Installation and Operational Instructions for ROBA®-DSM couplings Type 971._ _5

(B.971005.EN)

Please read these Operational Instructions carefully and follow them accordingly!
Ignoring these Instructions may lead to malfunctions or to coupling failure, resulting in damage to other parts.

Contents:

Safety Regulations

These Installation and Operational Instructions (I + O) are part of the coupling delivery.
Please keep them handy and near to the coupling at all times.

It is forbidden to start use of the product until you have ensured that all applicable EU directives, directives for the machine or system into which the product has been installed have been fulfilled.
At the time these Installation and Operational Instructions go to print, the ROBA®-DSM couplings accord with the known technical specifications and are operationally safe at the time of delivery.
Without a conformity evaluation, this product is not suitable for use in areas where there is a high danger of explosion. This statement is based on the ATEX directive.

CAUTION

- ❒ If the ROBA®-DSM couplings are modified.
- ❒ If the relevant standards for safety and / or installation conditions are ignored.

User-implemented Protective Measures

- ❒ Cover all moving parts to protect against seizure, dust or foreign body impact.
- ❒ Replace self-locking hexagon nuts when they become ineffective after frequent loosening and tightening.

To prevent injury or damage, only professionals and specialists should work on the devices, following the relevant standards and directives. Please read the Installation and Operational Instructions carefully before installation and initial operation of the device.

Electronic devices cannot be guaranteed fail-safe. Please read and observe the Operational Instructions carefully in order to avoid malfunctions, failures or damage.

These Safety Regulations are user hints only and may not be complete!

Safety and Guideline Signs

CAUTION

Danger of injury to personnel and damage to machines.

Please Observe!
Guidelines on important points.

According to German notation, decimal points in this document are represented with a comma (e.g. 0,5 instead of 0.5).

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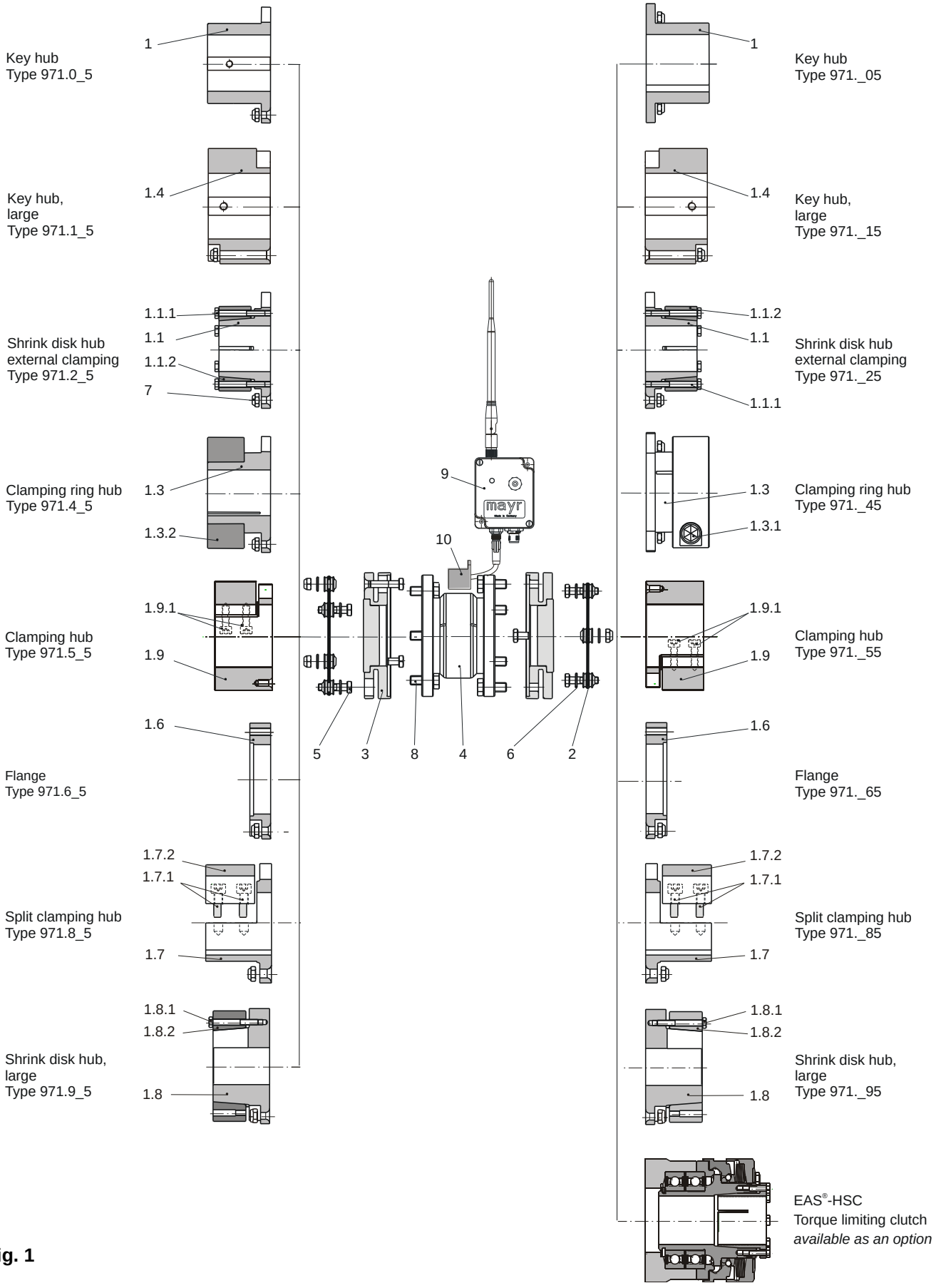

Fig. 1

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Parts List

Only use mayr® original parts

1	Hub Type 971.0_5
1.1	Hub Type 971.2_5
1.1.1	External tensioning screws for hubs Type 971.2_5
1.1.2	Shrink disk
1.3	Hub Type 971.4_5
1.3.1	Clamping screw for hubs Type 971.4_5
1.3.2	Clamping ring
1.4	Hub Type 971.1_5
1.6	Flange Type 971.6_5
1.7	Hub Type 971.8_5
1.7.1	Clamping screws for hubs Type 971.8_5
1.7.2	Half-shell
1.8	Hub Type 971.9_5
1.8.1	Tensioning screws for hubs Type 971.9_5
1.8.2	Shrink disk
1.9	Hub Type 971.5_5
1.9.1	Clamping screw for hubs Type 971.5_5
2	Disk pack
3	Adaptor flange
4	Strain sensor
5	Hexagon head screw
6	Washer
7	Hexagon nut
8	Hexagon head screw
9	ROBA®-DSM receiver
10	ROBA®-DSM stator

Table 1: Technical Data

ROBA®-DS Size	16	40	100	160
d_{Pmax} Hub Type 971.0 (1) [mm]	32	50	70	80
d_{Gmax} Hub Type 971.1 (1.4) [mm]	45	65	95	110
d_{Smax} Hub Type 971.2 (1.1) [mm]	26	45	55	65
d_{KRmax} Hub Type 971.4 (1.3) [mm]	35	45	68	80
d_{Kmax} Hub Type 971.5 (1.9) [mm]	45	60	90	100
d_{Hmax} Hub Type 971.8 (1.7) [mm]	28	40	60	75
d_{SGmax} Hub Type 971.9 (1.8) [mm]	45	60	90	100
Coupling nominal torque T_{KN} [1] [Nm] valid for changing load direction as well as for max. permitted shaft misalignment	190	450	800	1600
Coupling peak torque T_{KS} [Nm] valid for unchanging load direction, max. load cycles ≤ 10^5	285	675	1200	2400
Coupling ultimate torque T_{KB} [Nm]	570	1350	2400	4800
Max. speed $n_{max.}$ [rpm]	9500	7000	5100	4300
Distance dimension "S" [mm]	7,1 ±0,2	8,4 ±0,2	10 ±0,25	11,6 ±0,25
Axial displacement ΔK_a [mm] Values refer to couplings with 2 disk packs. Only permitted as a static or virtually static value.	±0,8	±1,1	±1,5	±1,7
Radial misalignment ΔK_r [mm]	1,1	1,3	1,6	1,8
Angular misalignment ΔK_w per disk pack [°]	0,7	0,7	0,7	0,7
Hexagon head screws Item 1.1.1 (Hub Type 971.2_5) Tightening torque [Nm]	M5x30 6	M5x40 8,5	M8x50 25	M8x55 25
Cap screws Item 1.3.1 (Hub Type 971.4_5) Tightening torque [Nm]	M8x25 41	M12x35 145	M16x50 355	M18x55 485
Cap screws Item 1.7.1 (Hub Type 971.8_5) Tightening torque [Nm]	M6x18 14,9	M8x25 36	M12x35 102	M12x35 122
Hexagon head screws Item 1.8.1 (Hub Type 971.9_5) Tightening torque [Nm]	M5x30 6	M5x40 8,5	M8x50 25	M8x55 32
Cap screws Item 1.9.1 (Hub Type 971.5_5) Tightening torque [Nm]	M6x25 17,4	M10x35 83	M12x45 143	M14x50 220
Hexagon head screws Item 5 Tightening torque [Nm]	M5x23 8,5	M6x25 14	M8x30 35	M10x40 69
Hexagon head screws Item 8 Tightening torque [Nm]	M5x16 8,5	M8x20 30	M10x25 48	M12x30 97
Adjusting screws for hub Type 971.0_5 with hub bore Tightening torque [Nm]	M5 ≤22: 2 M6 >22: 4,1	M6 4,1	M10 14	M10 ≤50: 14 M12 >50: 35
Adjusting screws for hub Type 971.1_5 Tightening torque [Nm]	M8 8,5	M10 14	M12 35	M12 35

1) For split clamping hubs (Type 971.8_5), the following applies:
Valid for unchanging load direction as well as for max. permitted shaft misalignment.
When the load direction changes, max. 60% of the stated nominal torque is permitted.

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Application – Operation – Function

ROBA®-DSM couplings are torque measurement systems based on flexible shaft misalignment compensation couplings.
If the torque is transmitted in an almost backlash-free way, angular misalignments, axial displacements and radial misalignments of the shafts to be connected can be compensated.

State of Delivery

ROBA®-DSM couplings are manufacturer-assembled on delivery.Except for the disk pack (2), all parts are phosphated and therefore have a basic corrosion protection.
The hub bores produced at the site of manufacture are usually produced with tolerance H7; other tolerances are possible (please contact the manufacturer).
The key hubs (Items 1 and 1.4) have a keyway acc. DIN 6885 sheet 1 or 3, as well as an adjusting screw for axial securement.

Guidelines on Shaft Design

- ❑ The hub bores are usually produced with tolerance H7. The required shaft tolerance depends on the hub type used as well as on the basic overall load configuration.
  - Shrink disk hubs/clamping ring hubs: h6/g6
  - Key hubs: r6/s6 (alternating rotational direction), k6/n6 (one-way rotational direction)
- ❑ The shaft surfaces should be finely turned or ground (Ra = 0,8 µm).
- ❑ The required yield point for the shafts used is at least 350 N/mm² (St60, St70, C45, C60).

Hub Installation (Fig. 1)

Types 971.0_5/971.1_5 (Hubs with Keyway)

The configuration of the different individual components can be seen in Fig.1.

Hub installation Types 971.0_5 /971.1_5 (hubs with keyway, Figs. 2 and 3):

- ❑ Mount the hubs (1, 1.4) onto the shafts using a suitable device and secure them axially.
  Axial securement takes place using a set screw (adjusting screw, Fig. 2), which presses radially onto the key; or via a press cover and a screw, screwed into the shaft threaded centre hole (Fig. 3).
- ❑ The key must lie over the entire length of the hub.

Fig. 2

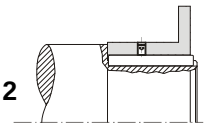
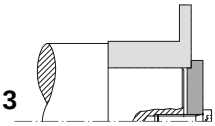


Fig. 3



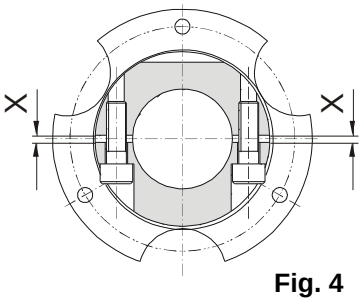


Fig. 4

Types 971.8_5 (hubs with half-shells)

a) Loosen the pre-assembled half-shell (1.7.2) from the hub (1.7).
b) Mount the hub (1.7) onto the shaft using a suitable device and bring it into the correct position.
c) Mount the half-shell. Tighten the cap screws (1.7.1) cross-wise and in several tightening sequences to the tightening torque stated in Table 1. Please make sure that the gap "X" has the same size on both hub sides (Fig. 4). If necessary, re-adjust it.

Types 971.2_5/971.9_5 (Hubs with Shrink Disk) or 971.4_5 (Hubs with Clamping Ring)

- ❒ The force transmission of the shrink disk hubs or the clamping hubs (1.1/1.3/1.8) takes place using frictional locking. The contact surfaces between the shrink disk and the hub as well as between the clamping ring and the hub are greased manufacturer-side.
- ❒ The hub bores and the shaft ends must be completely grease-free during installation.
- ❒ Greasy or oily bores or shafts do not transmit the maximum coupling torque.
- ❒ The shafts must not have a keyway.
- ❒ The hub and the shrink disk (1.1.2/1.8.2) or the clamping ring (1.3.2) must be completely relaxed; if necessary, loosen the screws (1.1.1/1.3.1/1.8.1) by several thread turns.

Hub installation Types 971.2_5/971.9_5 (hubs with shrink disk)

a) Mount the hubs (1.1/1.8) onto the shafts using a suitable device and bring them into the correct position.
b) Tighten the tensioning screws (1.1.1/1.8.1) using a torque wrench evenly and **one after the other in several tightening sequences** to the torque stated in Table 1.
c) Check the tightening torque produced after 5 to 10 operating hours.

For de-installation:

a) Loosen all tensioning screws (1.1.1/1.8.1) in several sequences by several thread turns.
b) Screw out the tensioning screws located next to the tapped extracting holes and screw them into the tapped extracting holes up to their limits.

Please take the axial space requirements for the tensioning screws to be screwed into the tapped extracting holes into account (length of the hexagon head screws Item 1.1.1 / Item 1.8.1, see Table 1).

c) Tighten the tensioning screws (1.1.1/1.8.1) evenly and step-wise so that the shrink disk (1.1.2/1.8.2) is loosened from the hub.

Hub installation Type 971.4_ 5 (hubs with clamping ring)

a) Mount the hubs (1.3) onto the shafts using a suitable device and bring them into the correct position.
b) Tighten the clamping screw (1.3.1) using a torque wrench to the torque stated in Table 1.
c) Check the tightening torque produced after 5 to 10 operating hours.

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Types 971.5_5 (Clamping Hubs)

- ❒ The hub bores and the shaft ends must be completely grease-free during installation. Greasy or oily bores or shafts do not transmit the maximum coupling torque.
- ❒ The shafts must not have a keyway.
- ❒ The clamping hub (1.9) must be completely relaxed; if necessary, loosen the screws (1.9.1) by several thread turns.

a) Mount the hubs (1.9) onto the shafts using a suitable device and bring them into the correct position.
b) Tighten the clamping screws (1.9.1) using a torque wrench to the torque stated in Table 1.
c) Check the tightening torque produced after 5 to 10 operating hours.

Installation of the Compensation Coupling (Figs. 1 and 5)

The disk packs (2) are screwed **alternately** to the adaptor flange (3) or to the hubs (1, 1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 1.8) or the flanges (1.6) via lightly oiled hexagon head screws (5), washers (6) and hexagon nuts (7).
Pease observe the tightening torque acc. Table 1!
The generation of pre-tension force on the disk pack (2) generally takes place* via the hexagon nut (7). While doing this, disk pack (2) distortion must be avoided (secure the hexagon head screw (5) against turning).

On principle, the disk pack (2) is inserted so that the collar bushing radius (Item 2a, Fig. 5, detail "X") lies in the hub recesses (1, 1.1, 1.3, 1.4, 1.5, 1.7, 1.8), the flanges (1.6), or the adaptor flanges (3).

*** The hexagon head screws (5) must be arranged in such a way that the screw head with the washer (6) always lies against the disk pack (2).**

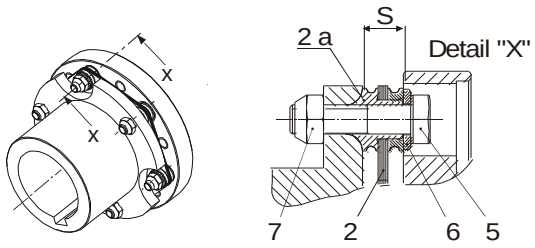

Fig. 5

Strain Sensor (4) Installation

ROBA®-DSM couplings are delivered manufacturer-sided assembled and calibrated. If the coupling is de-installed for final installation, this could lead to loss of the pre-set zero point. Therefore, de-installation should be avoided if possible.
The joining surfaces of the strain sensor (4) should be kept free of dirt and grease at all times.
A zero point drift resulting from de-installation should ideally be corrected through a signal offset by the customer.

- ❑ The installation of the strain sensor takes place after installation of a disk pack and an adaptor flange on both sides of the respective shaft-hub connection.
- ❑ Tighten the screws using a torque wrench **evenly and one after the other in several tightening sequences** to the torques stated in Table 1.
- ❑ Align the adaptor flanges (3) relative to the strain sensor (4) according to the position marked in the direction of the circumference (sealing lacquer dots).

Coupling Alignment

Exact alignment of the coupling reduces the load on the shaft bearing and reduces measurement mistakes due to the reaction forces from the disk pack.
In drives with high speeds or in drives with limited measuring mistake tolerance, we recommend alignment of the coupling using a dial gauge.
In most of the applications, coupling alignment using a straight edge in two levels vertical to each other is sufficient.
In order to prevent an axial distortion of the disk packs, **"distance dimension S"** (Fig. 5, Detail „X" and Table 1) must be maintained with aligned angular and radial shaft misalignments.

Permitted Shaft Misalignments

The ROBA®-DSM coupling compensate for angular, axial and radial shaft misalignments (Fig. 6) without losing their backlash-free function. However, the permitted shaft misalignments indicated in Table 1 must not simultaneously reach their maximum value. If more than one kind of misalignment takes place simultaneously, they influence each other. The permitted misalignment values are dependent on one another, see Fig. 7.
The sum total of the actual misalignments in percent of the maximum value must not exceed 100 % (see Fig. 7).

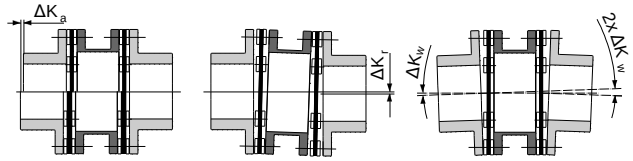

Fig. 6

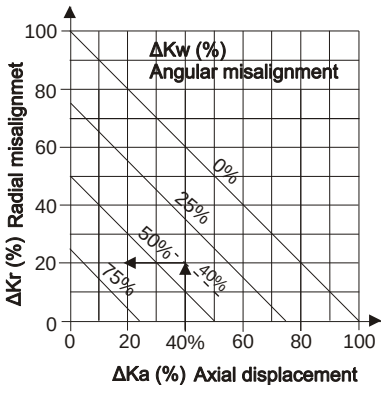

Fig. 7

Example:
ROBA®-DSM, Size 40, Type 971.005

Axial displacement occurence ΔK_a = 0,4 mm;
equals **40 %** of the permitted maximum value
(100 % ΔK_a = 1,00 mm).

Angular misalignment occurrence in the disk pack ΔK_w = 0,28°;
equals **40 %** of the permitted maximum value
(100 % ΔK_w = 0,7°).

This makes the **permitted radial misalignment 20 %** of the permitted maximum value,
i. e. ΔK_r = 0,26 mm (100 % ΔK_r = 1,3 mm).

Balancing the Coupling

In most applications, balancing the ROBA®-DSM couplings is not necessary, as all parts are machined on all sides and therefore fulfil the G 6.3 (DIN ISO 1940) standard for lower and medium speed ranges.
If higher demands are placed on the balance quality, it is possible to balance individual parts or even the entire installed coupling (on request). However, for this option, the hubs must have a finish bore.

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ROBA®-DSM Receiver

The ROBA®-DSM receiver (9) establishes the contactless connection to the strain sensor (4) and supplies it with energy via the ROBA®-DSM stator (10).

Installation and Adjustment

The user is responsible for providing a mounting plate for mounting the ROBA®-DSM stator (10); for mounting dimensions, see Fig. 8.
The stator (10) must be mounted in such a way, that the plastic surface lies tangentially to the strain sensor (4).
The stator (10) is connected to the receiver (9) at the M8 bushing.
After installation, please check the function.
When applying voltage to the receiver (9), the LED must light up in green.
The ROBA®-DSM receiver (9) must be placed within a radius of 1 m to the strain sensor (4); for hole pattern dimensions, please see Fig. 8.

During installation, it needs to be made sure that the radio contact for all rotational angles works. To do this, the strain sensor (4) must be rotated once slowly by 360° and the signal LEDs must be observed.
The display must be green the whole time.
If the LED lights up red at different angle positions, please select a different mounting place for den ROBA®-DSM (9).

The stator (10) is mountable on all sides, and it is therefore only necessary to align it in its axial and radial position, relative to the strain sensor (4). The axial position is central to the strain sensor (4); the radial distance can total between 1 mm and 5 mm (Fig. 9).
If installed correctly, the LED on the ROBA®-DSM receiver (9) lights up green and indicates that the data transmission works.

Metallic protective covers or shieldings over the strain sensor (4) must be broken (slot length ≥ 6 cm) or the ROBA®-DSM receiver (9) must also be installed within these protective covers.

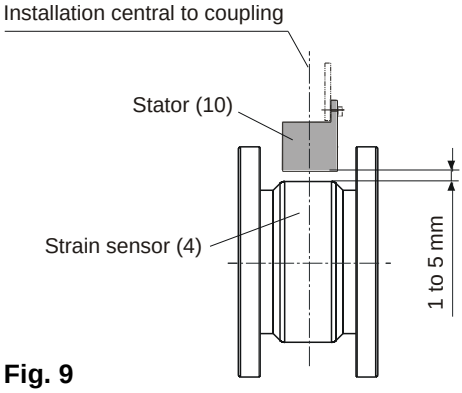

Fig. 9

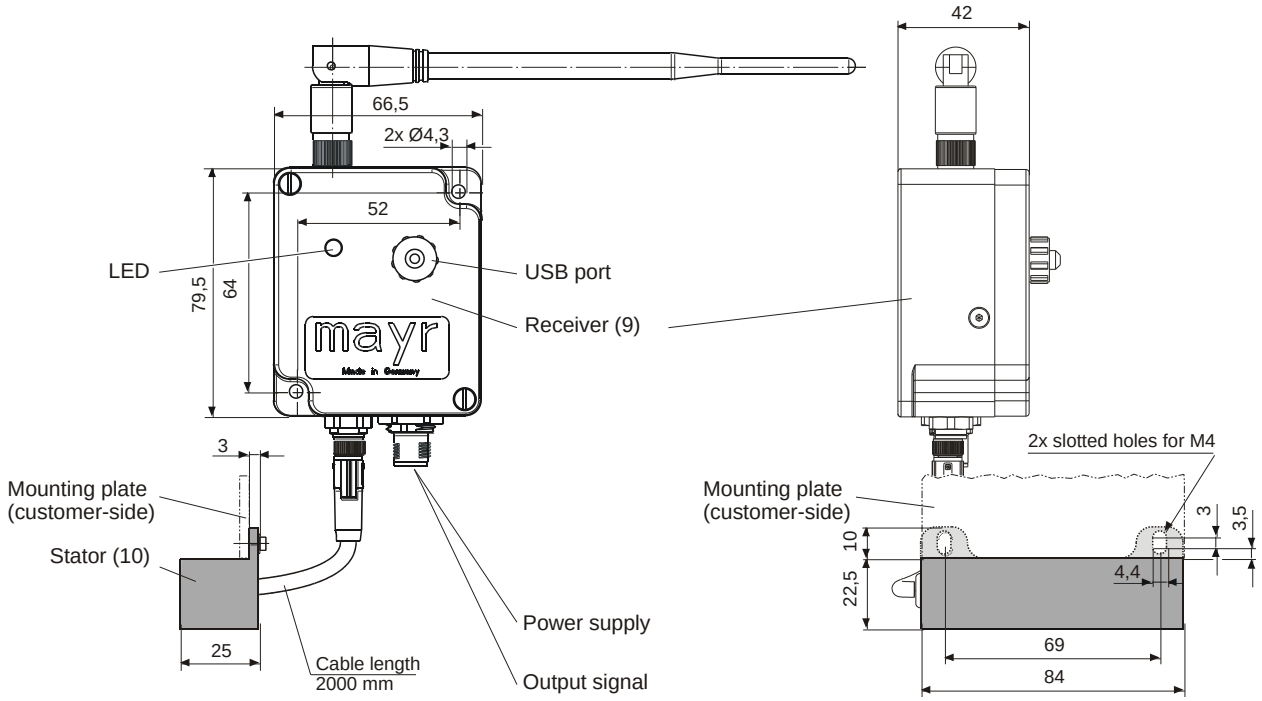

Fig. 8

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Electrical connection (Fig. 10)

- ❑ The ROBA®-DSM receiver (9) is equipped manufacturer-side with a firmly installed 4-pole, A-encoded M12 plug.
- ❑ The voltage supply takes place via
  Pin 1 = +24V ±10 % and
  Pin 3 = GND.
- ❑ The output signal is provided to
  Pin 4 = Ua torque 0 ... ±10V and
  Pin 2 = GND.
- ❑ The digital measurement data can be read into a PC directly via the USB port using the mayr® software..
- ❑ The radio ID and the radio channel can be set and the offset compensation can be carried out via the USB port using the service software.

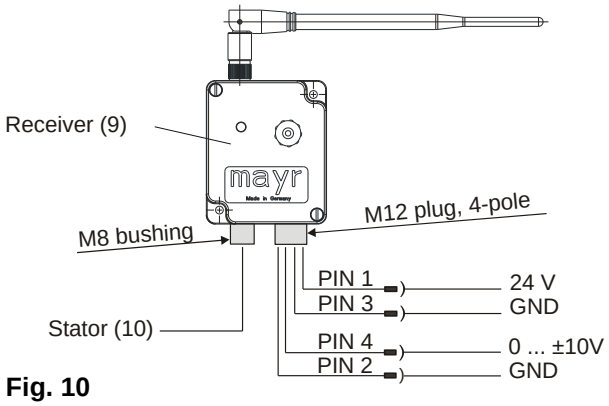

Fig. 10

Technical Data

Supply voltage:	24 VDC (±10 %)
Max. current consumption:	1 A
Measuring signal output:	0...±10 V (rotational direction right positive, 10V refers to $T_{KN)}$
Nominal temperature range:	-20 °C to +70 °C
Temperature drift, zero point:	0,04 % of final value / K
Temperature drift, measured value:	0,03 % of final value / K
Max. total errors: :	< 1 % of final value
Bandwidth:	3 kHz (-3 dB)
Max. dyn. load:	100 % of T_{KN}
Protection:	Receiver/stator IP65 Strain sensor IP52
Permitted speed:	0 ... n_{max} (see Table 1, page 3)

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