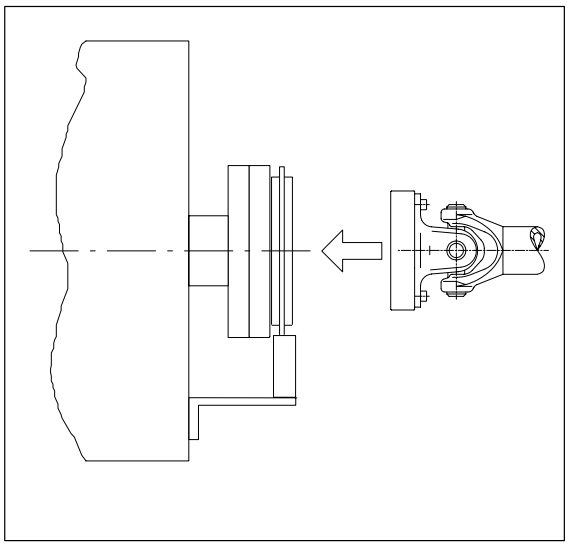
4.3.1 Installation without removing the antenna ring



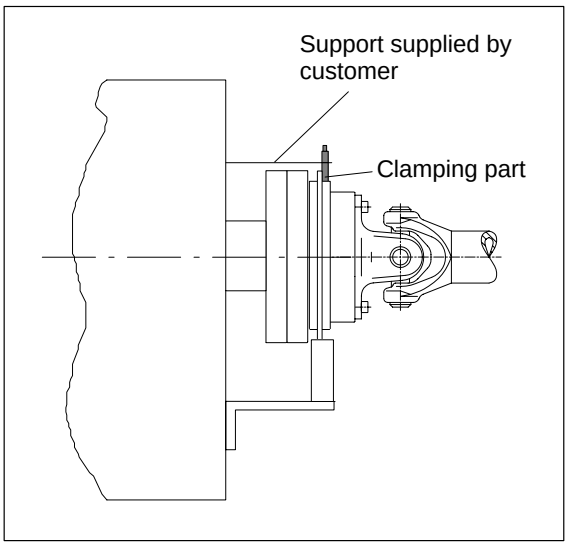
1. Install rotor



2. Install stator

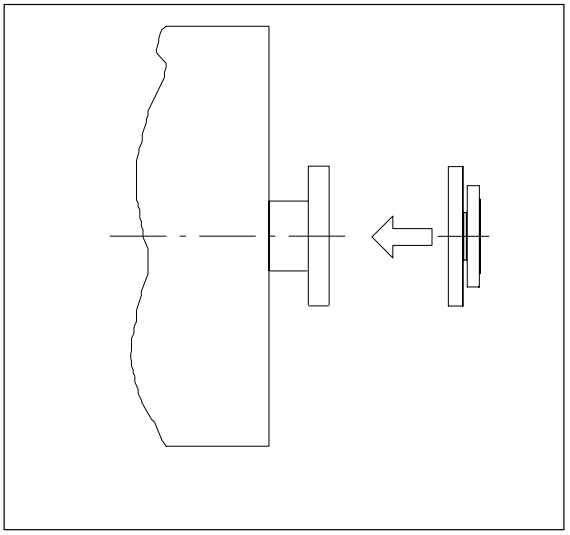


3. Finish installation of shaft run

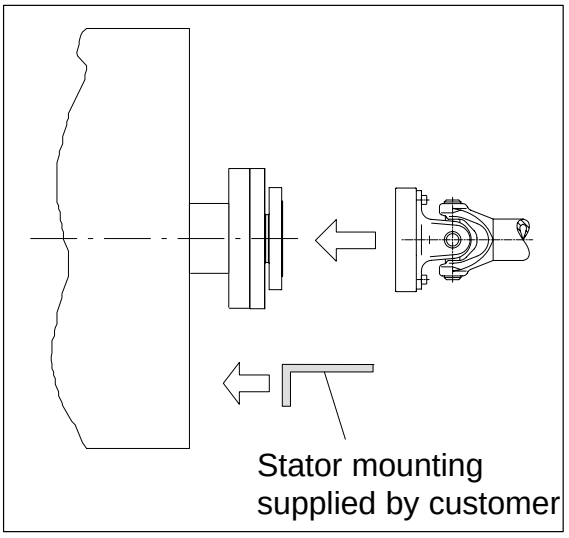


4. Mount clamp. part where required

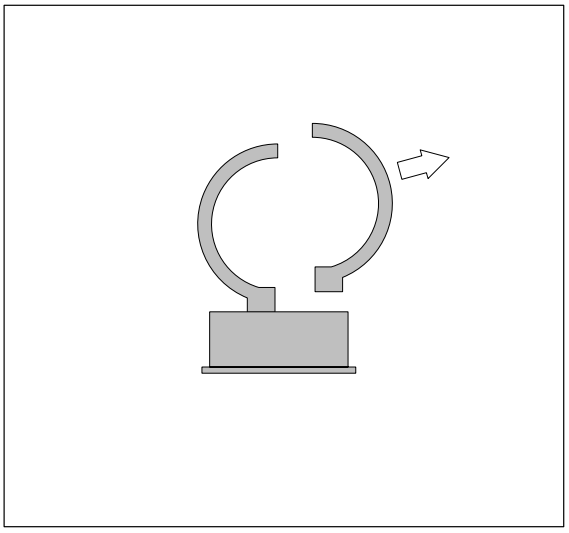
4.3.2 Installation with subsequent stator mounting



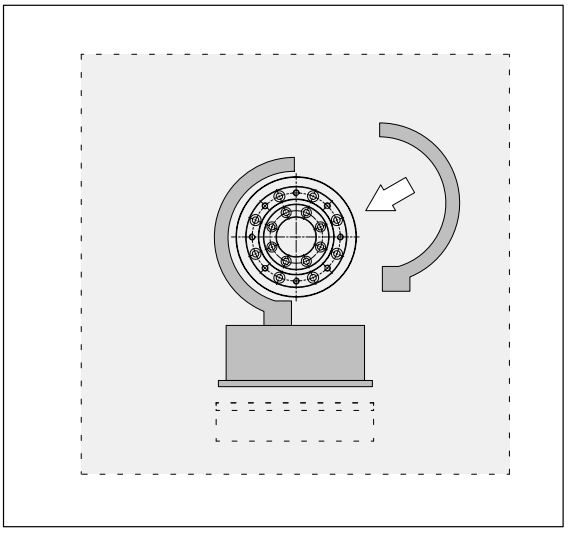
1. Install rotor



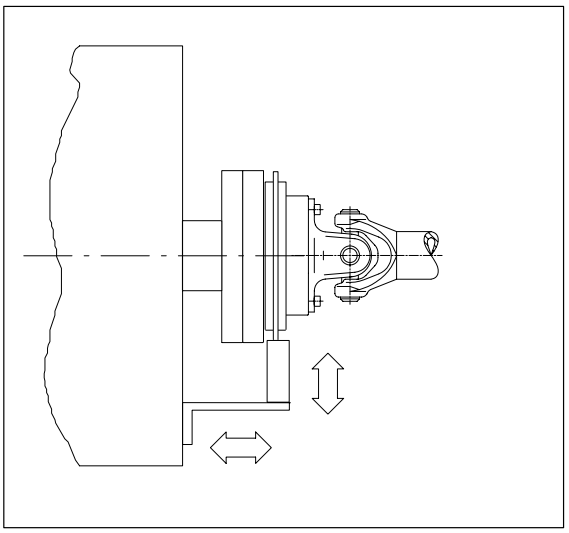
2. Install shaft run



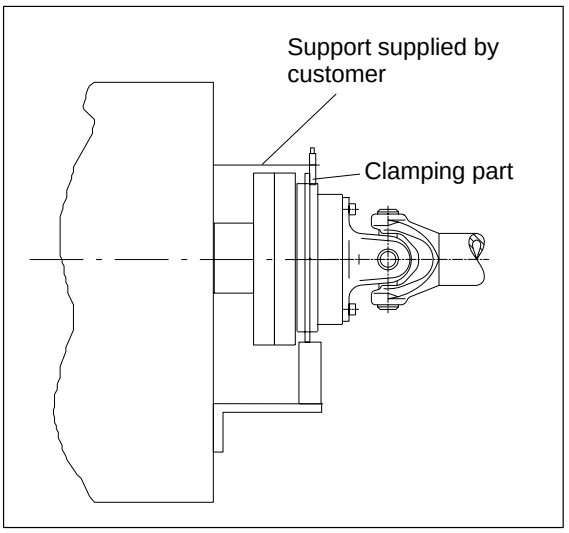
3. Remove one antenna segment



4. Install antenna segment around shaft run



5. Align stator and finish installation



6. Mount clamp. part where required

4.4 Preparation for fitting the rotor

CAUTION

The rotor is heavy (depending on the measuring range, 26 kg – 60 kg)! To lift it from its packaging and to fit it, use a crane or other suitable lifting devices.

Two lugs are bolted to the rotor to aid transportation and assembly. Hook the lifting harness into these lugs, as this is the only way to ensure that the rotor will be lifted horizontally from its packaging (see Fig. 4.1).

CAUTION

You must remove these transportation and assembly lugs once the rotor is fitted! Keep them somewhere you can find them.

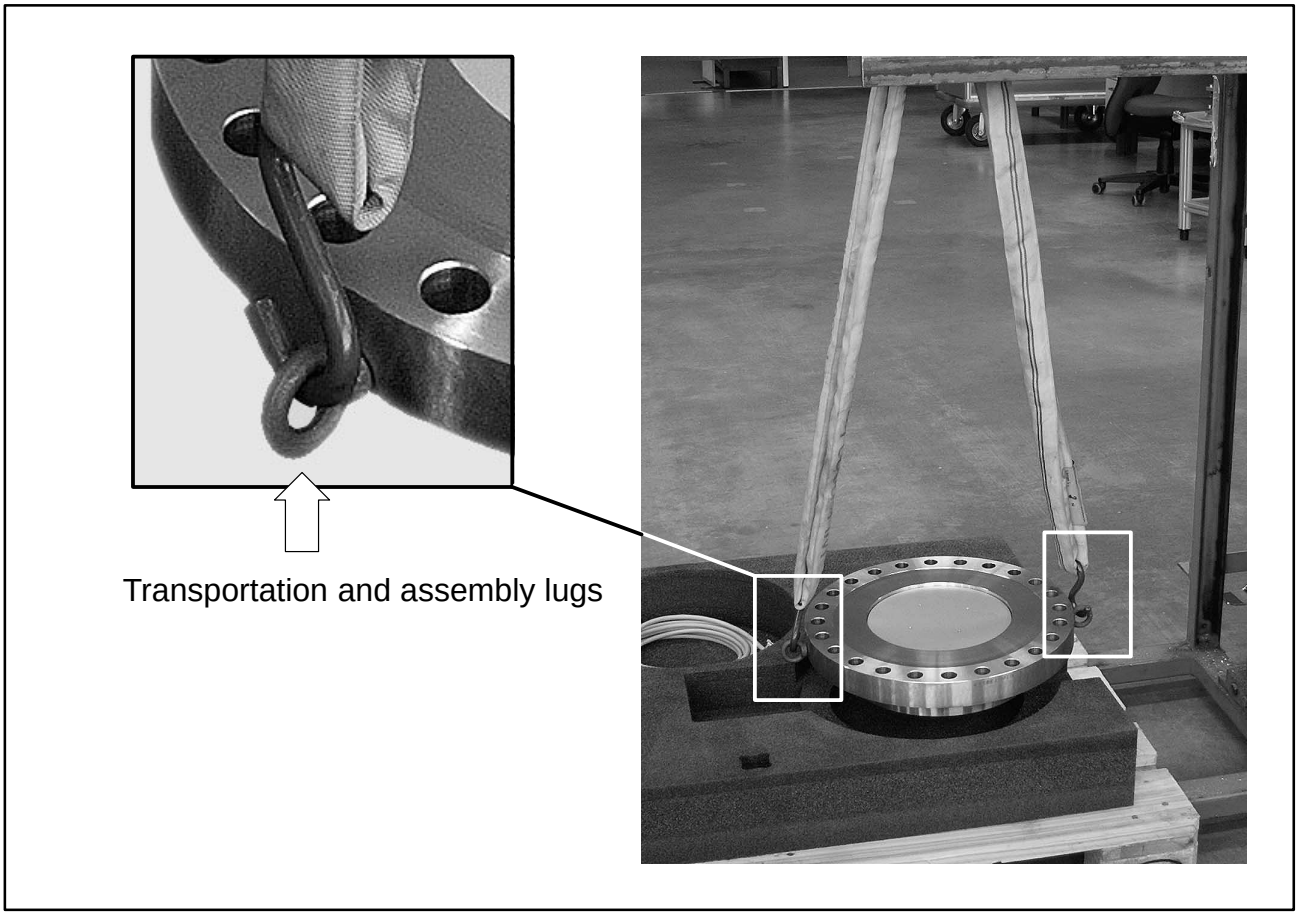


Fig. 4.1: Transportation and assembly lugs on the rotor

1. Lift the rotor from its packaging, turn it horizontally by 180 degrees so that flange B is pointing upwards (see Fig. 4.2).

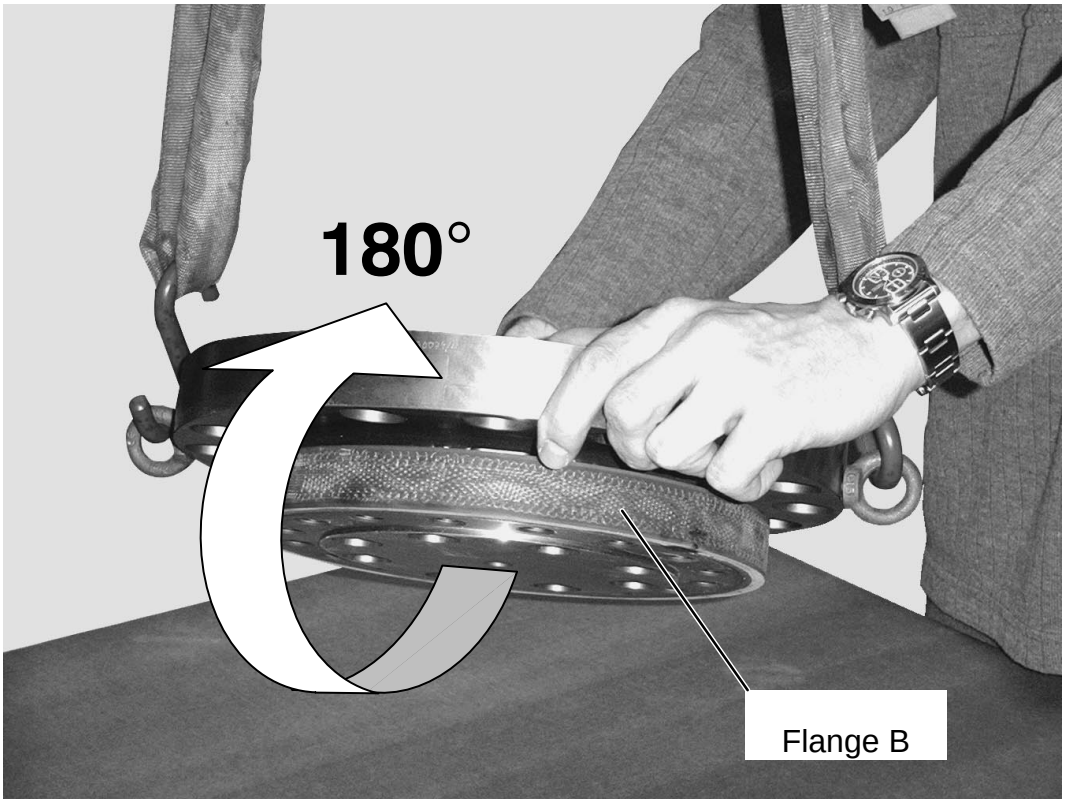


Fig. 4.2: Turning the rotor

2. Place the rotor carefully on a clean, stable table.
3. If the rotor is to be mounted horizontally (as in Fig. 4.3), remove one of the assembly lugs. If the rotor is to be mounted vertically, you need both the assembly lugs to fit it.
4. Clean the gaging flange's and counter flanges' plane surfaces. For safe torque transfer, the surfaces must be clean and free from grease. Use a piece of cloth or paper soaked with a solvent. Make sure that no solvent drips into the gaging flange's interior and that the transmitter coils do not suffer damage.
5. Attach the lifting harness to the assembly lug(s), lift the rotor carefully and move it to the assembly point (see Fig. 4.3).

Fig. 4.3: Rotor installation (horizontal)

4.5 Mounting the rotor

CAUTION

If the rotor is to operate perfectly, you must comply with the mounting dimensions (especially the air gap area, see Page 40).

Additional installation notes for the speed measuring system can be found in Chapter 4.8, Page 22.

NOTE

In general, the rotor identification plate is no longer visible after mounting. This is why we include with the rotor additional stickers with the important ratings, which you can attach to the stator or any other relevant test-bench components. You can then refer to them whenever there is anything you wish to know, such as the calibration signal.

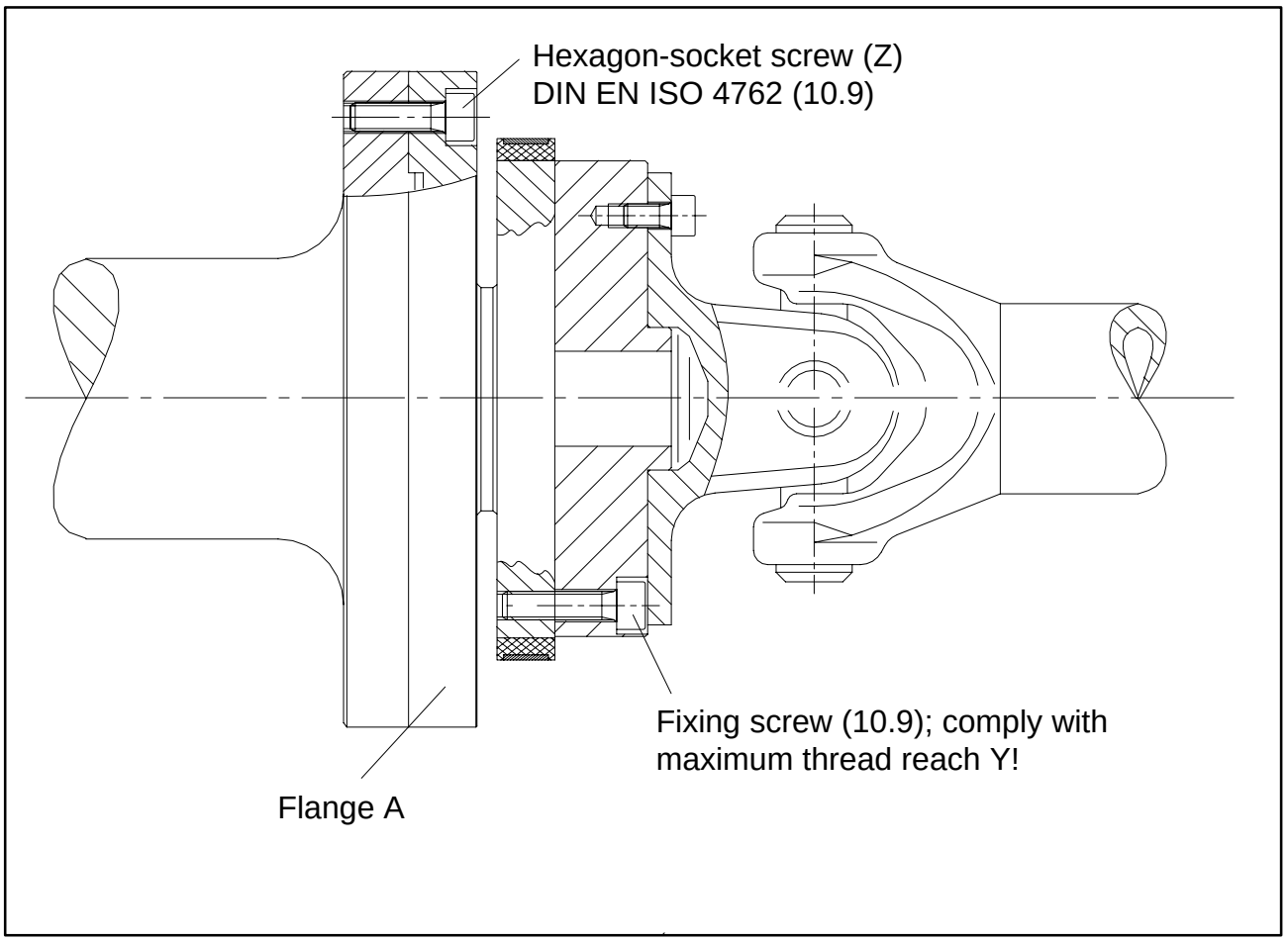


Fig. 4.4: Screwed joint of the rotor

1. Use **DIN EN ISO 4762 hexagon-socket screws, property class 10.9** of the appropriate length (depending on the connection geometry, see Table 4.1) to screw-fasten flange A.

   We recommend fillister-head screws DIN EN ISO 4762 or similar, blackened, smooth-headed, permitted size and shape variance in accordance with DIN ISO 4759, Part 1, product class A.

WARNING

With alternating load: Use a screw locking device (e.g. LOCTITE no. 242) to glue the screws into the counter thread to exclude a pretension loss due to screw slackening.

2. Fasten all screws with the specified torque (Table 4.1).
3. Now remove the transportation and assembly lug(s).
4. For further mounting of the shaft run, there are corresponding threaded bores on flange B. Also use screws of property class 10.9 and fasten with the 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.

It is essential to keep to the maximum thread reach as specified in Table 4.1 ! Otherwise torque shunt may cause extensive measurement errors or the transducer may be damaged.

Measuring range (N·m)	Fastening screws (Z)[1)]	Fastening screws Resistance class	Maximum thread reach (Y) of screws in flange B (mm)	Prescribed tightening torque (N·m)
15 20 25	M20 x 2.5	10.9	30	400
30 40 45	M20 x 2.5		40	560
50 60 70 80	M22 x 2.5		45	760

Table 4.1: Fastening screws

[1)]DIN EN ISO 4762; black/oiled/μ_{tot}=0.125

4.6 Installing the stator

On delivery, the stator has already been installed and is ready for operation. The antenna segments can be separated from the stator, for example, for maintenance or to facilitate stator mounting. To stop you modifying the center alignment of the segment rings opposite the base of the stator, we recommend that you separate only one antenna segment from the stator.

If your application does not require stator disassembly, proceed as described in sections 2., 6., 7. and 8.

Version with speed measuring system

As the speed sensor includes the slotted disc, it is not possible to move the stator axially over the pre-assembled rotor. In this case, you should also comply with Chapter 4.8.

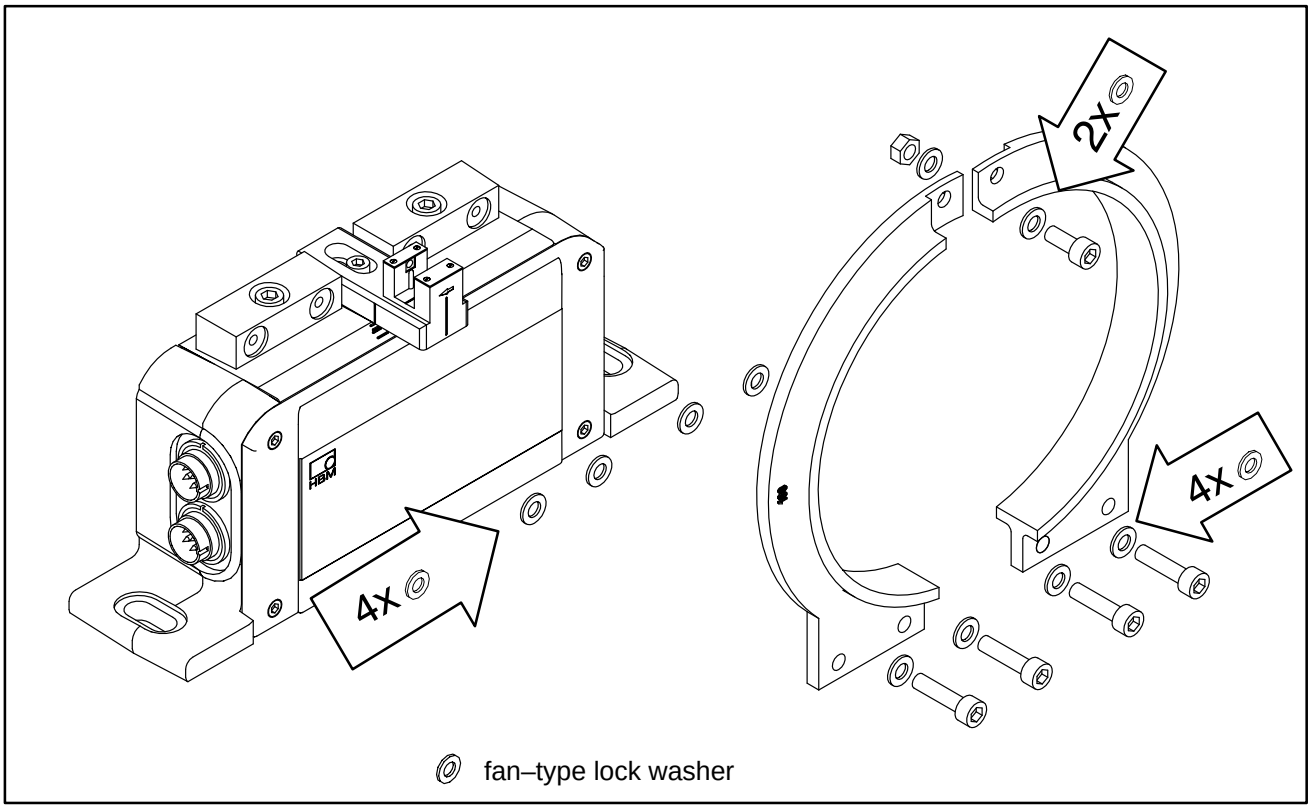
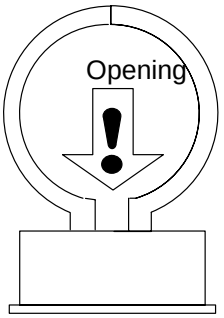


Fig. 4.5: Screwed joints of the antenna segments

1. Slacken and remove the screwed joints (M4) on one antenna segment. Make sure that the fan-type lock washers are not lost.
2. Use an appropriate foundation plate to install the stator housing in the shaft run such that there is sufficient possibility for horizontal and vertical adjustments. Do not yet fasten the screws.
3. Now mount the antenna segment removed under point 1. back on the stator with two hexagon-socket screws and the fan-type lock washers. Make sure that none of the fan-type lock washers necessary for a defined contact resistance are missing (see Fig. 4.5). Do not yet fasten the screws.
4. Install the two antenna segments' upper connection screw such that the antenna ring is closed. Also pay attention to the fan-type lock washers.
5. Now fasten all antenna-segment screw fastenings with a starting torque of 5 N·m.
6. Align antenna and rotor such that the antenna encloses the rotor coaxially. Please observe the permissible alignment tolerances specified in the specifications.

7. Fasten the stator-housing screwed joints.
8. Make sure that the opening in the lower antenna-segment section is free from electroconductive foreign substances.



CAUTION

To make sure that they function perfectly, the fan-type lock washers (A5,1–FST DIN 6798 ZN/galvanized) must be replaced after the screwed joint of the antenna has been detached three times.

4.7 Mounting the clamping part

Depending on the operating conditions, the antenna ring may be excited to vibrate. This effect is dependent on

- the speed,
- the antenna diameter (depends in turn on the measuring range),
- the construction of the machine foundations.

To avoid vibrations, a clamping part with an extension is enclosed with the torque flange enabling the antenna ring to be supported.

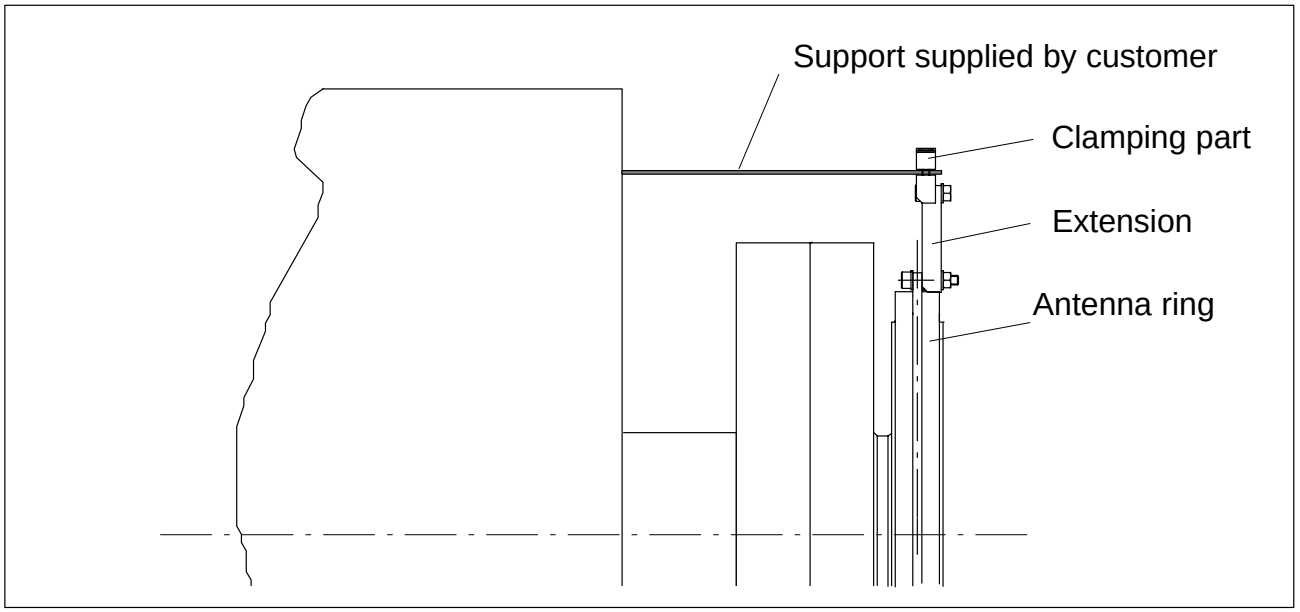


Fig. 4.6: Supporting the antenna ring

Assembly sequence

1. Loosen and remove the upper antenna segment screws.
2. Screw-fasten the clamping part to the extension as shown in Fig. 4.7.
3. Attach the clamping part and the extension to the antenna segment with the enclosed screwed joint in accordance with Fig. 4.7. It is essential to use the new fan-type locking washers.
4. Clamp a suitable supporting element (we recommend a threaded rod of ∅ 3 mm to 6 mm diameter) between the upper and lower parts of the clamping part and tighten the clamping screws.

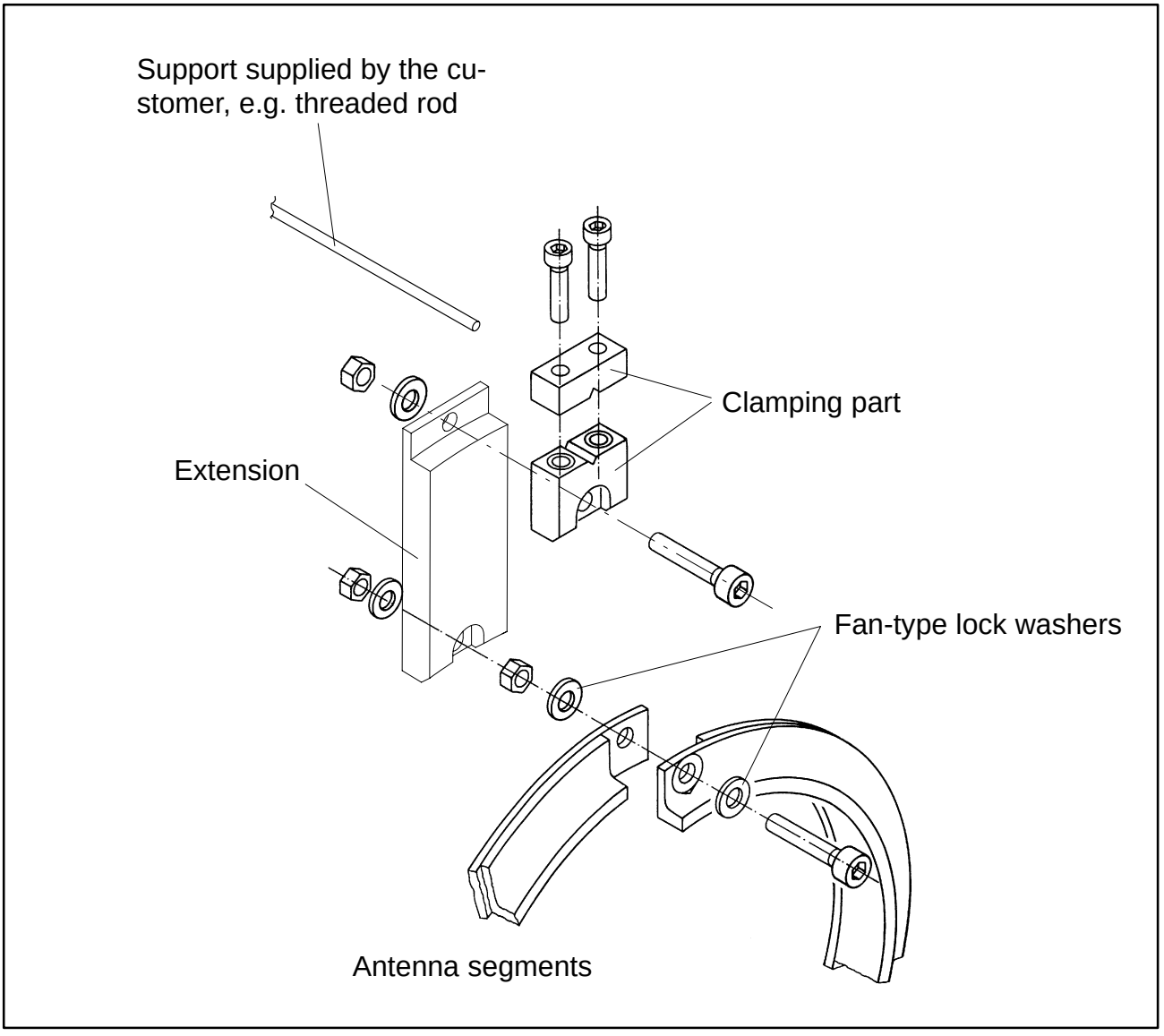


Fig. 4.7: Mounting of clamping part

4.8 Installing the slotted disc (speed measuring system)

In order to prevent the slotted disc of the speed measuring system being damaged during transportation, it is not fitted to the rotor. The customer must attach it to the intermediate flange before mounting the rotor in the shaft run. The intermediate flange and the associated rotation speed sensor have already been fitted at the factory.

The requisite screws, a suitable screwdriver and the screw locking device are included in the list of components supplied.

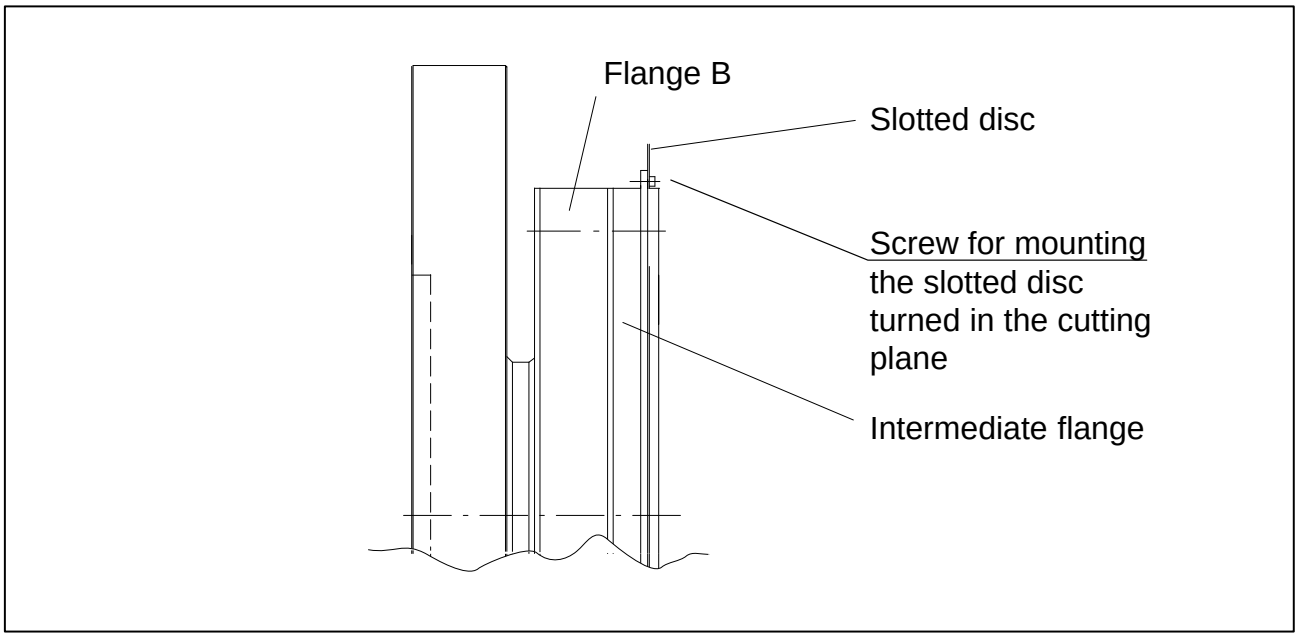


Fig. 4.8: Mounting the slotted disc

CAUTION

When carrying out installation work, be careful not to damage the slotted disc!

Assembly sequence

1. Push the slotted disc onto the additional flange and align the screw holes.
2. Apply some of the screw locking device to the screw thread and tighten the screws (tightening torque < 15 N·cm).

4.9 Aligning the stator (speed measuring system)

The stator can be mounted in any position (for example, ”upside down” installation is possible).

For measuring mode to operate perfectly, the slotted disc of the speed measuring system must rotate at a defined position in the optical sensor.

Axial alignment

There is a marker in the optical sensor for axial alignment (orientation line). When installed, the slotted disc should be exactly above this orientation line. Deviations of up to ±2 mm are permissible in measuring mode (total of static and dynamic shift).

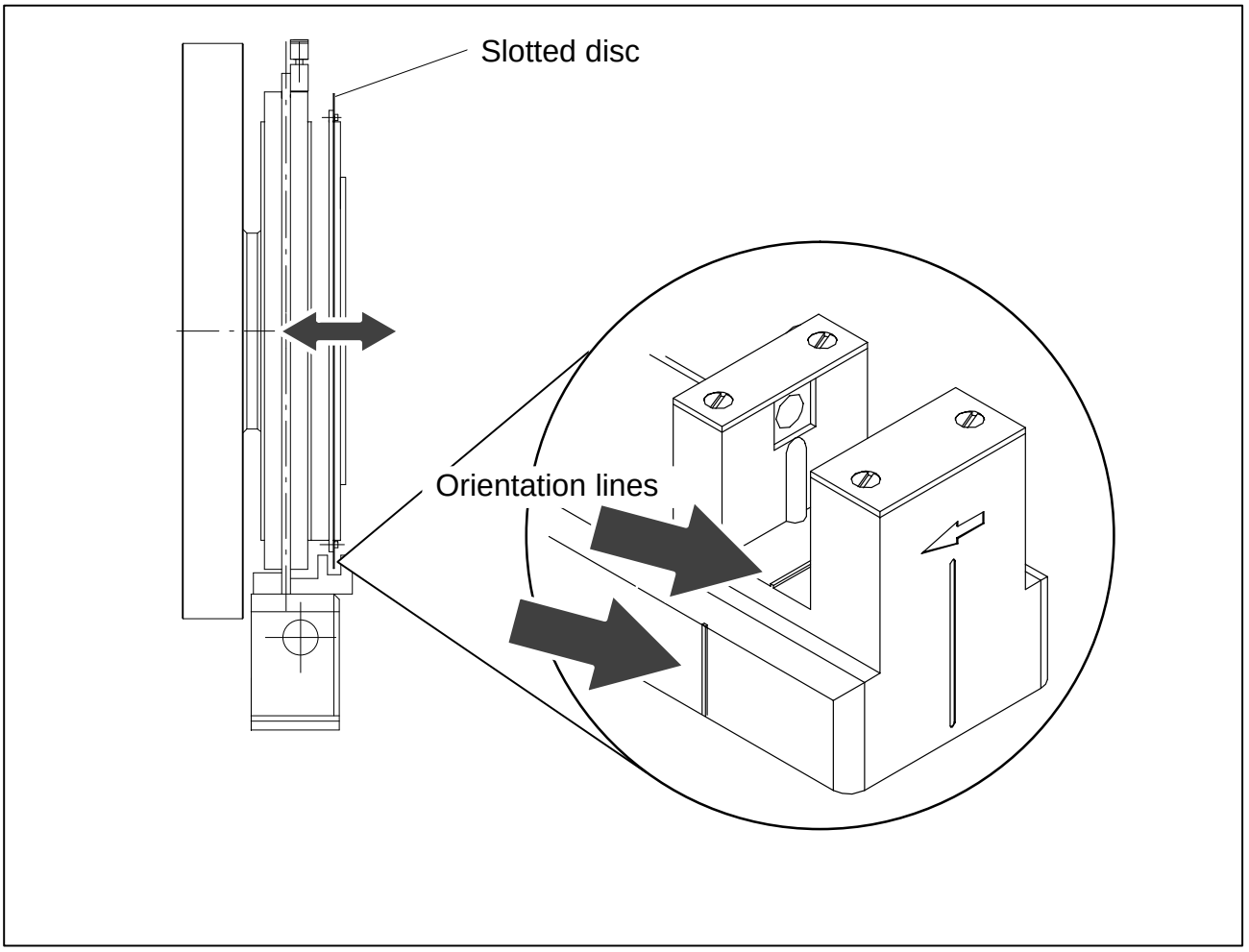


Fig. 4.9: Position of the slotted disc in the speed sensor

NOTE

To attach the stator, we recommend the use of M6 screws with plain washers (width of oblong hole, 9 mm). This size of screw guarantees the necessary travel for alignment.

Radial alignment

The rotor axis and optical axis of the speed sensor must be along a line at right angles to the stator platform. A conical turn (or colored marker) at the central point of flange B and a vertical marker line on the sensor head serve as orientation aids.

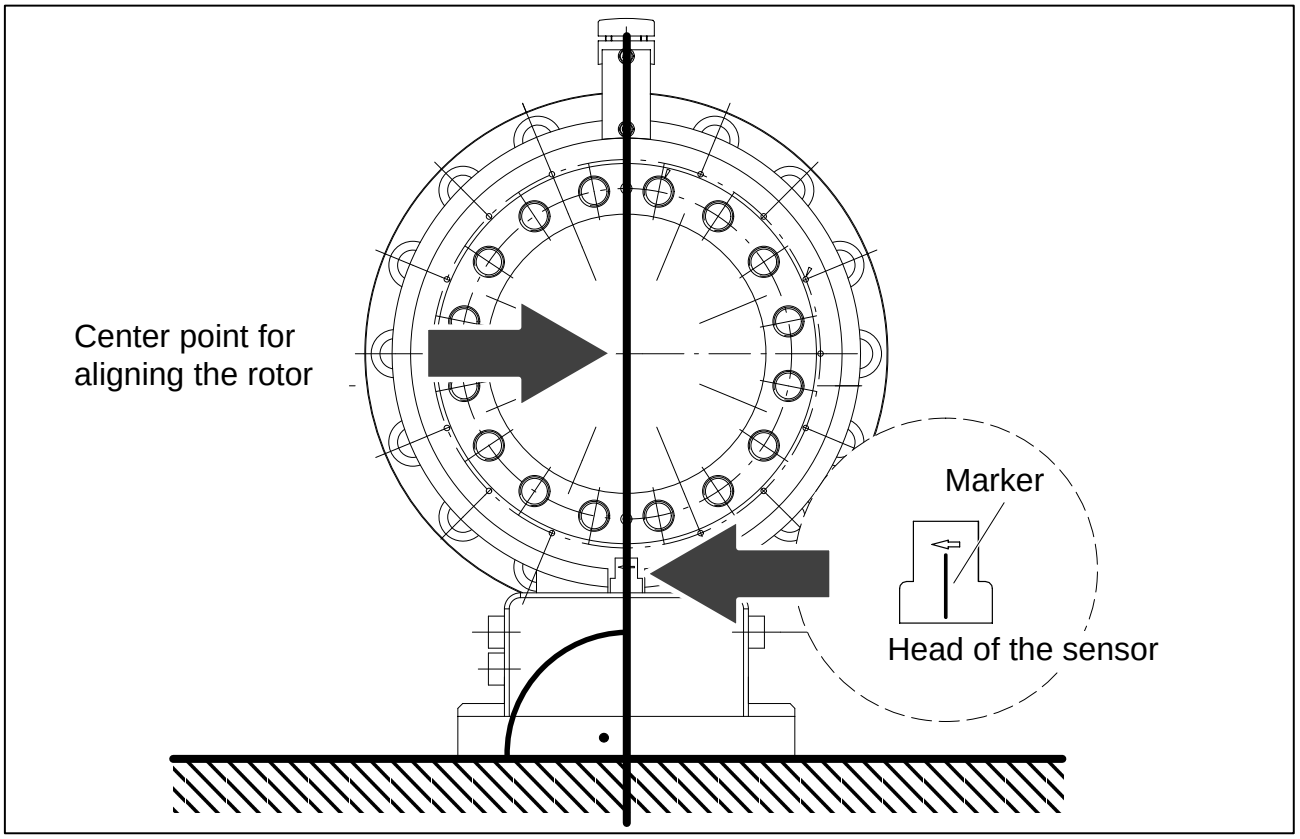


Fig. 4.10: Orientation markers on the rotor/stator

5 Electrical connection

CAUTION

Transducer connection cables from HBM with attached connectors are identified in accordance with their intended purpose (Md or n). When cables are shortened, inserted into cable ducts or installed in control cabinets, this identification can get lost or become concealed. If this is the case, it is essential for the cables to be re-labelled!

5.1 Shielding design

The cable shielding is connected in accordance with the Greenline concept. This encloses the measurement system (without a rotor) 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. Special electronic coding methods are used to protect the transmission path and the rotor from electromagnetic interferences.

In the case of interferences due to potential differences (compensating currents), operating-voltage zero and housing ground must be disconnected on the amplifier and a potential equalization line established between stator housing and amplifier housing (copper conductor, 10 mm^2 wire cross-section).

If potential differences arise between the rotor and the stator on the machine, perhaps due to unchecked leakage, and this causes interference, it can usually be overcome by connecting the rotor directly to earth, for instance by a wire loop. The stator should be fully earthed in the same way.

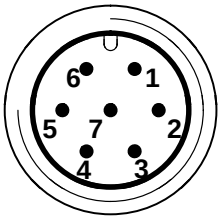
5.2 Connector pin assignment

On the stator housing, there are two 7-pin male device connectors (Binder 723) and in the case of the speed module option, there is also an 8-pin male device connector, assigned in accordance with the selected option.

The supply voltage and the calibration signal of plugs 1 and 3 are direct-coupled via multifuses (automatically resetting fuses).

Assignment for plug 1:

Voltage supply and frequency output signal.

	Plug Binder Pin	Pin assignment	Wire color	Sub-D connector Pin
Binder 723  **Top view**	1	Measurement signal torque (frequency output; 5 V[1]; ⏚ /0 V)	WH	13
	2	Supply voltage 0 V; ⏚	BK	5
	3	Supply voltage 18 V – 30 V	BU	6
	4	Measurement signal torque (frequency output; 5 V[1]/12 V)	RD	12
	5	Measurement signal 0V; ⏚ symmetrical	GY	8
	6	Calibration signal (external trigger 5 V – 30 V	GN	14
	7	Calibration signal 0 V; ⏚	GY	8
		Shielding connected to enclosure ground		

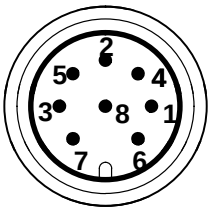
[1] Factory settings; RS422 complementary signals

CAUTION

The torque flanges are only intended for operation with a DC supply voltage. They must not be connected to older HBM measuring amplifiers with square-wave excitation. This could lead to the destruction of the connection board resistances, or other errors in the measuring amplifiers (the torque flange, on the other hand, is protected and once the proper connections have been re-established, is ready for operation again).

Assignment for plug 2:

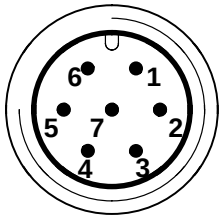
Speed measuring system.

	Plug Binder Pin	Pin assignment	Wire color	Sub-D Plug Pin
Binder 723  **Top view**	1	Rotation speed measurement signal (pulse string, 5 V[1]; 0°)	RD	12
	2	No function		
	3	Rotation speed measurement signal (pulse string, 5 V[1]; 90° out-of-phase)[2]	GY	15
	4	No function		
	5	No function		
	6	Rotation speed measurement signal (pulse string, 5 V[1]; 0°)	WH	13
	7	Rotation speed measurement signal (pulse string, 5 V[1]; 90° out-of-phase[2]	GN	14
	8	Zero operating voltage	BK	8
		Shielding connected to enclosure ground		

[1] Complementary signals RS-422
[2] When switching to double frequency, static direction of rotation signal.

Assignment for plug 3:

Voltage supply and voltage output signal.

	Plug Binder Pin	Pin assignment
Binder 723  **Top view**	1	Measurement signal torque (voltage output; 0 V)
	2	Supply voltage 0 V;
	3	Supply voltage 18 V to 30 V DC
	4	Measurement signal torque (voltage output, ±10 V)
	5	No function
	6	Calibration signal (external trigger 5 V – 30 V
	7	Calibration signal 0 V;
		Shielding connected to enclosure ground

5.3 Supply voltage

The transducer is designed for operation at direct voltage (18 – 30 volts). The circuitry is intended for operation with a separated extra-low voltage (SELV) (SELV circuit). It is **not** intended for connection to a d.c. network according to EN 61010–1.

5.3.1 Supply voltage for standalone operation

The notes in this chapter relate to the standalone operation of the T10FM without HBM system solutions.

The supply voltage is electrically isolated from signal outputs and calibration signal inputs. Connect a separated extra-low voltage of 18 V – 30 V to pin 3 (+) and pin 2 (⏥) of plug 1 or 3. We recommend that you use HBM cable KAB 8/00–2/2/2 and relevant Binder sockets, that at nominal (rated) voltage (24 V) can be up to 50 m long and in the nominal (rated) voltage range, 20 m long (see Accessories, Page 41). If the permissible cable length is exceeded, you can supply the voltage in parallel over two connection cables (plug 1 and 3). This enables you to double the permissible length. Alternatively an on-site power pack should be installed.

If you feed the supply voltage through an unshielded cable, the cable must be twisted (interference suppression). We also recommend that a ferrite element should be located close to the connector on the cable, and the stator should be earthed.

CAUTION

At the instant of switching on, a current of up to 2 A may flow and this may switch off power packs with electronic current limiters.

6 Calibration signal

T10FM torque flanges deliver an electrical calibration signal that can be switched at the amplifier end for measurement chains with HBM components. The gaging flange generates a calibration signal of about 50 % of the nominal (rated) torque. The precise value is specified on the identification plate. Adjust the amplifier output signal to the calibration signal supplied by the connected torque flange to adapt the amplifier to the gaging flange.

NOTE

The gaging flange should not be under load when the calibration signal is being measured, since the calibration signal is mixed additively.

CAUTION

To maintain measurement accuracy, the calibration signal should be connected for no more than 5 minutes. A similar period is then needed as a cooling phase before triggering the calibration signal again.

Applying a 5 V separated extra-low voltage to pins 6 (+) and 7(⏚) on plug 1 or 3, triggers the calibration signal.

The nominal (rated) voltage for triggering the calibration signal is 5 V (triggered when U>2.7 V). The trigger voltage is galvanically isolated from the supply voltage and the measurement voltage. The maximum permissible voltage is 30 V.At voltages lower than 0.7 V, the gaging flange is in measuring mode. Current consumption at nominal (rated) voltage is approx. 2 mA and at maximum voltage is approx. 22 mA.

NOTE

In the case of HBM system solutions, the measuring amplifier triggers the calibration signal.

7 Settings

NOTE

You will find a table containing all the relevant switch positions on the back of the stator cover. Changes to the factory settings should be noted here using a waterproof felt-tip pen.

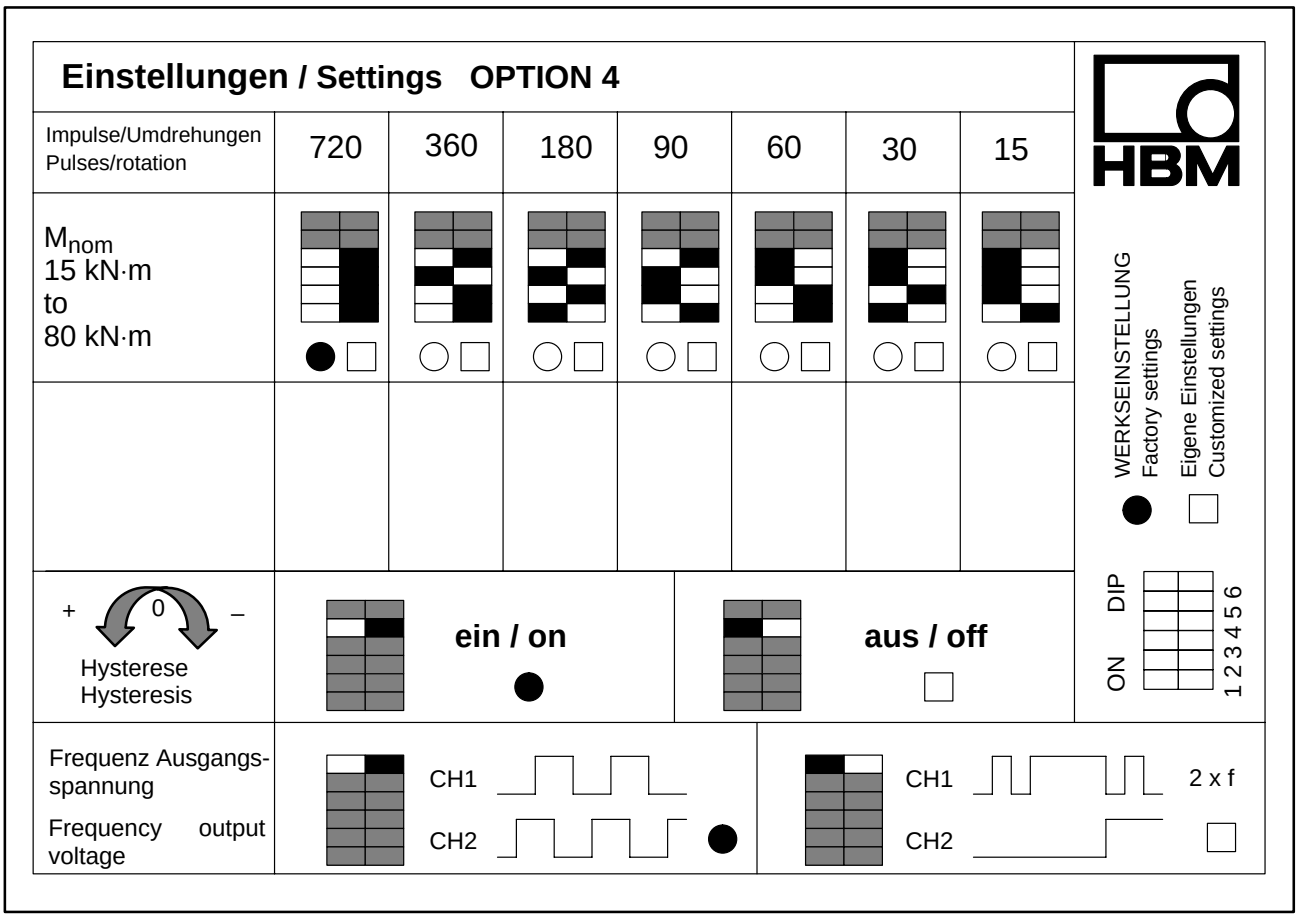


Fig. 7.1: Sticker with the switch positions

7.1 Torque output signal

The factory setting for the frequency output voltage is 5V (symmetrical, complementary RS422 signals). The frequency signal is on pin 4 opposite pin 1. You can change the output voltage to 12V (asymmetrical). To do this, change switches S1 and S2 to position1 (and pin 1 → M).

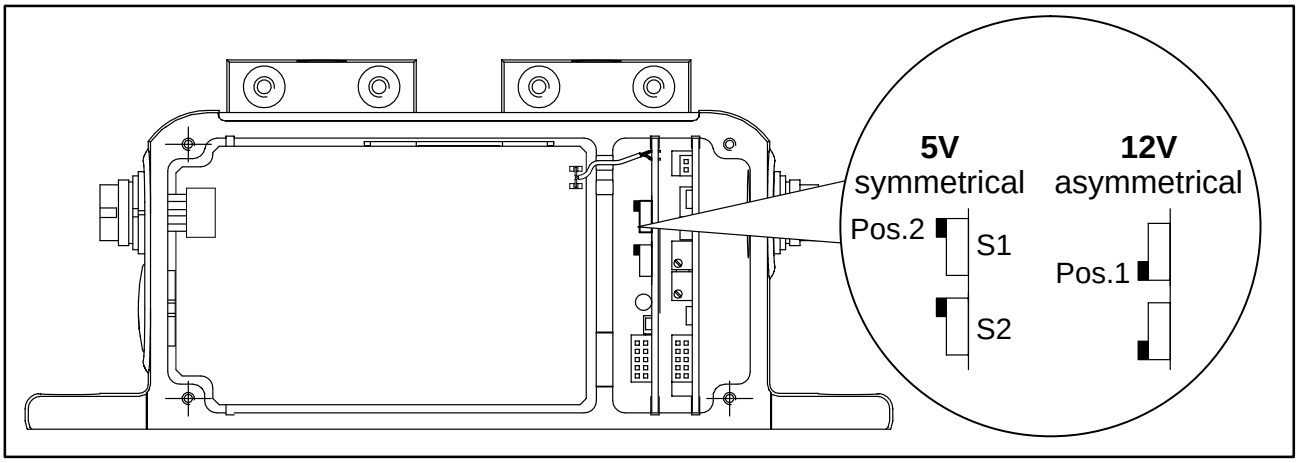


Fig. 7.2: Switch for changing the frequency output voltage

7.2 Setting up the zero point

In the stator, you can access two potentiometers once the stator cover is removed. You can use the zero point potentiometer to correct certain zero point deviations. The balancing range is a minimum of ±400 mV at nominal (rated) gain. The end point potentiometer is used for compensation at the factory and is capped with varnish so that it cannot be turned unintentionally.

CAUTION

Turning the end point potentiometer changes the factory calibration of the voltage output.

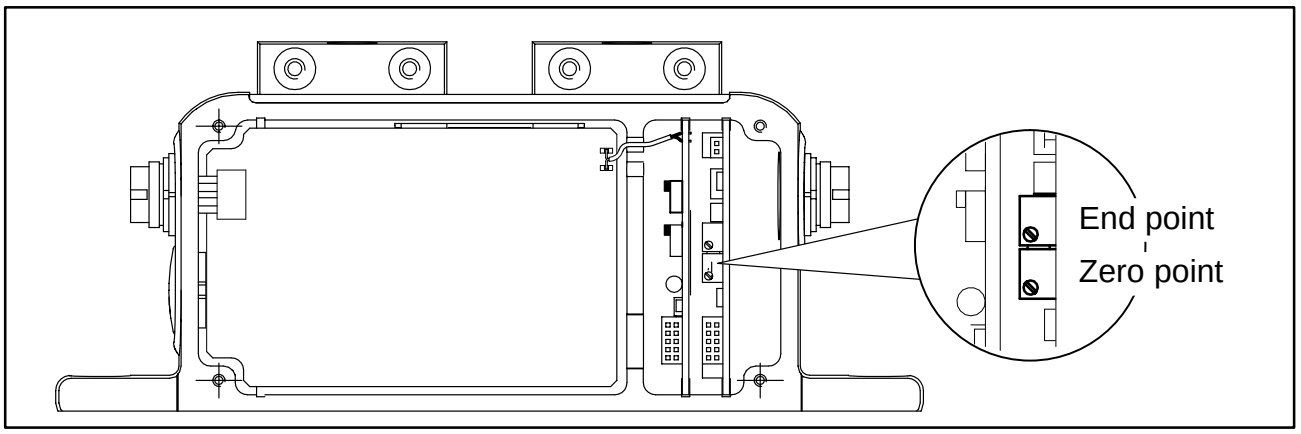


Fig. 7.3: Setting up the voltage output zero point

7.3 Functional testing

7.3.1 Power transmission

If you suspect that the transmission system is not working properly, you can remove the stator cover and test for correct functioning. If the LED is on, the rotor and stator are properly aligned and there is no interference with the transmission of measuring signals. When the calibration signal is triggered, the LED shines more brightly.

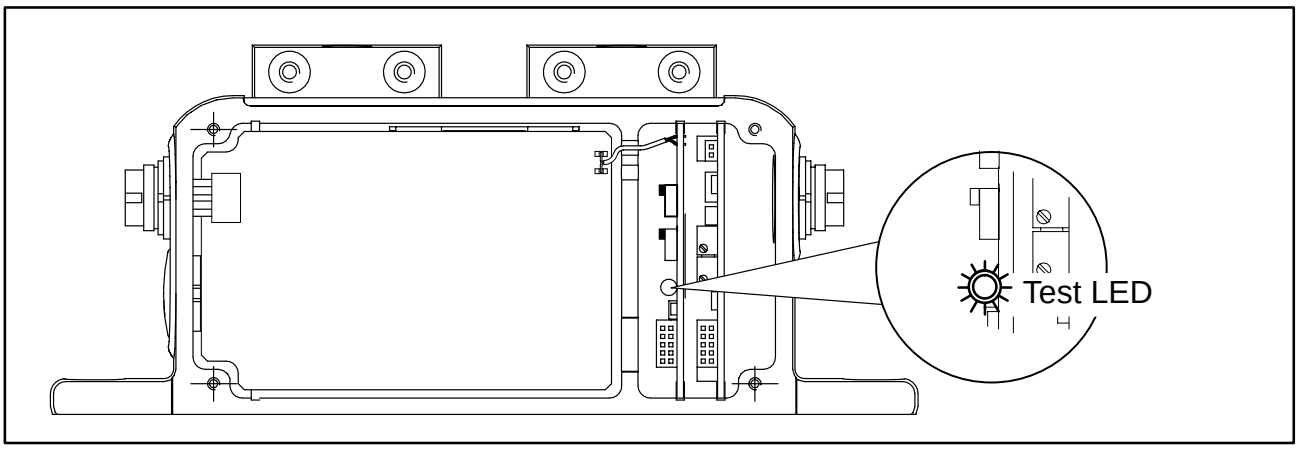


Fig. 7.4: Functional test for power transmission

7.3.2 Alignment of the speed module

When required, you can test the correct functioning of the speed measuring system.

1. Remove the cover of the stator housing.
2. Turn the rotor by at least 2 min^{-1} (=rpm (revs per minute)).

If both the control LEDs come on while you are turning the rotor, the speed measuring system is properly aligned and fully operational.

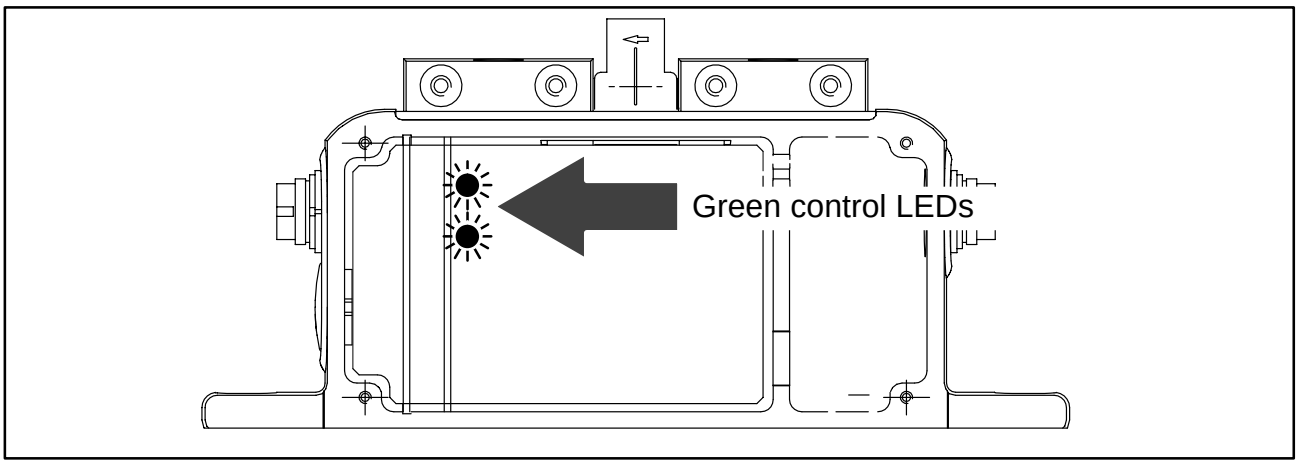


Fig. 7.5: Control LEDs of the speed measuring system

CAUTION

When closing the cover of the stator housing, make sure that the internal connector cables are positioned in the grooves provided and are not caught up.

7.4 Setting the pulse count

In the case of the speed module option, the number of pulses per revolution of the rotor can be adjusted by using DIP switches S1...S4.

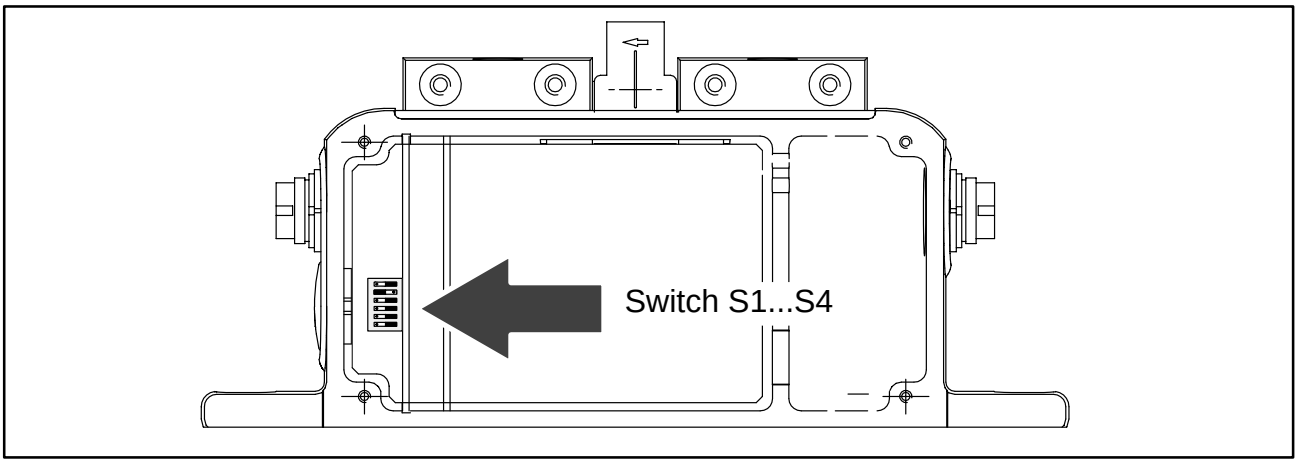


Fig. 7.6: Switches for setting the pulse count

Setting the pulse count

1. Remove the stator cover.
2. Use switches S1...S4 in accordance with Table 7.1 to set the required pulse count.

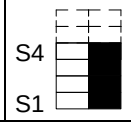
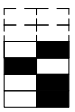
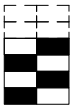
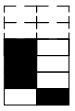
Pulses/revolution	720[1)]	360	180	90	60	30	15
							

Table 7.1: Switch position for the pulse count (■ ≙ switch lever)

[1)] Factory settings

7.5 Vibration suppression (hysteresis)

Low rotation speeds and higher relative vibrations between the rotor and the stator can cause disturbance signals that reverse the direction of rotation. Electronic suppression (hysteresis) to eliminate these disturbances is connected at the factory. Disturbances caused by radial stator vibration amplitudes of approx. 2 mm are thus suppressed.

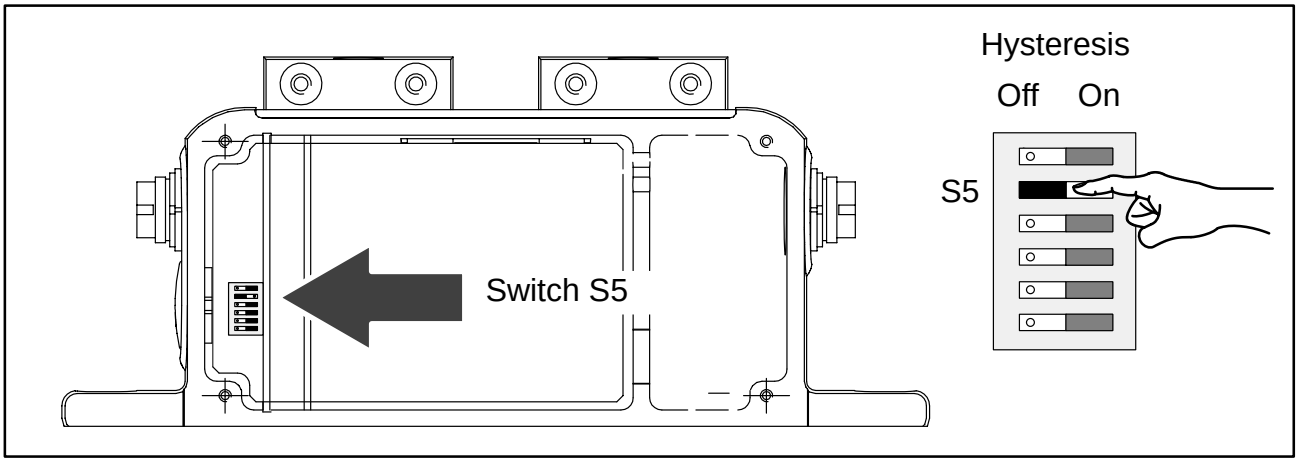


Fig. 7.7: Switch for switching off hysteresis

7.6 Shape of the rotation speed output signal

In the factory settings, two 90° phase-offset speed signals (5 V symmetrical, complementary RS422 signals) are available. You can double the pulse count set in each case by moving switch S6 to the ”On” position. Pin 3 then outputs the direction of rotation as a static direction of rotation signal (pin 3=+5 V, pin 7=0 V opposite pin 8), if the shaft turns in the direction of the arrow. At a rotation speed of 0 min^{-1} (=rpm (revs per minute)), the direction of rotation signal has the last measured value.

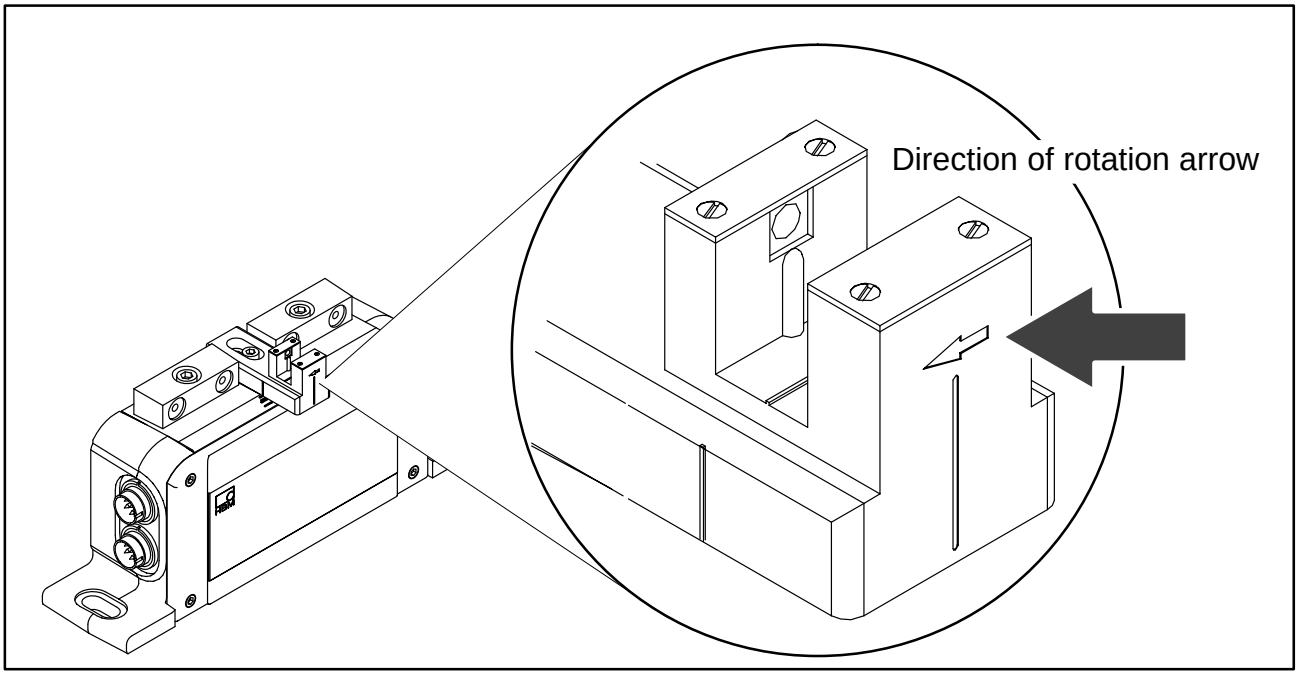


Fig. 7.8: Direction of rotation arrow on the head of the sensor

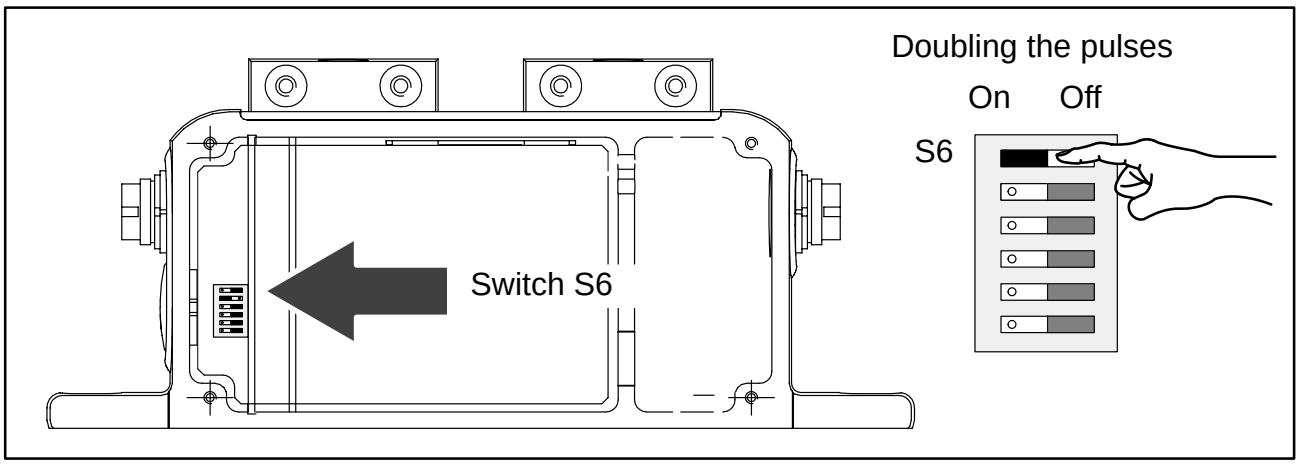


Fig. 7.9: Switch for doubling the pulses

7.7 Type of rotation speed output signal

You can use switch S7 to change the symmetrical 5 V output signal (factory setting) to an asymmetrical signal of 0 V ... 5 V.

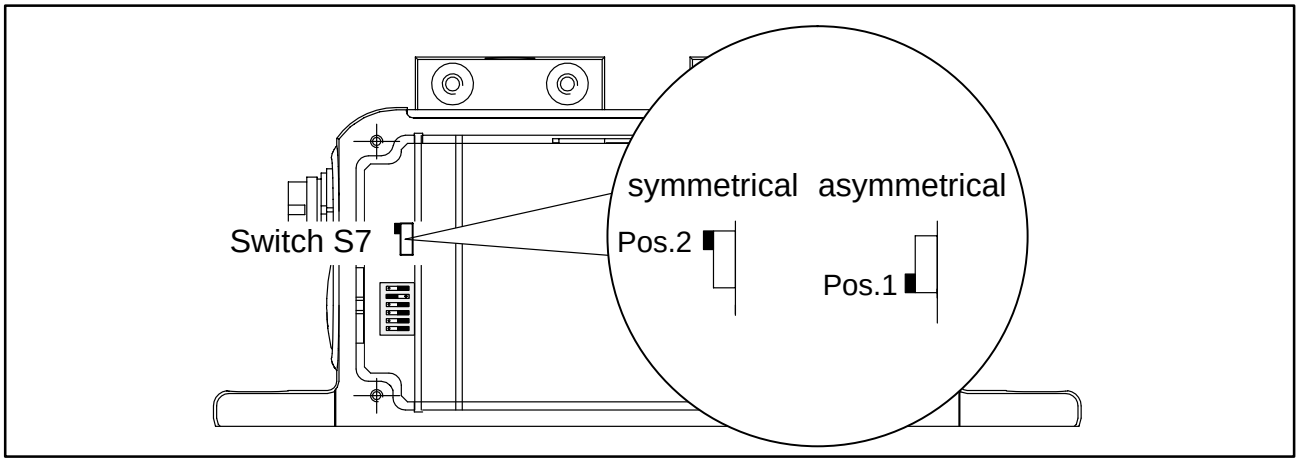


Fig. 7.10: Switch S7; symmetrical/asymmetrical output signal

8 Loading capacity

Nominal (rated) torque can be exceeded statically up to the limit torque. If nominal (rated) 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 42.

8.1 Measuring dynamic torque

The torque flanges can be used to measure static and dynamic torques. The following applies to the measurement of dynamic torque:

- The T10FM calibration made for static measurements is also valid for dynamic torque measurements.
- 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 T10FM's torsional stiffness.

Use the equation below 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 kg·m^2
c_T = Torsional stiffness in N·m/rad

- Depending on the measuring range, the vibration bandwidth is 25, 45 and 80 kN·m (see Specifications, Page 46), even at alternating load. The vibration bandwidth must fall within the loading range defined by the upper and lower maximum torque. The same also applies to transient resonance points.

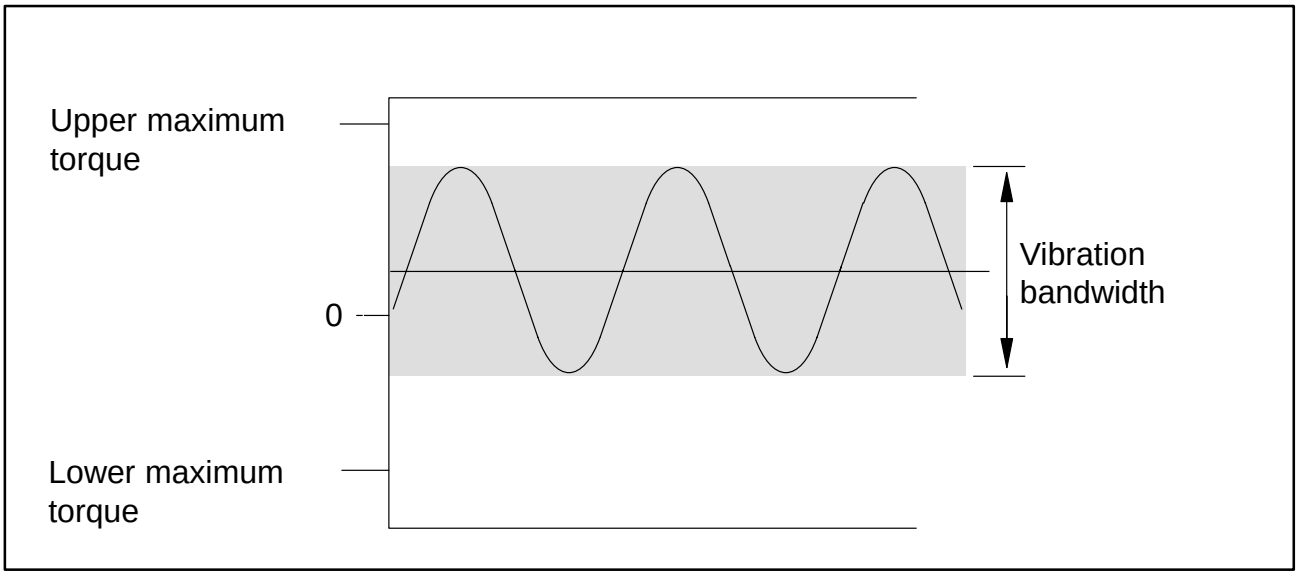


Fig. 8.1: Permissible dynamic loading

9 Maintenance

Torque flanges are maintenance free.

9.1 Speed module maintenance

During operation and depending on the ambient conditions, the slotted disc of the rotor and the associated stator sensor optics can get dirty. This will become noticeable when the polarity of the display changes. Should this occur, the sensor and the slotted disc must be cleaned.

1. Use compressed air (up to 6 bar) to clean the slotted disc.
2. Carefully clean the sensor optics with a dry cotton bud or one which has been soaked in spirit. **Do not use any other solvent!**

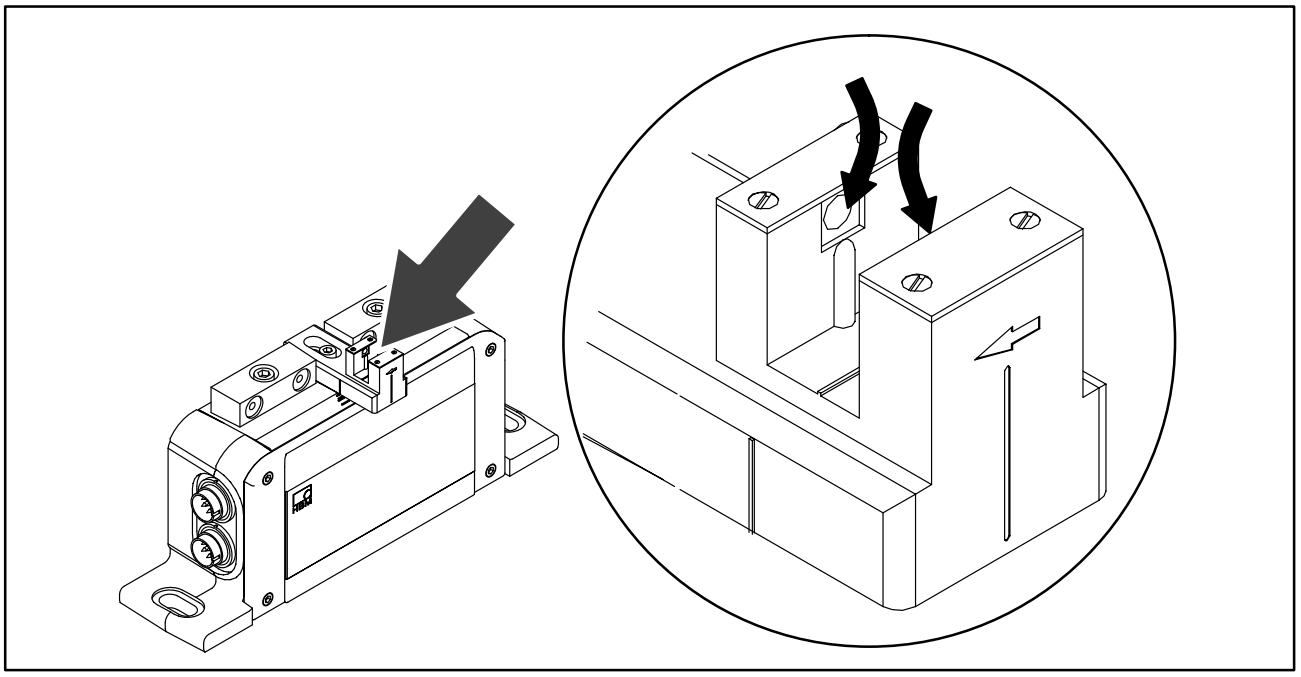
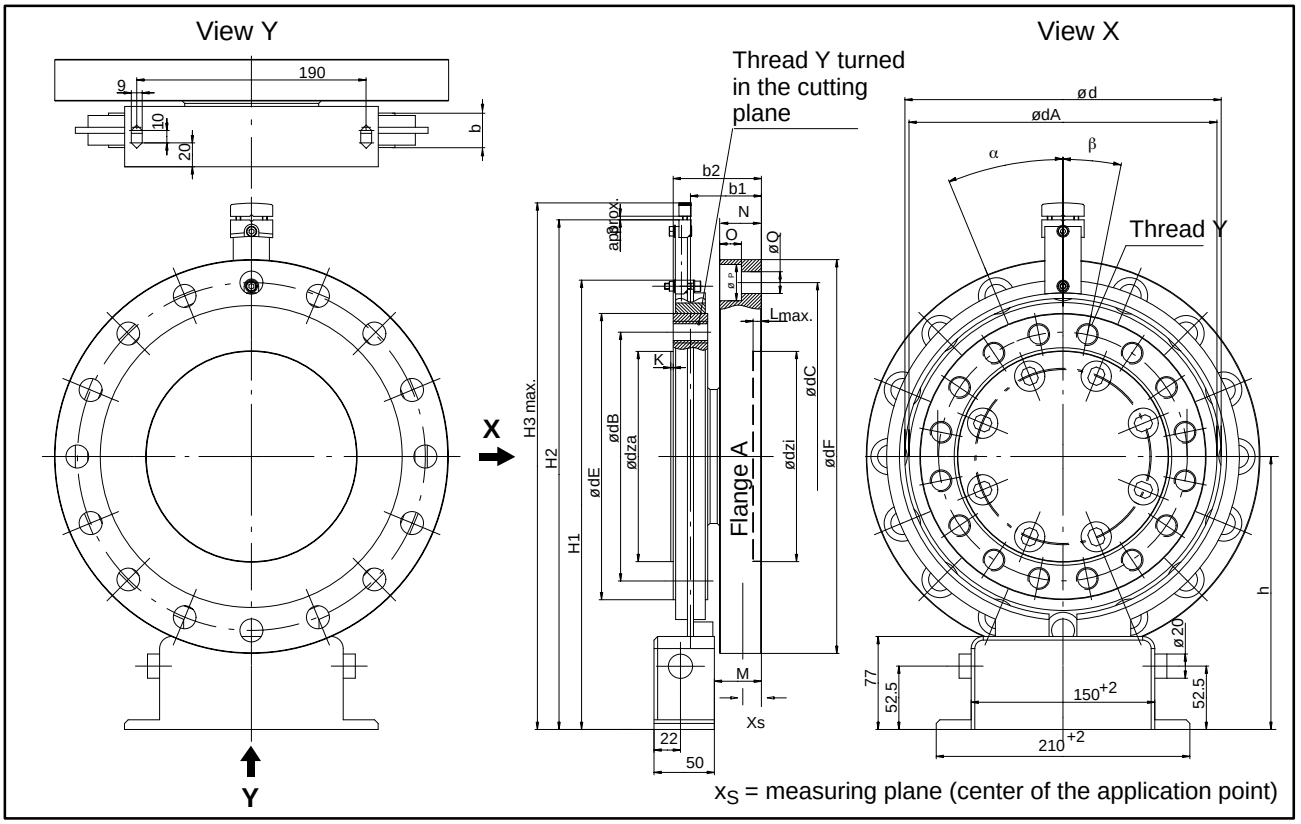


Fig. 9.1: Cleaning points on the speed sensor

10 Dimensions

10.1 Dimensions without the speed measuring system

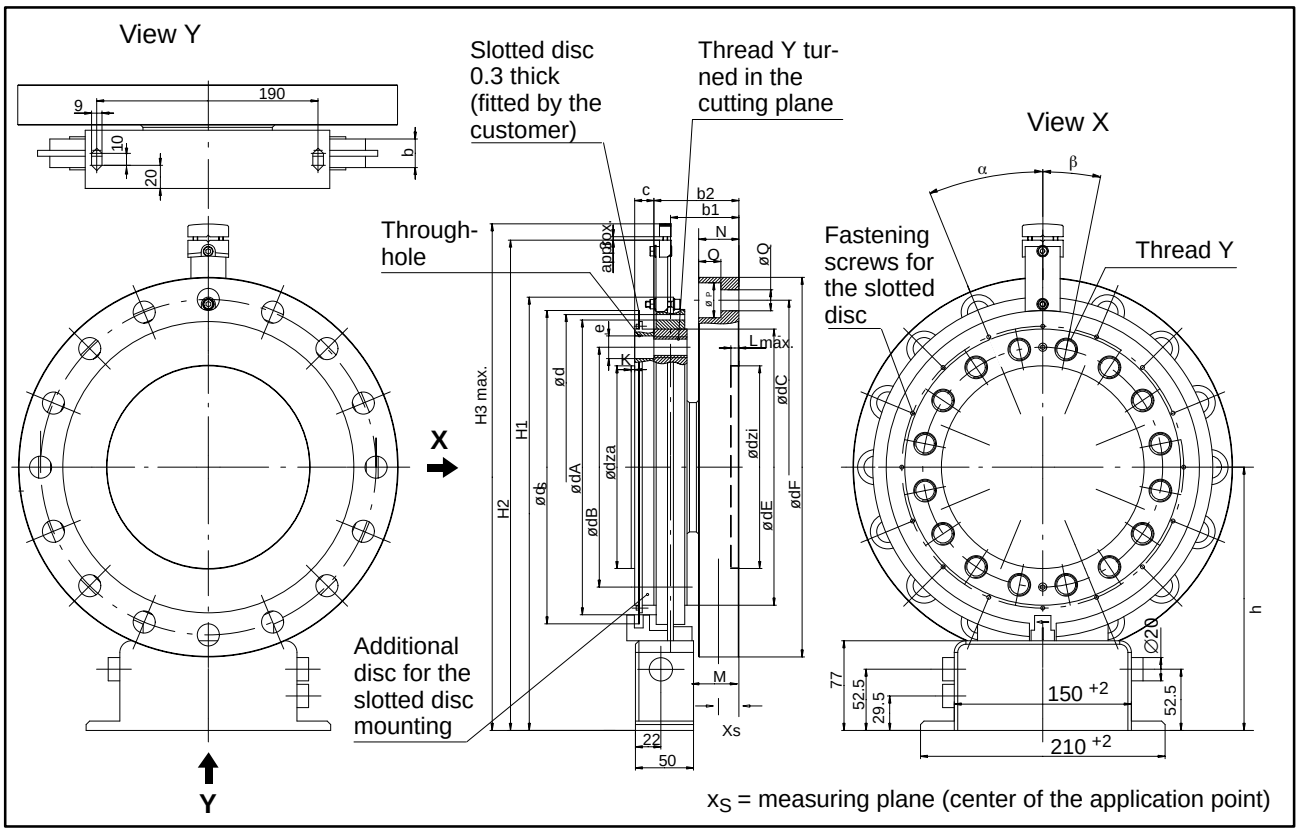


x_S = measuring plane (center of the application point)

Measuring range (kN·m)	Dimensions (in mm)														
	h	H1	H2	H3	b	b1	b2	Ød	ØdA	ØdB	ØdC	ØdE	Ø∂F	Ødza	K
15 20 25	226.5	373	423	437	28.5	59	73	262	256	206	288	237.15	326	174_{g5}	3
30 40 45	248	416	466	480	35	69	85	305	299	250	350	280.15	390	210_{g5}	4
50 60 70 80	263	446	495	509	40	74	95	335	329	275	385	310.15	425	240_{g5}	4

Measuring range (kN·m)	Dimensions (in mm)										
	Ødzi	L_{max}	M	N	O	P	Q	x_S	α	β	Y
15 20 25	174^{H6}	4	38	34.5	19.5	30	19	24	22.5° 16x22.5°=360°	11.25° 16x22.5°=360°	M18
30 40 45	210^{H6}	4	44	40	21.5	33	21	26	15° 24x15°=360°	15° 24x15°=360°	M20
50 60 70 80	240^{H6}	4	49	45	23.5	36	23	29	15° 24x15°=360°	15° 24x15°=360°	M22

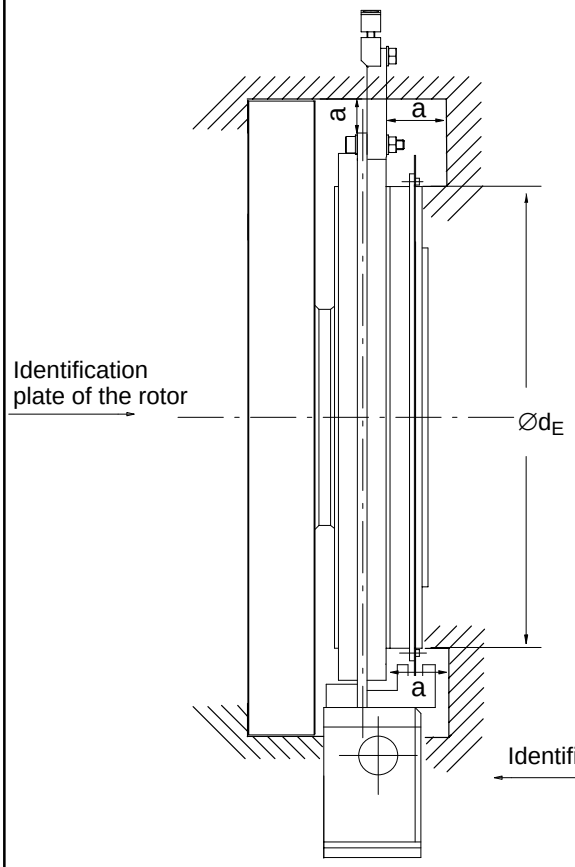
10.2 Dimensions with the speed measuring system



Measuring range (kN·m)	Dimensions (in mm)																
	h	H1	H2	H3	b	b1	b2	Ød	ØdA	ØdB	ØdC	ØdE	Ø∂F	Ødza	K	Ødzi	L_{max}
15 20 25	226.5	373	423	437	28.5	59	73	262	256	206	288	237.15	326	174_{g5}	3	174^{H6}	4
30 40 45	248	416	466	480	35	69	85	305	299	250	350	280.15	390	210_{g5}	4	210^{H6}	4
50 60 70 80	263	446	495	509	40	74	95	335	329	275	385	310.15	425	240_{g5}	4	240^{H6}	4

Measuring range (kN·m)	Dimensions (in mm)											
	$Ød_S$	c	e	M	N	O	P	Q	x_S	α	β	Y
15 20 25	269	16.5	19.5	38	34.5	19.5	30	19	19	22.5° 16x22.5°=360°	11.25° 16x22.5°=360°	M18
30 40 45	312	14.5	21.5	44	40	21.5	33	21	21	15° 24x15°=360°	15° 24x15°=360°	M20
50 60 70 80	342	9.5	23.5	49	45	23.5	36	23	23	15° 24x15°=360°	15° 24x15°=360°	M22

10.3 Mounting dimensions



Mounting dimensions	
Measuring range(kN·m)	**Area free of metal parts*) "a" (mm)**
15 20 25	20
30 40 45	
50 60 70 80	

*) You can use a metal rod in the recommended dimensions for support

11 Order Numbers, accessories

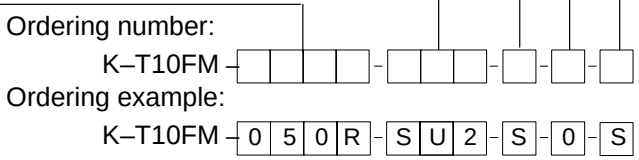
Code	Option 1: Measuring range
015R	15 kN·m
020R	20 kN·m
025R	25 kN·m
030R	30 kN·m
040R	40 kN·m
045R	45 kN·m
050R	50 kN·m
060R	60 kN·m
070R	70 kN·m
080R	80 kN·m

Code	Option 4: Speed measuring system
0	Without speed measuring system
1	With speed measuring system

Code	Option 5: Customised modification
S	None

Code	Option 2: Electrical configuration
SU2	Output signal 10 kHz ± 5 kHz and ± 10 V, Supply voltage 18...30 V DC

Code	Option 3: Accuracy
S	Standard



Accessories, to be ordered separately

1–KAB149–6, torque connection cable, 423–D–Sub 15P, 6 m

1–KAB150–6, rotation speed connection cable, 423–D–Sub 15P, 6 m

1–KAB153–6, torque connection cable, 423 unterminated, 6 m

1–KAB154–6, rotation speed connection cable, 423 unterminated, 6 m

Cable socket 423G–7S, 7–pin, straight cable entry, for torque output (plugs 1, 3), Order No. 3–3101.0247

Cable socket 423W–7S, 7–pin, 90° cable entry, for torque output (plugs 1, 3), Order No. 3–3312.0281

Cable socket 423G–8S, 8–pin, straight cable entry, for speed output (plug 2), Order No. 3–3312.0120

Cable socket 423W–8S, 8–pin, 90° cable entry, for speed output (plug 2), Order No. 3–3312.0282

Kab8/00–2/2/2 by the meter, Order No. 4–3301.0071

12 Specifications

Type		T10FM									
Accuracy class		0.1									
Torque measuring system											
Nominal (rated) torque M_{nom}	kN·m	15	20	25	30	40	45	50	60	70	80
for reference only	ft–lb · 10^3	11.25	15.0	18.75	22.5	30.0	33.75	37.5	45.0	52.5	60.0
Nominal (rated)sensitivity (range between torque = zero and M_{nom}											
Frequency output	kHz	5									
Voltage output	V	10									
Characteristic tolerance (deviation of the actual output at M_{nom} of the nominal (rated) sensitivity)											
Frequenzausgang	%	±0.2									
Voltage output	%	±0.3									
Output signal at torque = zero											
Frequency output	kHz	10									
Voltage output	V	0									
Nominal (rated) output signal											
Frequency output											
at positive nominal (rated) torque	kHz	15 (5 V symmetrical[1]/12 V asymmetrical)									
at negative nominal (rated) torque	kHz	5 (5 V symmetrical[1]/12 V asymmetrical)									
Voltage output											
at positive nominal (rated) torque	V	+10									
at negative nominal (rated) torque	V	–10									
Load resistance											
Frequency output	kΩ	>2									
Voltage output	kΩ	>5									
Long-term drift over 48 h											
Voltage output	mV	< ±3									
Measurement frequency range											
Voltage output –3 dB	kHz	1									
Group delay											
Frequency output	ms	0.15									
Voltage output	ms	0.9									
Residual ripple											
Voltage output	mV	40 (peak-to-peak)									

1) RS422 complementary signals; factory settings

Specifications (continued)

Nominal (rated) torque M_{nom}	kN·m	15	20	25	30	40	45	50	60	70	80
for reference only	ft–lb · 10^3	11.25	15.0	18.75	22.5	30.0	33.75	37.5	45.0	52.5	60.0
Effect of temperature per 10 K in nominal (rated) temperature range											
on the output signal, relative to the actual value of the signal span											
Frequency output	%	≤ ±0.1									
Voltage output	%	≤ ±0.2									
on the zero signal, relative to the nominal (rated) sensitivity											
Frequency output	%	≤ ±0.05									
Voltage output	%	≤ ±0.15									
Maximum modulation range											
Frequency output	kHz	4 ... 16									
Voltage output	V	–10.5 ... +10.5									
Power supply											
Nominal (rated) supply voltage (separated extra-low voltage (SELV))	V (DC)	18 ... 30; asymmetrical									
Current consumption											
in measuring mode	A	< 0.9									
in start-up mode	A	< 2									
Nominal (rated) power consumption	W	< 12									
Linearity deviation including hysteresis, related to the nominal (rated) sensitivity											
Frequency output	%	≤ ±0.1									
Voltage output	%	≤ ±0.1									
Rel. standard deviation repeatability according to DIN 1319, by reference to variation of the output signal											
Frequency output	%	≤ ±0.02									
Voltage output	%	≤ ±0.03									
Calibration signal		approx. 50 % of M_{nom}; value given to the identification plate									
Tolerance of calibration signal, related to M_{nom}	%	< ±0.05									

Specifications (continued)

Speed measuring system											
Nominal (rated) torque M_{nom}	kN·m	15	20	25	30	40	45	50	60	70	80
for reference only	ft–lb · 10^3	11.25	15.0	18.75	22.5	30.0	33.75	37.5	45.0	52.5	60.0
Rotation speed measurement system	optical, by means of infrared light and metallic slotted disc										
Mechanical increments	Number	720									
Positional tolerance of the increments	mm	±0.05									
Tolerance of the slot width	mm	±0.05									
Pulses per rotation											
Electrically adjustable	Number	720*); 360; 180; 90; 60; 30; 15									
Output signal	V	5 2) symmetric; 2 square-wave signals, approx. 90° out-of-phase									
Minimum speed for sufficient pulse stability	rpm	2									
Group delay	µs	< 5. typically 2.2									
Hysteresis of reversing the direction of rotation 3) in the case of relative vibrations between the rotor and the stator											
Torsional vibration of rotor	degree	< approx. 2									
Radial vibration of stator	mm	< approx. 2									
Load resistance	kΩ	≥2 (regard to terminating resistances according RS–422)									
Permitted degree of soiling, in the optical path of the optical sensor (lenses, slotted disc)	%	< 50									
Protection against scattered light		By fork and infrared filter									

*) Factory settings
2) Complementary signals RS-422
3) Can be switched off

Specifications (continued)

General specifications											
Nominal (rated) torque M_{nom}	kN·m	15	20	25	30	40	45	50	60	70	80
for reference only	ft–lb · 10^3	11.25	15.0	18.75	22.5	30.0	33.75	37.5	45.0	52.5	60.0
EMC											
EME (Emission according to EN61326–1, table 4)											
RFI field strength	–	Class B									
Immunity from interferences (EN61326–1, table A.1)											
Electromagnetic field AM	V/m	10									
Magnetic field	A/m	30									
ESD											
Contact discharge	kV	4									
Air discharge	kV	8									
Burst	kV	1									
Surge	kV	1									
Line–conducted disturbance (AM)	V_{SS}	3									
Protection class according to EN 60529		IP 54									
Weight,											
approx. Rotor	kg	26			45			60			
Stator	kg	1.4									
Reference temperature	°C [°F]	+23 [73.4]									
Nominal (rated) temperature range	°C [°F]	+10...+60 [+50...+140]									
Operating temperature range	°C [°F]	–10...+60 [+14...+140]									
Storage temperature range	°C [°F]	–20...+70 [–4...+158]									
Impact resistance, test severity level according to DIN IEC68; Part 2-27; IEC68-2-27-1987											
Number of impacts	n	1000									
Duration	ms	3									
Acceleration (half-sine)	m/s^2	650									
Vibration resistance, test severity level according to DIN IEC 68, Part 2-6: IEC 68-2-6-1982											
Frequency range	Hz	5...65									
Duration	h	1.5									
Acceleration (amplitude)	m/s^2	50									

Specifications (continued)

Nominal (rated) torque M_{nom}	kN·m	15	20	25	30	40	45	50	60	70	80
for reference only	ft–lb	11,250	15,000	18,750	22,500	30,000	33,750	37,500	45,000	52,500	60,000
Nominal (rated) speed	rpm	6000			4000			3000			
Load limit [4]											
Limit torque	kN·m	32			60			110			
Breaking torque	kN·m	> 50			> 90			> 160			
Longitudinal limit force	kN	60			120			240			
Lateral limit force	kN	80			160			240			
Bending limit moment	N·m	6000			12000			24000			
Vibration bandwidth to DIN 50 100 (peak-to-peak)		25			45			80			
upper maximum torque	kN·m	+20			+40			+70			
lower maximum torque	kN·m	–20			–40			–70			

[4] Each type of irregular stress (bending moment, lateral or longitudinal force, exceeding nominal (rated) torque) can only be permitted up to its specified static limit load 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 moment limit and lateral force limit occur at the same time, only 40 % of the longitudinal force limit is permissible and nominal (rated) torque must not be exceeded. The permissible bending moments, longitudinal forces and lateral forces can affect the measurement result by approx. 1 % of nominal (rated) torque.

Mechanical values 15 kN·m ... 45 kN·m							
Nominal (rated) torque M_{nom}	kN·m	15	20	25	30	40	45
for reference only	ft–lb	11,250	15,000	18,750	22,500	30,000	33,750
Torsional stiffness c_T	kN·m/rad	14500			34000		
Torsion angle at M_{nom}	degree	0.06	0.08	0.1	0.05	0.065	0.075
Maximum excursion at longitudinal force limit	mm	< 0.05			< 0.08		
Additional max. concentric error at lateral force limit	mm	< 0.05			< 0.07		
Additional in-plane deviation at bending moment limit	mm	< 0.5					
Balance quality-level to DIN ISO 1940		G 6.3					
Max. limits for relative shaft vibration (peak-to-peak)[6)]	µm	$s_{max} = \frac{4500}{\sqrt{n}}$					
Mass moment of inertia of the rotor							
L_V (about axis of rotation)	kg·m²	0.3			0.7		
Proportional mass moment of inertia for transmitter side (flange A)	%	70			70		
Max. permissible static eccentricity of the rotor (radially)							
without speed measuring system	mm	± 2					
with speed measuring system	mm	± 1					
Permissible axial displacement between rotor and stator							
without speed measuring system	mm	± 3					
with speed measuring system	mm	± 2					

6) Relative undulation in the connection flange range, following DIN 45670/VDI 2059

Mechanical values 50 kN·m ... 80 kN·m					
Nominal (rated) torque M_{nom}	kN·m	50	60	70	80
for reference only	ft–lb	37,500	45,000	52,500	60,000
Torsional stiffness c_T	kN·m/ rad	60000			
Torsion angle at M_{nom}	degree	0.05	0.06	0.07	0.08
Maximum excursion at longitudinal force limit	mm	< 0.12			
Additional max. concentric error at lateral force limit	mm	< 0.1			
Additional in-plane deviation at bending moment limit	mm	< 0.5			
Balance quality-level to DIN ISO 1940		G 6.3			
Max. limits for relative shaft vibration (peak-to-peak)[6)]	µm	$s_{max} = \frac{4500}{\sqrt{n}}$			
Mass moment of inertia of the rotor					
L_V (um Drehachse)	$kg \cdot m^2$	1.1			
Proportional mass moment of inertia for transmitter side (flange A)	%	70			
Max. permissible static eccentricity of the rotor (radially)					
without speed measuring system	mm	± 2			
with speed measuring system	mm	± 1			
Permissible axial displacement between rotor and stator					
without speed measuring system	mm	± 3			
with speed measuring system	mm	± 2			

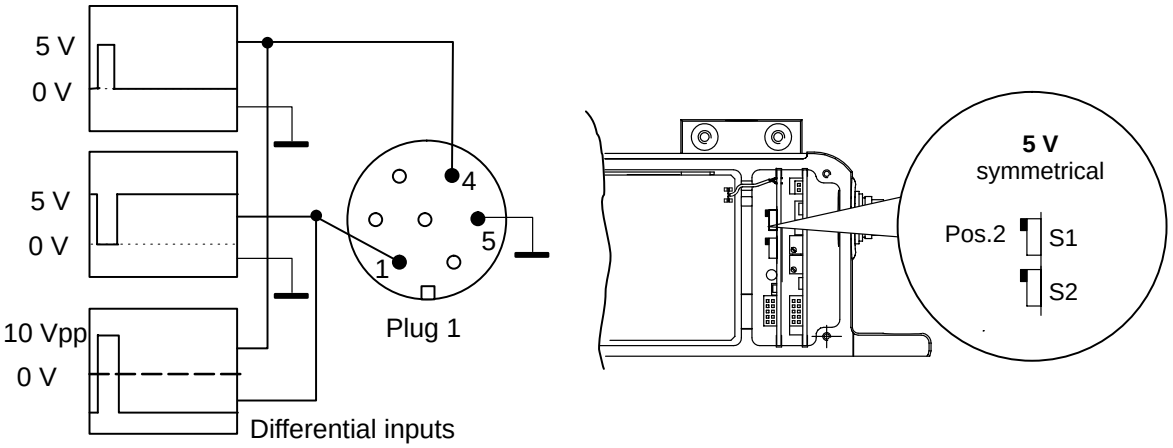
6) Relative undulation in the connection flange range, following DIN 45670/VDI 2059

13 Supplementary technical information

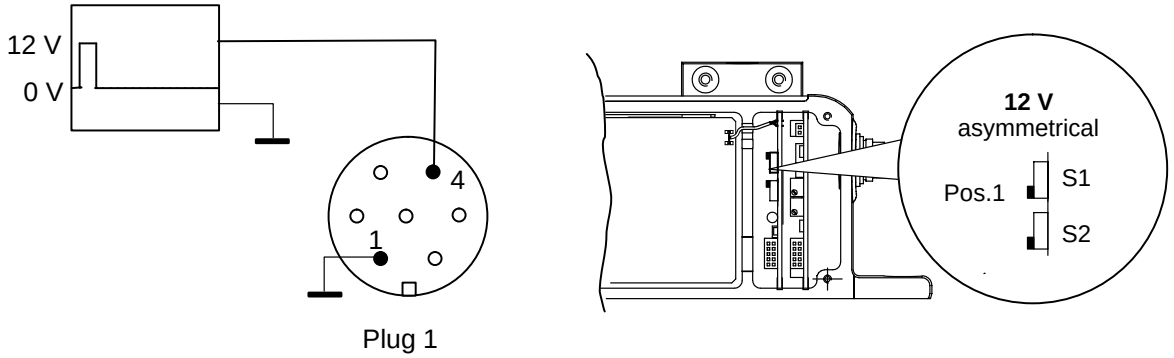
13.1 Output signals

13.1.1 Output MD: torque (plug 1)

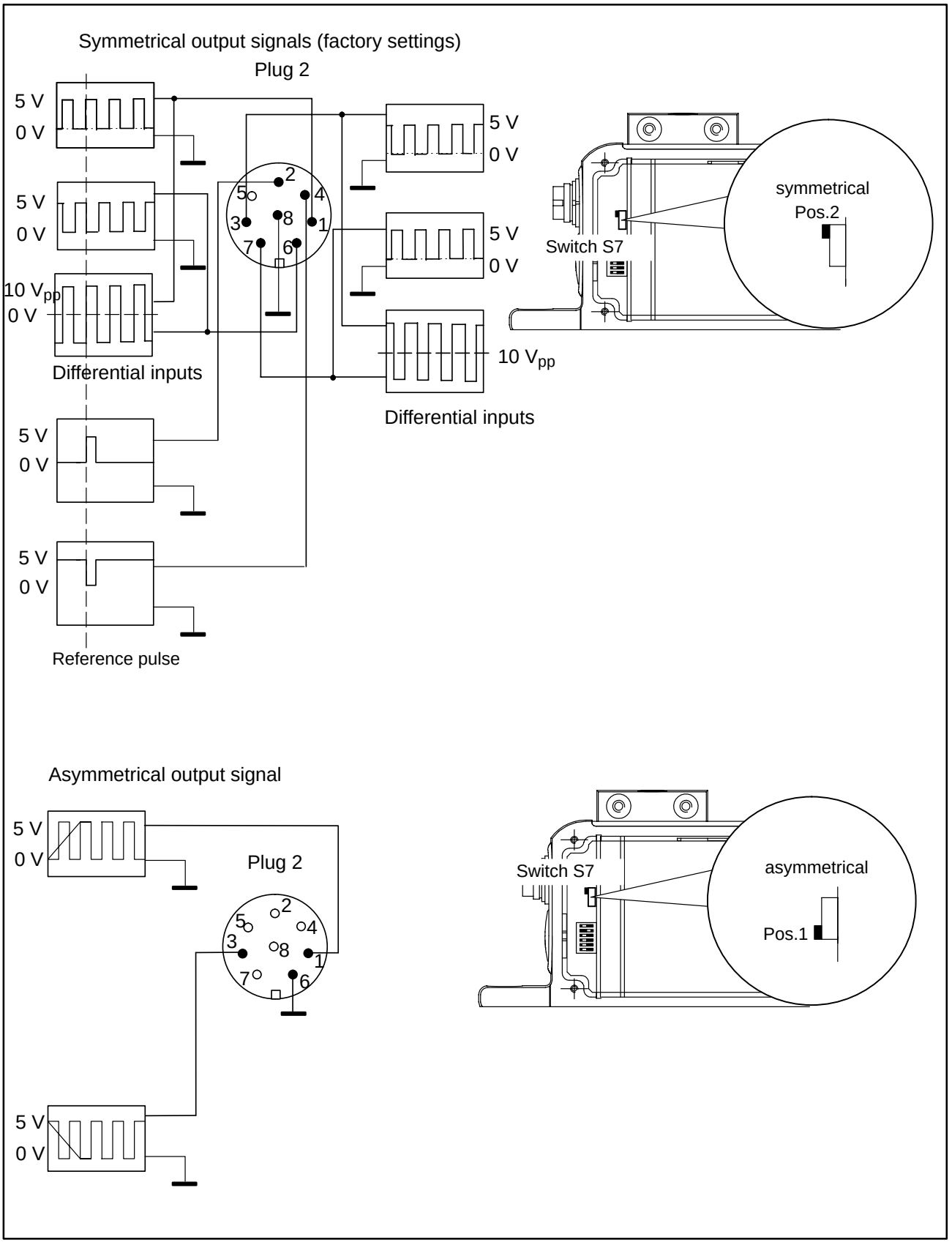
Symmetrical output signals (factory settings)



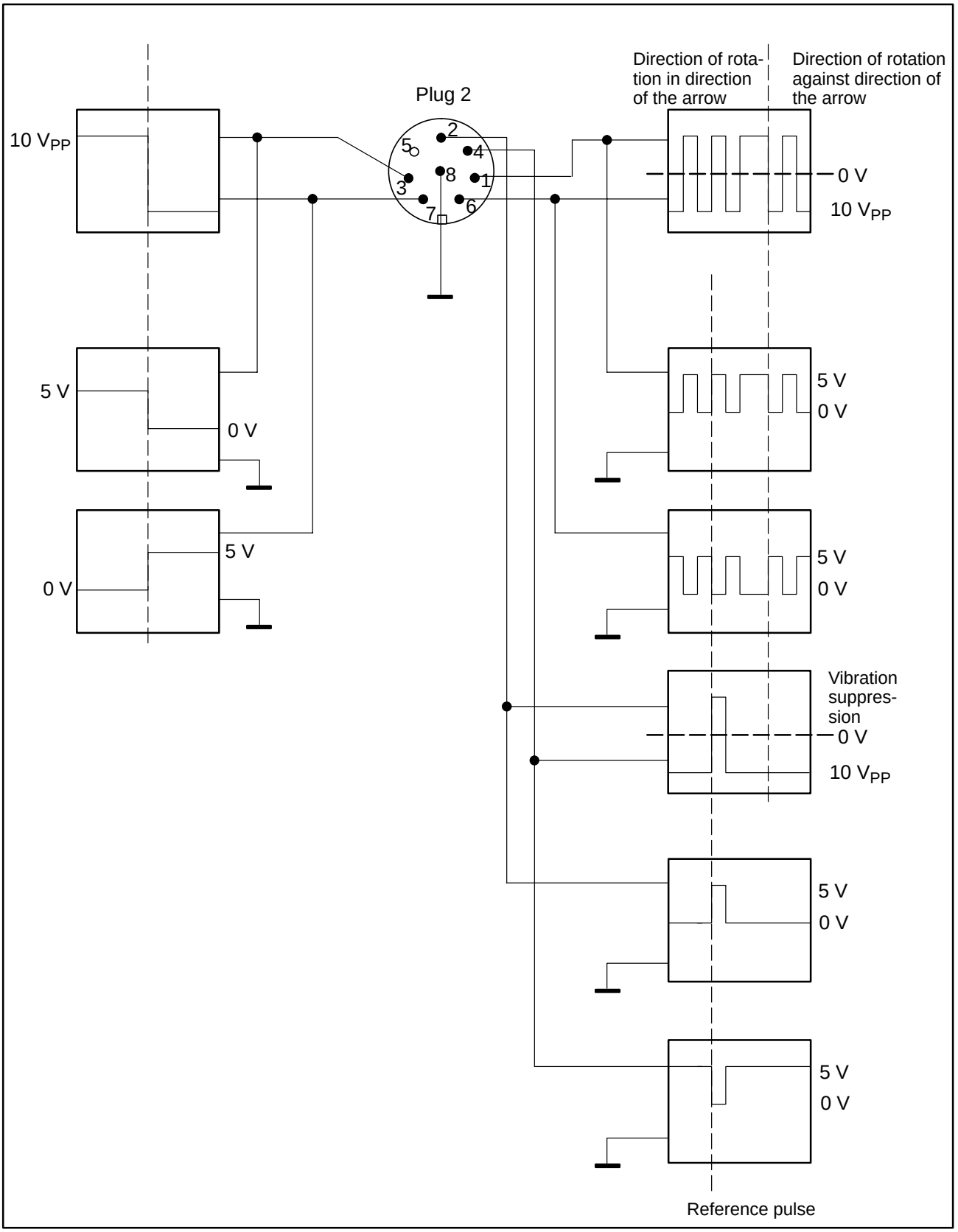
Asymmetrical output signal



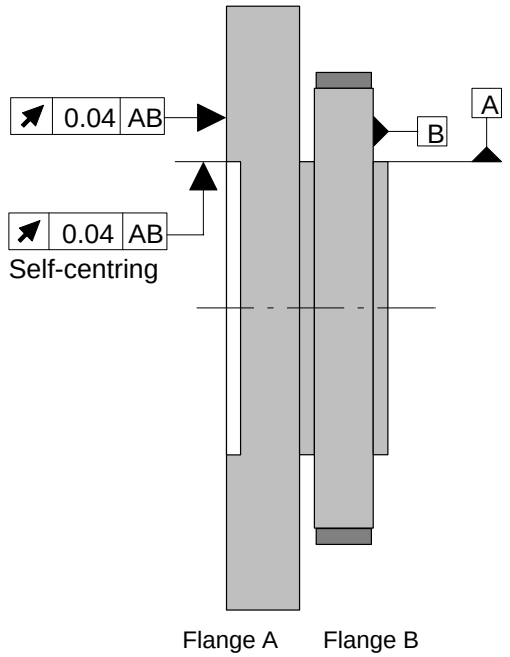
13.1.2 Output N: rotation speed and rotation speed with reference pulse (plug 2)



13.1.3 Plug 2, double frequency, stat. direction of rotation signal



13.2 Run-out and concentric tolerances



13.3 Additional mechanical data

Measuring range	kN·m	15	20	25	30	40	45	50	60	70	80
Mechanical values											
Stiffness in the axial direction c_a	kN/mm	1250			1500			2200			
Stiffness in the radial direction c_r	kN/mm	1800			2500			3600			
Stiffness during the bending moment round a radial axis c_b	kN·m/rad	3300			7400			14800			

14 Declaration of conformity

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

Document: *207/03.2002*

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
	Drehmoment-Messflansch	
	Typ T10FM...SU2...	
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, 2002-03-07

Dr. Michael Altwein *H. Fritz*

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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

Messbereiche: ***15kNm, 20kNm, 25kNm, 30kNm, 40kNm, 45kNm, 50kNm, 60kNm, 70kNm, 80kNm***
Option: ***Drehzahlmeßsystem***

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