Original manual

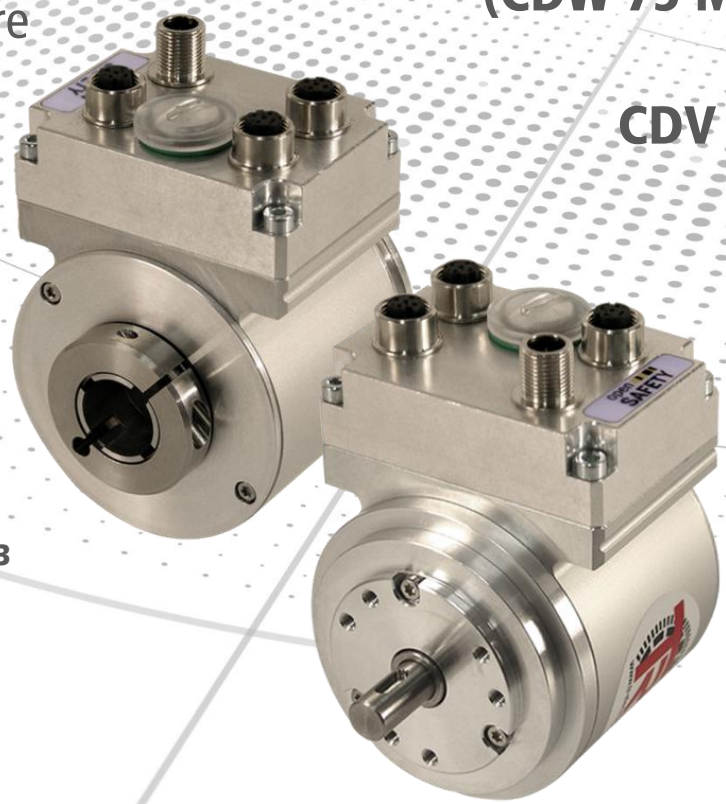
Absolute Encoder CD_-75
Safety Manual

Explosion Protection Enclosure
_A**75*
_A**88*
_A**100*
_A**115*
Protection Enclosure
_CDV115

CDH 75 M

(CDW 75 M)

CDV 75 M



DIN EN 61508 / EN IEC 62061: SIL 3
DIN EN ISO 13849: PL e

_Basic safety instructions
_Intended use
_General functional description
_General characteristics
_Assembly

Safety Manual

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PROFIBUS variant added	10/22/2015	02
Differentiation Tu = f(n) in case of IP54 and IP65	11/04/2015	03
EtherCAT/FSoE variant added	02/04/2016	04
Revision Electrically permissible speed -> Scanning system, double magnetic: old: ≤ 1500 min-1; new ≤ 3000 min-1	02/25/2016	05
Additional notice, electrically permissible speed	03/01/2016	06
EtherCAT/FSoE variant: old: Tu = f(n) = -20…+70 °C; new: Tu = f(n) = -25…+65 °C	03/03/2016	07
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1 General

This Manual addresses the following topics:

- General functional description
- Basic safety information with declaration of the intended use
- General specifications
- Assembly

Since it has a modular structure, this Manual is supplementary to other documentations, such as product data sheets, dimensional drawings, brochures, interface-specific user manuals, etc.

1.1 Scope

This Manual is only applicable to measuring system model ranges having the following type designation codes:

* 1	* 2	* 3	* 4	* 5	-	* 6	* 6	* 6	* 6	* 6

Position	Designation	Description
* 1	A C	Explosion protection enclosure (ATEX); Absolute encoder, programmable
* 2	D	Redundant dual scanning unit
* 3	V H S W	Solid shaft Hollow shaft Blind-hole shaft Rope length transmitter (wire)
* 4	75 88 100 115	External diameter ∅ 75 mm External diameter ∅ 88 mm External diameter ∅ 100 mm External diameter ∅ 115 mm
* 5	M	Multi-turn
* 6	-	Consecutive number

* = Wild card

The products are labeled with affixed nameplates and are components of a system.

1.2 Other applicable documents

- The responsible organization’s system-specific operating instructions
- This Safety Manual
- Pin assignment
- Interface-specific User Manual
- Product data sheet
- Optional: User Manual

1.3 Abbreviations and terms used

A**75*	Explosion protection enclosure with ∅ 75 mm and built-in measuring system, all variants
A**88*	Explosion protection enclosure with ∅ 88 mm and built-in measuring system, all variants
A**100*	Explosion protection enclosure with ∅ 100 mm and built-in measuring system, all variants
A**115*	Explosion protection enclosure with ∅ 115 mm and built-in measuring system, all variants
$B10_d$	Number of operations that a device will operate prior to 10 % of a sample of those devices would fail to danger
CD_	Absolute encoder with redundant dual scanning feature, all designs
EMC	***E***lectro***M***agnetic ***C***ompatibility
ESD	***E***lectro***S***tatic ***D***ischarge
Fault exclusion	Compromise between technical safety requirements and the theoretical possibility that an error occurs
Functional safety	Part of the overall system safety, which depends on the correct functioning of safety instrumented systems for risk reduction. Functional safety is ensured when each safety function is executed as specified.
IEC	International Electrotechnical Commission
ISO	***I***nternational ***O***rganization for ***S***tandardization
$MTTF_d$	***M***ean ***T***ime ***T***o ***F***ailure, ***d***angerous
n_{op}	Number of operations/cycles in one year
PL	***P***erformance ***L***evel according to EN ISO 13849-1
SIL	***S***afety ***I***ntegrity ***L***evel: Four discrete levels (SIL1 to SIL4). The higher the SIL of a safety instrumented system, the lower the probability that the system cannot execute the required safety functions.
Standard measuring-system	Definition: Safety instrumented measuring system, without explosion protection
VDE	Association for Electrical, Electronic & Information Technologies

1.4 General functional description

The rotary measuring system is a safe and absolute multi-turn position measuring system with a safety protocol and a standardized interface that is, however, NOT safety instrumented.

The measuring system has primarily been designed for use in systems that require safe position detection.

The safety measuring system consists of **a redundant, dual-channel system** in which

- variant 1: optical and magnetic scanning units, or
- variant 2: two magnetic scanning units

are arranged on a drive shaft that is designed either as hollow shaft or as solid shaft.

2 Basic safety instructions

2.1 Definition of symbols and notes

⚠ DANGER	means that death or serious injury will occur if the user fails to take the respective precautionary measures.
⚠ WARNING	means that death or serious injury may occur if the user fails to take the respective precautionary measures.
⚠ CAUTION	means that minor injuries may occur if the user fails to take the respective precautionary measures.
NOTICE	means that damage to property may occur if the user fails to take the respective precautionary measures.
	indicates important information or features and application tips for the product used.
	means that appropriate ESD protective measures according to DIN EN 61340-5-1 supplementary sheet 1 must be taken.

2.2 General risks when using the product

The product, hereinafter referred to as ***measuring system***, is manufactured according to state-of-the-art technology and accepted safety rules. ***Nevertheless, non-intended use can pose a danger to life and limb of the user or third parties, or lead to impairment of the measuring system or other property values!***

The measuring system may only be used in technically perfect condition in accordance with its intended use and the instructions set out in the ***Other applicable documents*** and only by safety-conscious persons who are fully aware of the risks involved in operating the measuring system. Faults which could threaten safety should be eliminated without delay!

2.3 IT security vulnerabilities

The measuring system has a digital fieldbus interface that is designed for operation in networked control systems. The measuring system contains software that enables network communication. No sensitive information is stored on the device itself. The standardized fieldbus protocols are not protected against attacks, e.g., MITM (man in the middle), by default. The system integrator must implement appropriate protective measures when designing the control network.

2.4 UL / CSA approval

Measuring systems with this approval are signed with the UL Symbol on the name plate:

File No.: E300802

The measuring systems comply to the following UL / cUL -requirements:

- US Standard UL508, Industrial Control Equipment
- Canadian Standard CSA C22.2 No. 107.1-01, General Use Power Supplies

It is therefore only permitted to start up these measuring systems if it has been established that the system/machine into which the measuring system is to be fitted satisfies the following requirements:

- NFPA 79 Standard, “Electrical Standard for Industrial Machinery”
- Class 2 power source, according to the requirements of the NEC
- Supply voltage 24 V DC, ≤ 6 watt, range of the supply voltage see data sheets: www.tr-electronic.com/s/S011827

UL compliant connection cables are available from the manufacturer

- SSI, Incremental, Order-No.: 64 200 014
- PROFIBUS, Order-No.: 64 200 086
- PROFINET, Order-No.: 64 200 173

or equivalent.

2.5 Intended use

The safety measuring system can be used for the detection of angular movement and processing of measured data for a downstream safety host in systems in which the **goal of "Protection of travel"** must be reliably achieved. In this case, the complete processing chain of the safety function must satisfy the requirements of the applied safety standard.
The safety measuring system may only be used in safety applications in conjunction with a control certified according to the applied safety standard.
The system manufacturer must verify that the properties of the measuring system satisfy his application-specific safety requirements. The responsibility or decision regarding the use of the measuring system lies with the system manufacturer.

Intended use also includes:

- following all instructions given in the other applicable documents;
- observing the nameplate and any prohibition or instruction symbols on the measuring system;
- observing the enclosed documents;
- operating the measuring system within the limit values specified in the technical data;
- ensuring that the fail-safe processing unit fulfills all required safety functions;
- ensuring that the checklist – part 1 in the present document and part 2 in the interface-specific User Manual – is used and went through completely;
- safely attaching (form-locking; recommended) the measuring system to the driving axis.

2.6 Non-intended use

⚠ WARNING

Any non-intended use of the measuring system results in the risk of death, physical injury and damage to property.

➢ The following areas of use are especially forbidden:
- in environments where there is an explosive atmosphere
- for medical purposes

NOTICE

2.7 Usage in explosive atmospheres

When used in explosive atmospheres, the standard measuring system has to be installed in an appropriate explosion protective enclosure and subject to requirements.

The products are labeled with an additional marking on the nameplate.

The “intended use” as well as any information on the safe usage of the ATEX-compliant measuring system in explosive atmospheres are contained in the User Manual.

Standard measuring systems that are installed in the explosion protection enclosure and are intended for use with safety instrumented applications can therefore be used in explosive atmospheres. In case of the **ADW**** the information out of chapter 2.8 from page 11 must be observed.

When the measuring system is installed in the explosion protection enclosure, which means that it meets explosion protection requirements, the properties of the measuring system will no longer be as they were originally.

Following the specifications in the User Manual, please check whether the properties defined in that manual meet the application-specific requirements.

Fail-safe usage requires additional measures and requirements. Such measures and requirements must be determined prior to initial commissioning and must be taken and met accordingly.

2.8 Combination measuring system and draw-wire box (CDW** / ADW**)

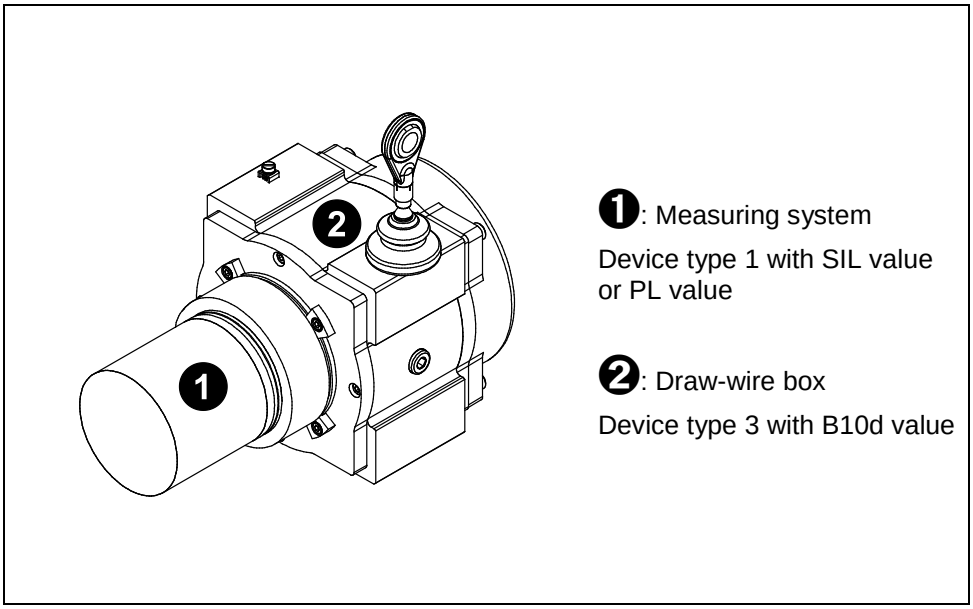

Figure 1: Combination measuring system and draw-wire box

From a safety viewpoint the combination of measuring system and draw-wire box is a series connection with a device type 1 (measuring system) and a device type 3 with a category 1 structure in accordance with EN ISO 13849-1 (draw-wire box).

Device type 1 is characterized by the fact that the device can already be used as the safety-relevant part of a control system.

Device type 3 refers to devices with a failure behavior which is dependent on the switching frequency (cycle) and in terms of the draw-wire corresponds to complete extension and retraction of the wire. This fact is expressed by the **B10d-value** and represents the average number of cycles by which 10 % of the components have failed dangerously. The draw-wire box has not been developed in accordance with any specific safety standard, but this does not in principle exclude its use in accordance with DIN EN 61508, EN ISO 13849-1 or IEC 62061.
Generally, however, the use of such devices, if they are used as a safety-relevant part of a control system, must be independently assessed by the user in relation to safety.

As the combination of measuring system and draw-wire box is a series connection, this "unified structure" must be reassessed in relation to safety. The component with the lowest reliability in the series connection is determining for the highest possible level of safety that can be achieved. For mechanical reasons draw-wires only have a limited number of cycles, which in turn is strongly dependent on the type used.

In practice this means that the draw-wire is the limiting component in the series connection and the safety requirement level of the measuring system can never be achieved for the unified structure. For this reason there is also no TÜV certification for the combination of measuring system and draw-wire box!

This fact means that the unified structure may only be used as the subsystem of a safety function if the safety requirement level of the unified structure corresponds to the required safety requirement level for the subsystem.

To enable the user to assess the safety function, TR Electronic provides the relevant safety indicators in the product data sheets valid for the respective measuring system, see https://www.tr-electronic.com/s/S019325.

TR Electronic can provide the relevant B10d value for the draw-wire box on request.

1) The $MTTF_d$ value for the draw-wire box can be calculated as follows:

$$MTTF_d = \frac{B10_d}{0.1 * n_{op}}$$

The total $MTTF_d$ value for the draw-wire box + measuring system can be calculated from this:

$$MTTF_{d\ (total)} = \frac{(\ MTTF_{d\ (draw\text{-}wire\ box)}\ *\ MTTF_{d\ (measuring\ system)}\ )}{(\ MTTF_{d\ (draw\text{-}wire\ box)}\ +\ MTTF_{d\ (Mess\text{-}System)}\ )} = \text{value in years [a]}$$

1) Abbreviations, also see page 7

2.9 Safety functions of the fail-safe processing unit

It is absolutely necessary that the **safety control** to which the measuring system is connected carries out the safety checks required according to the interface-specific User Manual.

2.10 Warranty and liability

The “General Terms and Conditions” of TR Electronic GmbH are applicable as a general rule. They will be submitted to the responsible organization along with the order confirmation or on conclusion of the contract at the latest. Warranty and liability claims in the event of personal injury or damage to property are excluded if they result from one or more of the following causes:

- Non-intended use of the measuring system.
- Improper assembly, installation, commissioning and programming of the measuring system.
- Work on the measuring system that is carried out improperly.
- Operation of the measuring system with technical defects.
- Unauthorized mechanical or electrical modifications to the measuring systems.
- Unauthorized repairs.
- Catastrophic events beyond human control and acts of God.

2.11 Organizational measures

- The other applicable documents must always be kept ready-to-hand at the place of use of the measuring system.
- In addition to the other applicable documents, generally valid legal and other binding regulations on accident prevention and environmental protection must be observed and communicated.
- The respective applicable national, local and system-specific provisions and requirements must be observed and communicated.
- The responsible organization is obliged to inform personnel on special operating features and requirements.
- Prior to commencing work, personnel handling the measuring system must have read and understood the Safety Manual, especially the chapter on “Basic safety instructions”.
- It must be ensured that the nameplate and any prohibition or instruction symbols provided on the measuring system are always legible.
- Do not modify the measuring system in any mechanical or electrical way; the only modifications allowed are those expressly described in the other applicable documents.
- Repairs may only be made by the manufacturer or a center or person authorized by the manufacturer.

2.12 Personnel selection and qualification; basic duties

- Only qualified personnel is allowed to work with the measuring system. Qualified personnel are persons, who, through their training, experience and instruction, as well as their knowledge of the relevant standards, provisions, accident prevention regulations and operating conditions, have been authorized by the persons responsible for the system to carry out the required work and are able to recognize and avoid potential hazards. They are capable of identifying and avoiding potential hazards.
- The additional definitions of “qualified personnel” given in the VDE 0105-100 and IEC 364 standards must also be understood (source: e.g. Beuth Verlag GmbH, VDE-Verlag GmbH).
- The responsibilities for assembly, installation, commissioning and operation must be clearly defined. Personnel to be trained or educated must be supervised.

2.13 Technical safety instructions

- **To prevent destruction, damage and malfunction of the measuring system, the instructions listed below must be followed.**
  - Wiring work may only be carried out and electrical connections only be opened and closed while the system is de-energized.
  - Do not carry out any welding work after the measuring system has already been wired or switched on.
  - Ambient temperature values may never fall below or exceed the permissible limit values; this must be ensured by taking the appropriate heating/cooling measures at the place of installation.
  - The measuring system must be installed such that it is not exposed to any direct moisture.
  - Suitable aeration/ventilation and heating/cooling measures must be taken at the place of installation to prevent the temperature falling below the dew point (condensation).
  - If an overvoltage of >36 V DC is inadvertently applied, the measuring system must be inspected at the factory, with specification of the reasons or circumstances.
  - Potential hazards resulting from interactions with other systems and equipment which are or will be installed in the vicinity must be determined. The user is responsible for taking appropriate measures.

⚠ WARNING

  - Voltage supply must be protected with a fuse suitable for the supply lead cross-section.
  - Cables used must be suitable for the temperature range.

NOTICE

  - If defective, the measuring system may not be operated.
  - Make sure that the installation environment is protected from aggressive media (acids, etc.).
  - Avoid shocks (e.g., hammer blows) to the shaft during installation.
  - It is prohibited to open the measuring system.
  - After having set the address switches and LEDs, ensure that they are no longer accessible by firmly closing the access with the screw plug.
  - Connector plugs of the measuring system that are unused during storage and/or operation of the system have to be provided either with a mating connector or with a protective cap. The IP degree of protection is to be selected according to requirements.
  - The measuring system is designed for use in environments with pollution degree 2 according to IEC 60664-1: *"Only non-conductive pollution occurs; however, temporary conductivity due to condensation must be expected occasionally"* (e.g., due to hand perspiration). Therefore, care must be taken during installation to ensure that pollution degree 2 is maintained. This applies in particular to the installation of connections, the attachment of protective caps to unconnected connections, and the replacement of the device.
  - The nameplate specifies the technical properties of the measuring system. If the nameplate is no longer legible or is completely missing, the measuring system may no longer be put into operation.

- **Deactivation of the safety function by radiation-bound sources of interference**

⚠ WARNING

NOTICE

Handheld radio devices that are operated within a radius of less than 20 cm of the power drive system (e.g. motor, frequency converter, measuring system, etc.) can deactivate the safety function of the measuring system or the safety sub-function of the complete power drive system.

- It must be ensured that handheld radio devices can only be operated at a distance of more than 20 cm from the measuring system.

- **The measuring system contains components and assemblies susceptible to electrical discharge, which can be destroyed if incorrectly handled.**
  - Do not touch the measuring system connection contacts with your fingers, or take the relevant ESD protective measures.

- **Disposal**
  - If the device has be disposed of after its service life has elapsed, the respective applicable country-specific regulations must be observed.

3 Transport / storage

- **Shipping information**
  - Do not drop the device or subject it to heavy impacts!
    The device contains an optical system.
  - Only use the original packaging.
    Inappropriate packaging material may cause damage to the unit in transit.

- **Storage**
  - Storage temperature of optical/magnetic scanning system: –30 to +80 °C
  - Storage temperature of double magnetic scanning system: –40 to +80 °C
  - Store at a dry place

4 General technical data

4.1 Safety

Functional safety

DIN EN 61508 Part 1-7, EN IEC 62061 ..... **S**afety **I**ntegrity **L**evel (SIL): SIL 3

EN ISO 13849-1 ..... **P**erformance **L**evel: PLe / Cat. 4

4.2 Supply

Nominal voltage ..... 24 V DC acc. to IEC 60364-4-41, SELV/PELV

At UL / CSA approval ..... according to NEC Class 2

Power consumption ..... ≤ 4 W

Optional HTL level ..... Increased power consumption according to the interface-specific User Manual

4.3 Ambient conditions

4.3.1 CDV75 / CDH75

Vibration

DIN EN 60068-2-6 ..... ≤ 100 m/s^2, sine 50-2000 Hz

Shock

DIN EN 60068-2-27 ..... ≤ 600 m/s^2, half-sine 5 ms

EMC

Immunity to disturbance ..... EN 61000-6-2

Transient emissions ..... EN 61000-6-3

Working temperature ..... Tu = f(n) = -20…+70 °C
POWERLINK/EtherCAT variant ..... Tu = f(n) = -25…+65 °C
Scanning system, double magnetic ..... Tu = f(n) = -40…+65 °C
CDV75, for n >100 1/min, IP54 ..... Tu = f(n) = 70 °C – (0.002 * n)
POWERLINK/EtherCAT ..... Tu = f(n) = 65 °C – (0.002 * n)
CDV75, for n >100 1/min, IP65 ..... Tu = f(n) = 66 °C – (0.002 * n)
POWERLINK/EtherCAT,
Scanning system, double magnetic.... Tu = f(n) = 65 °C – (0.002 * n)
CDH75, for n >100 1/min, IP54 ..... Tu = f(n) = 70 °C – (0.005 * n)
POWERLINK/EtherCAT ..... Tu = f(n) = 65 °C – (0.005 * n)
CDH75, for n >100 1/min, IP65 ..... Tu = f(n) = 60 °C – (0.01 * n)
Optional HTL level..... According to the interface-specific User Manual
Storage temperature ..... see chapter: 3 “Transport / storage”
Relative air humidity, DIN EN 60068-3-4..... 98 %, non-condensing
Degree of protection, DIN EN 60529 [1)] ..... IP 54
Optional ..... IP 65

[1)] valid with screwed-on mating connector and/or screwed-on cable gland

4.3.2 CDV115

Vibration
DIN EN 60068-2-6..... ≤ 100 m/s², sine 50-2000 Hz
Shock
DIN EN 60068-2-27..... ≤ 600 m/s², half-sine 5 ms
EMC
Immunity to disturbance ..... EN 61000-6-2
Transient emissions ..... EN 61000-6-3
Working temperature ..... Tu = f(n) = -25…+70 °C
POWERLINK/EtherCAT variant ..... Tu = f(n) = -25…+65 °C
Scanning system, double magnetic ..... Tu = f(n) = -40…+65 °C
for n >100 1/min, IP65..... Tu = f(n) = 66 °C – (0.002 * n)
POWERLINK/EtherCAT,
Scanning system, double magnetic.... Tu = f(n) = 65 °C – (0.002 * n)
Optional HTL level..... According to the interface-specific User Manual
Storage temperature ..... see chapter: 3 “Transport / storage
Relative air humidity, DIN EN 60068-3-4..... 98 %, non-condensing
Degree of protection, DIN EN 60529 [1)] ..... IP 65

[1)] valid with screwed-on mating connector and/or screwed-on cable gland

4.4 Mechanical specifications

4.4.1 CDV75

Mechanically permissible speed ..... ≤ 6000 min^{-1}
Electrically permissible speed
* Scanning system, double magnetic ..... ≤ 3000 min^{-1}
Shaft load, at the shaft end ..... ≤ 50 N axial, ≤ 90 N radial
Bearing life time ..... ≥ 3.9 * 10^{10} revolutions at
Speed ..... ≤ 3000 min^{-1}
Operating temperature ..... ≤ 60 °C
Shaft load, at the shaft end ..... ≤ 50 N axial, ≤ 90 N radial
Permissible angular acceleration ..... ≤ 10^4 rad/s^2
Inertia torque ..... Typically 2.6 * 10^{-5} kg m^2
Start-up torque at 20 °C ..... Typically 0.6 Ncm
with radial shaft seal ..... Typically 2 Ncm
Mass ..... Typically 1 kg

4.4.2 CDH75

Availability ..... Only with optical/magnetic scanning system
Mechanically allowed speed ..... ≤ 3000 min^{-1}
Shaft load ..... Own mass
Bearing life time ..... ≥ 3.9 * 10^{10} revolutions at
Speed ..... ≤ 1000 min^{-1}
Operating temperature ..... ≤ 50 °C
Permissible angular acceleration ..... ≤ 10^4 rad/s^2
Start-up torque at 20 °C ..... Typically 6 Ncm
Mass ..... Typically 1 kg

4.4.3 CDV115

Mechanically permissible speed ..... ≤ 3600 min^{-1}
Shaft load, at the shaft end ..... ≤ 100 N axial, ≤ 150 N radial
Bearing life time ..... ≥ 2.8 * 10^{10} revolutions at
Speed ..... ≤ 3000 min^{-1}
Operating temperature ..... ≤ 60 °C
Shaft load, at the shaft end ..... ≤ 60 N axial, ≤ 90 N radial
Permissible angular acceleration ..... ≤ 10^4 rad/s^2
Inertia torque ..... Typically 2.6 * 10^{-5} kg m^2
Start-up torque at 20 °C ..... Typically 0.6 Ncm
Mass ..... Typically 6 kg

* Limitation by the scanning chip. When the speed is exceeded, plus an individual tolerance, the measuring system is switched into the fail-safe status. Error acknowledgment about supply voltage OFF/ON.

5 Assembly

- **If the safety functions are deactivated because of an unstable shaft drive, there will be the danger of death, serious physical injury and/or damage to property!**
  - ➢ The system manufacturer must ensure "**Failure Exclusion**" through design measures: The mechanical coupling of the measuring system via the shaft and its mounting must be guaranteed at all times. To this end, the requirements of the following standards, each under the heading "Adjustable speed electrical power drive systems – Safety requirements," must be complied with:
    - DIN EN 61800-5-2:2017: Complete drive systems
      – in particular Table D.8: "Motion and position feedback sensors"
    - DIN EN IEC 61800-5-3:2024: Safety instrumented measuring system (Encoder)
      – in particular Table G.1: "Mechanic fault list and fault exclusions"

⚠ DANGER

NOTICE

- ➢ As a general rule, it is recommended to prevent radial slippage of the measuring system on the drive shaft by using a parallel key / groove combination to ensure a form-locking.
- ➢ In general, the requirements and acceptance conditions for the complete system must be taken into account when the measuring system is attached.
- ➢ All fastening screws must be secured such that they cannot be loosened accidentally.
- ➢ In case of applications with low ambient temperatures, the start-up torque will be increased. This fact must be taken into account during assembly and when providing the shaft drive.

Due to the variety of measurement system series (75/88/100/115...) and the variety of types within a measurement system series, the following text and dimensions information must be considered as exemplary and have to be adapted to the specific product.

5.1 Solid shaft

Since the installation situation depends on the particular application and type of device, the following instructions are not exhaustive.

5.1.1 Requirements

- Tolerances and mounting capabilities have to be gathered from the customized dimensional drawing
- The coupling used must be suitable for the application and allow form-locking connection.
- The coupling manufacturer's information and installation requirements must be observed.
- In particular, you must ensure that
  - the coupling is suitable for the specified speed and the potential axial offset,
  - installation is on a grease-free shaft,
  - there is no axial load on the coupling and the measuring system,
  - the clamping screws are tightened with the torque defined by the coupling manufacturer,
  - the coupling screws are secured such that they cannot be loosened accidentally.
- Axial slipping of the measuring system on the drive shaft must be prevented by fixing the coupling in position.
- General recommendation: Radial slipping of the measuring system on the drive shaft should be prevented by a form-locking connection, using a parallel key / groove combination for example; a coupling with groove can be used for this purpose.

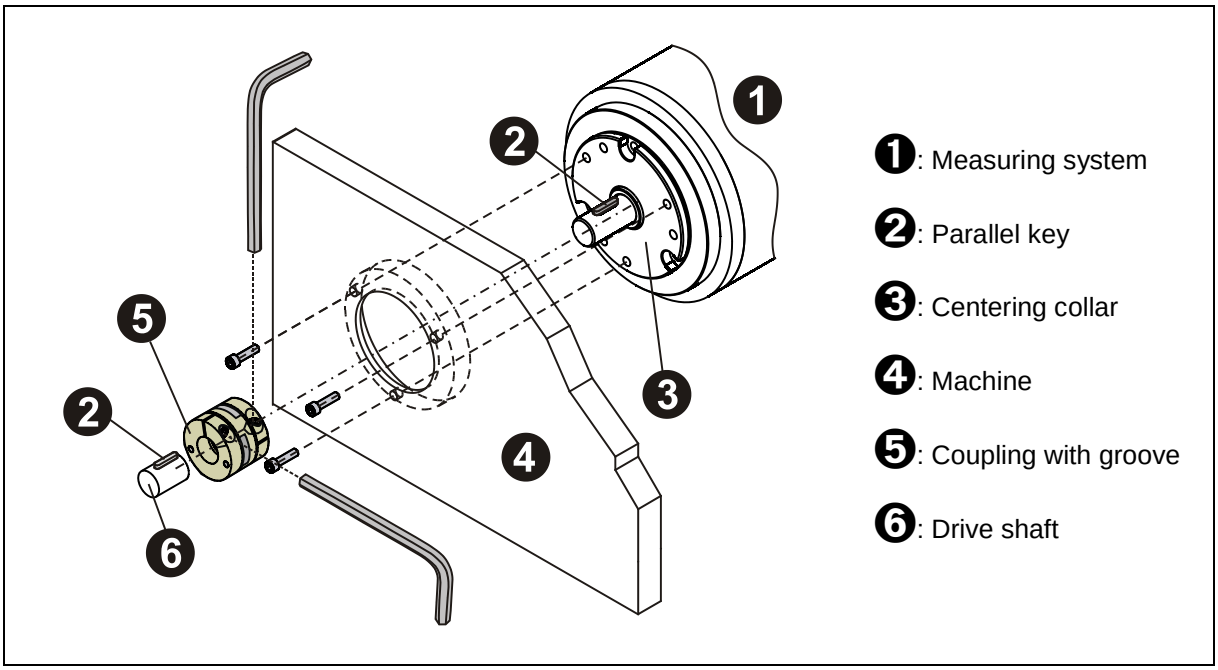

Figure 2: Installing the flange

5.1.2 Start-up torque of the shaft, CDV75

Temperature [°C]	Radius [cm]	Force [N]	Start-up torque [Ncm]
25	1.5	0.5	0.75
-20	1.5	1.5	2.25
-40	1.5	6.7	10.05

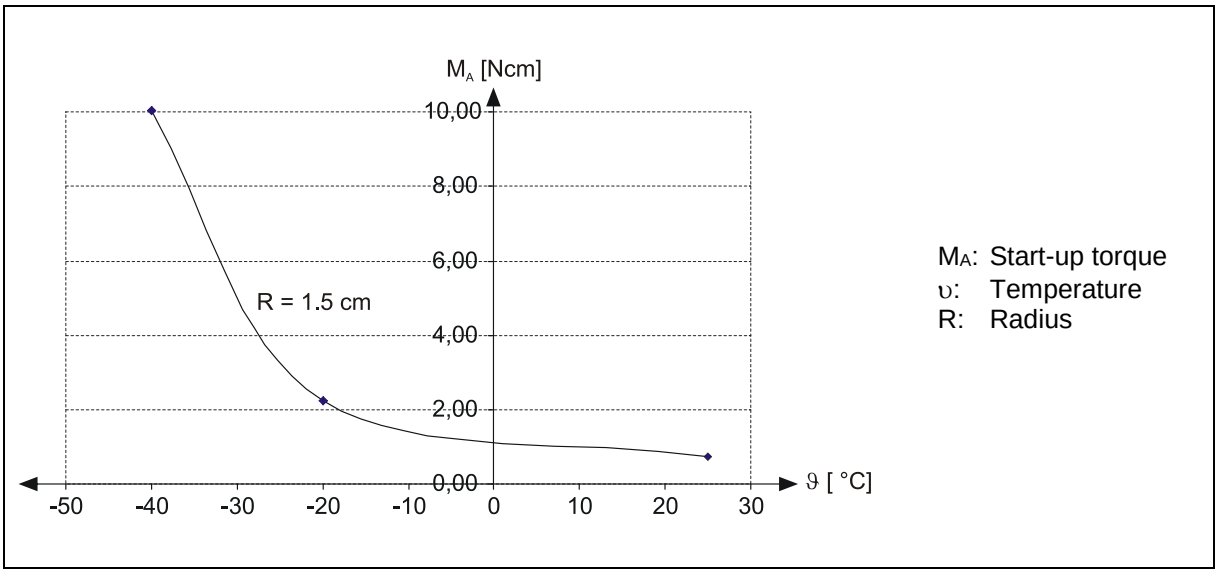

Figure 3: Start-up torque

5.2 Hollow shaft

The following information does not claim to be complete as the assembly situation depends on the application or model.

5.2.1 Requirements

- Please refer to the customer-specific drawing for any variations in size and individual assembly options.
- The measuring system must be installed on a grease-free shaft.
- Axial slipping of the measuring system on the drive shaft must be prevented by fixing the clamping ring in position, see Figure 4.
- Further measures may be required to prevent axial slipping of the measuring system.
- There may be no axial load on the clamping mechanism of the measuring system.
- The screw of the clamping ring must be tightened with 3 Nm using a torque wrench.
- The screw of the clamping ring must be secured such that it cannot be loosened accidentally.
- General recommendation: Radial slipping of the measuring system on the drive shaft should be prevented by a form-locking connection, using a parallel key/groove combination for example.

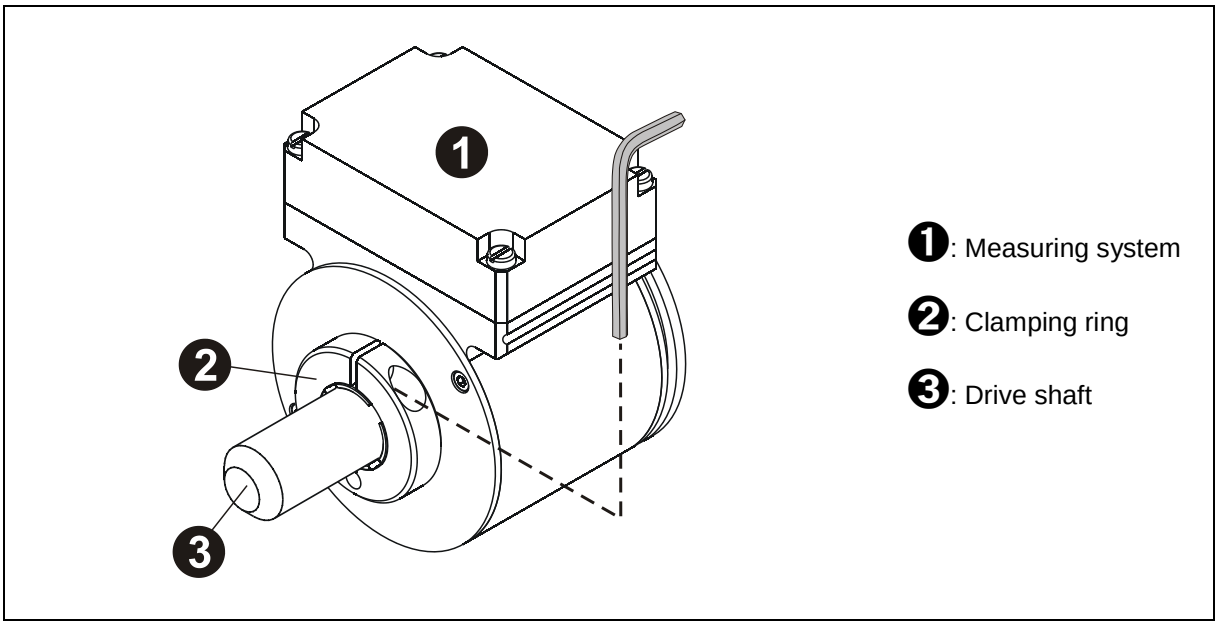

Figure 4: Friction locking

5.2.2 Dowel pin / groove insert

- A dowel pin is used to fix the measuring system on the drive end, see Figure 5.
- The dowel pin must extend at least 4 mm into the groove insert (max. 5.5 mm). The distance from the measuring system flange **Y** to the customer-provided device plane **X** must be> 1.5 mm, see Figure 6.
- The clamping ring assembly requirements must be observed, see Chapter: 5.2.1 “Requirements”.

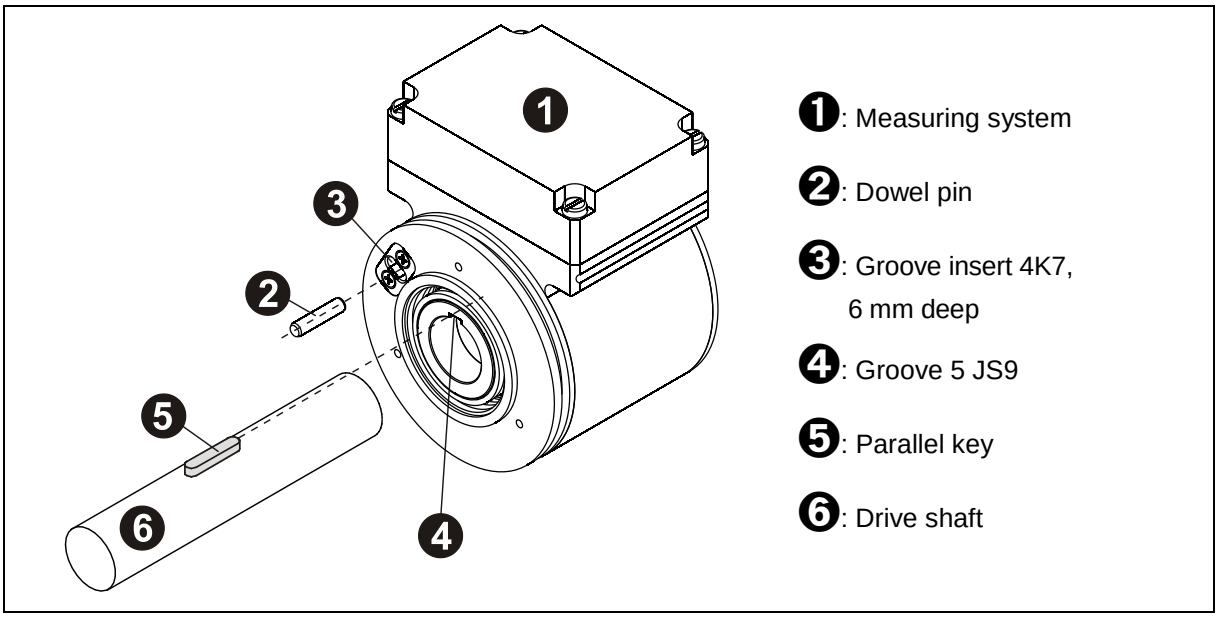

Figure 5: Form-locking

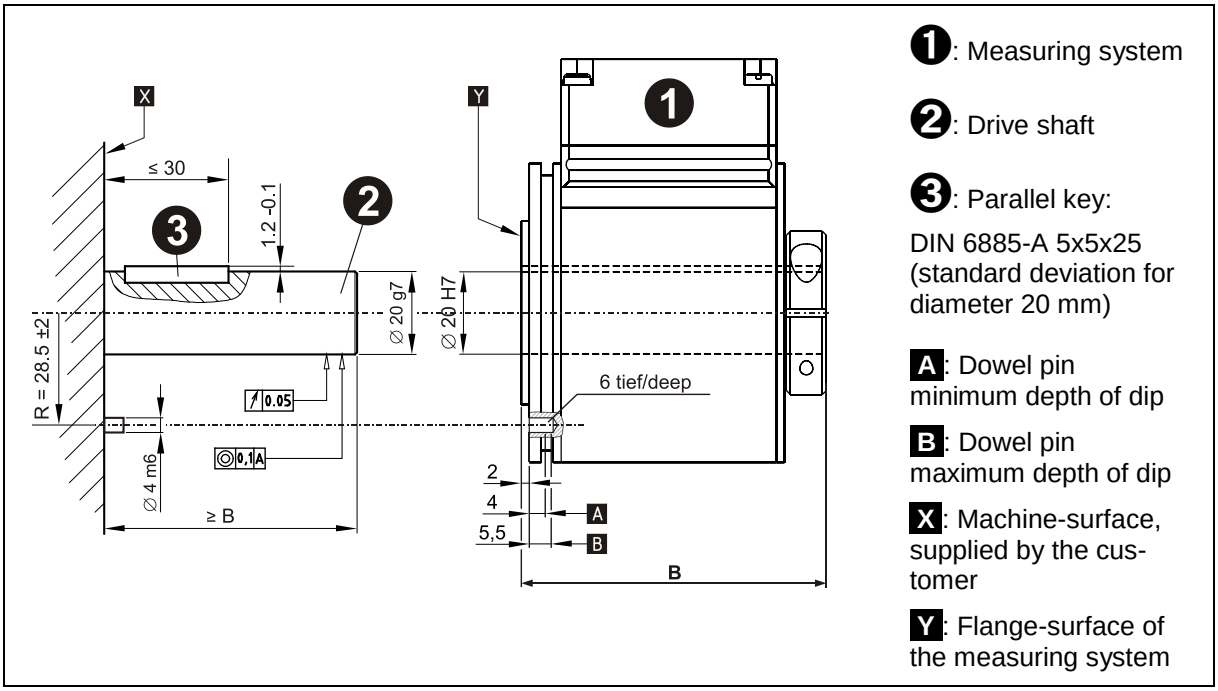

Figure 6: Shaft receptacle requirements

5.2.3 Joint head rod

- Please refer to the customer-specific drawing for any variations in size and individual assembly options. Please refer to the manufacturer's individual technical data for joint head rod specifications, such as the permissible tilt angle of the joint head.
- Two joint heads, a threaded rod and two M5 cheese head screws are required for assembly. See Chapter: 8 "Accessories / download".
- The joint head rod can be positioned on the measuring system flange in several ways. See Figure 9: Joint head rod – mounting variants.
- For maximum support of the measuring system, the joint head rod must be mounted at a 90° angle to the line connecting the threaded hole to the center of the shaft, see Figure 9.
- The M5 screws must be tightened with a tightening torque of 2.2 Nm and secured against unintentional loosening with a medium-strength screw locking device.
  - Ensure the thread is sufficiently long for the screws to be completely screwed in.
- The minimum thread reach into the flange plate (machine) is 4 mm in steel and 6 mm in aluminum. The minimum thread reach into the measuring system flange is 6 mm.
- The mounting surfaces should be free of any lubricants or dirt.
- The clamping ring assembly requirements must be observed, see Chapter: 5.2.1 "Requirements".

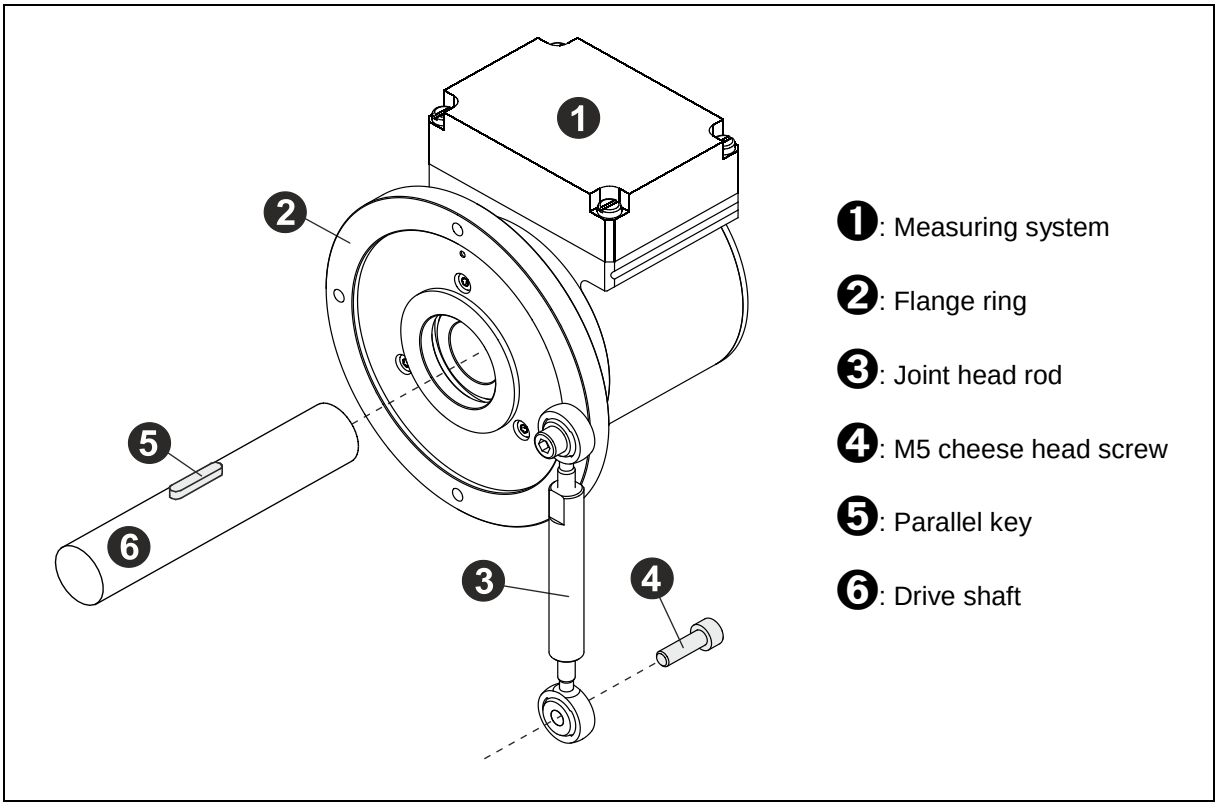

Figure 7: Positive engagement and joint head rod

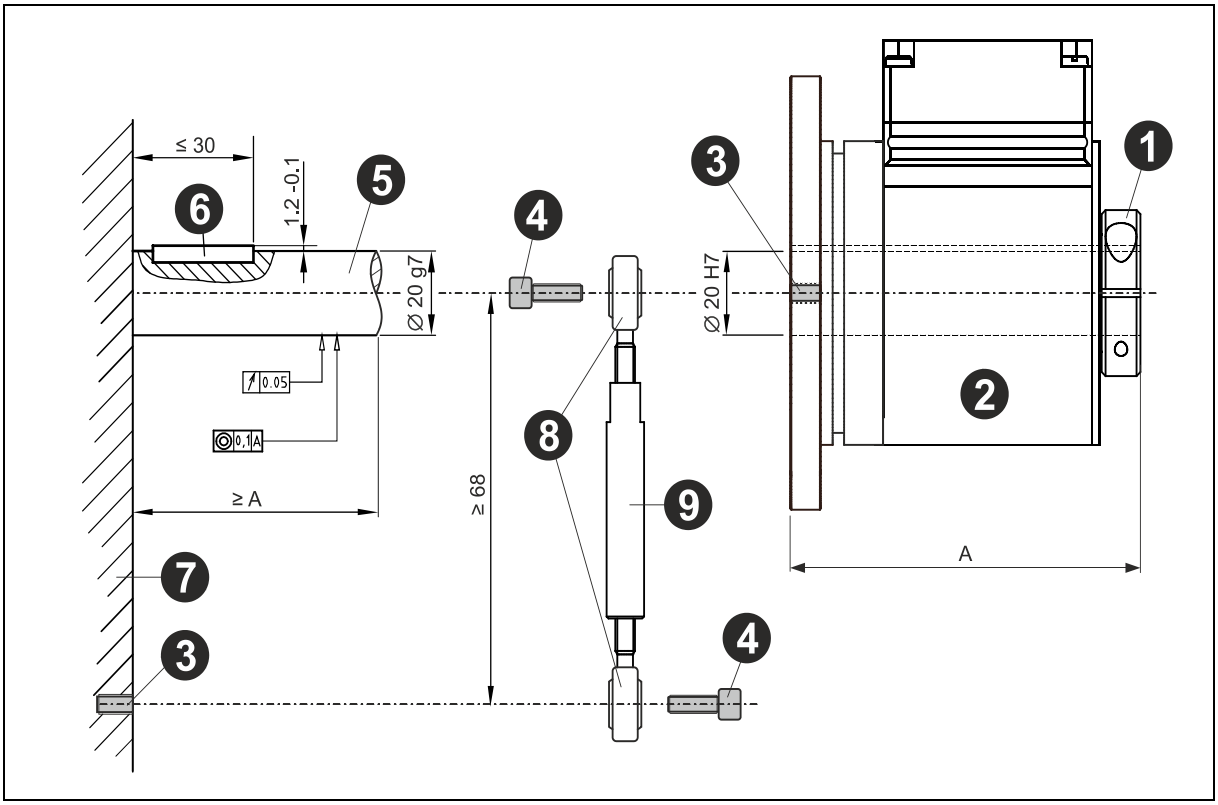

Figure 8: Shaft accommodation requirements

Components:

1: Clamping ring with screw
2: Measuring system with hollow shaft (H7 fit, according to article number in referenced drawing)
3: M5 threaded hole
4: 2x M5 cheese head screws
5: Drive shaft with g7 fit, provided by customer
6: Parallel key, according to the article number in the referenced drawing
7: Flange plate (machine)
8: 2x joint head
9: Threaded rod

Mounting variants:

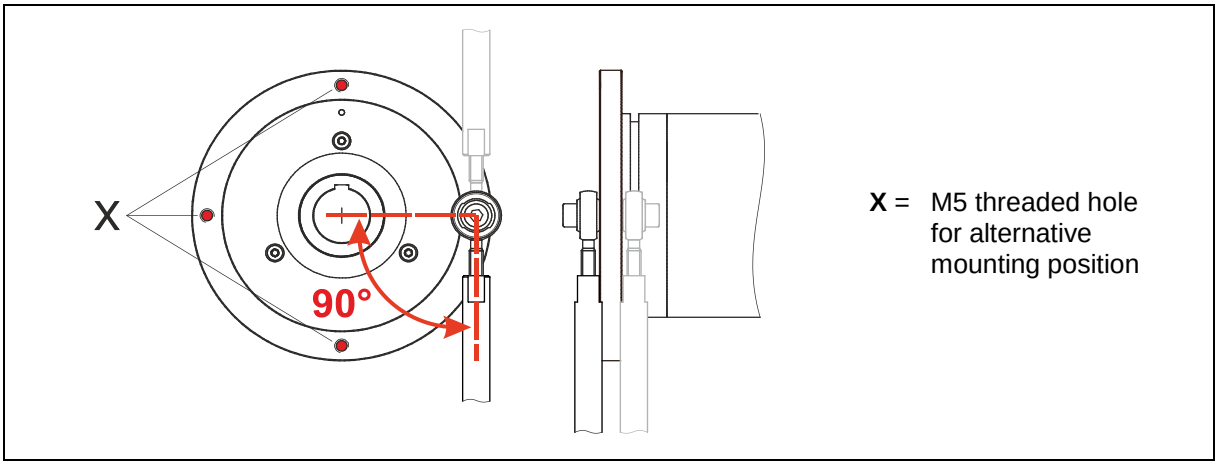

Figure 9: Joint head rod – mounting variants

5.3 Blind-hole shaft

Since the installation situation depends on the particular application and type of device, the following instructions are not exhaustive.

5.3.1 Requirements

- Tolerances and mounting capabilities have to be gathered from the customized dimensional drawing
- The measuring system must be installed on a grease-free shaft.
- Axial slipping of the measuring system on the drive shaft must be prevented by fixing the clamping ring in position, see Figure 10.
- Further measures may be required to prevent axial slipping of the measuring system.
- There may be no axial load on the clamping mechanism of the measuring system.
- The screw of the clamping ring must be tightened with 3 Nm using a torque wrench.
- The screw of the clamping ring must be secured such that it cannot be loosened accidentally.
- General recommendation: Radial slipping of the measuring system on the drive shaft should be prevented by a form-locking connection, using a cylinder pin / groove combination for example; in this case the measuring system can be fixed in position on the drive end using a dowel pin, see Figure 11. The dowel pin must extend at least 4 mm into the groove insert.

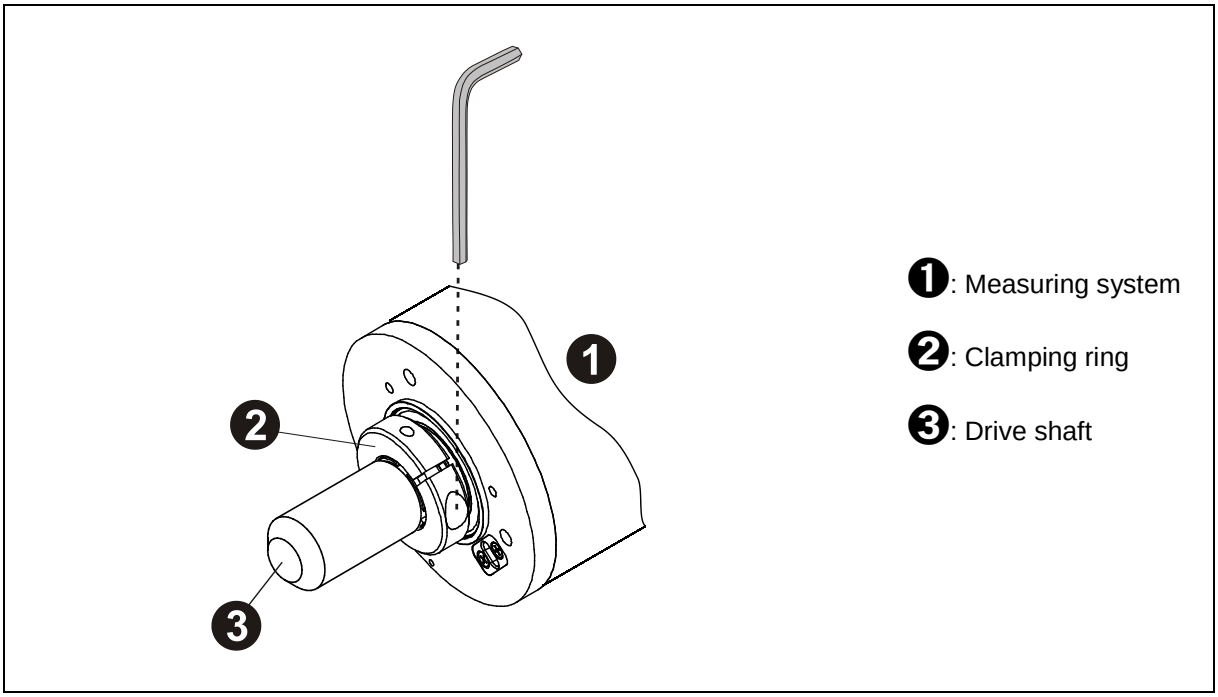

Figure 10: Friction locking

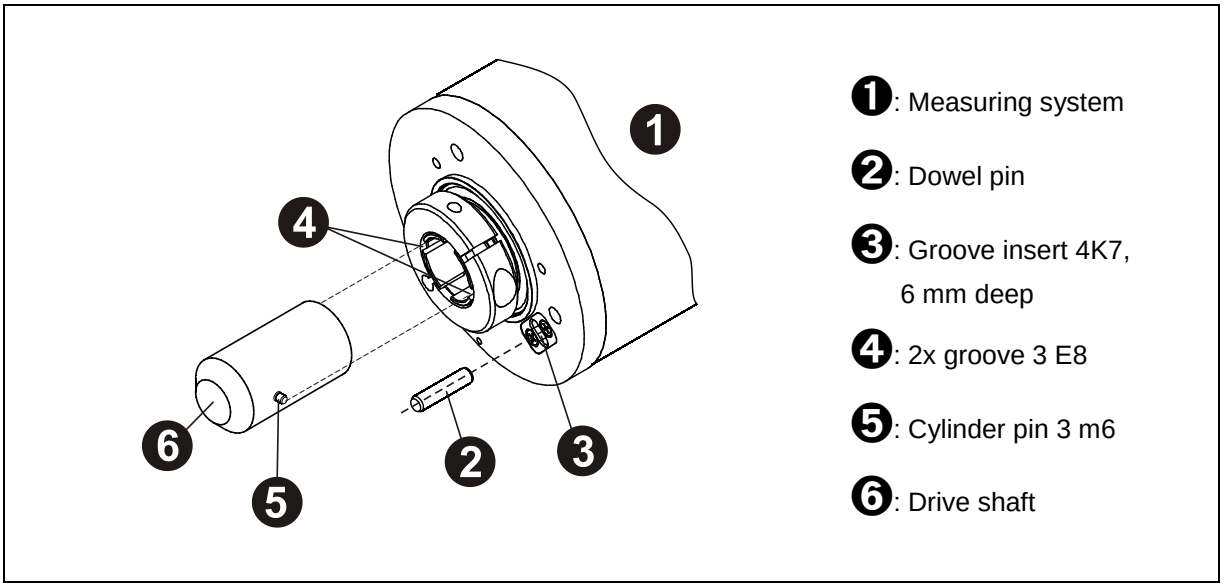

Figure 11: Form-locking

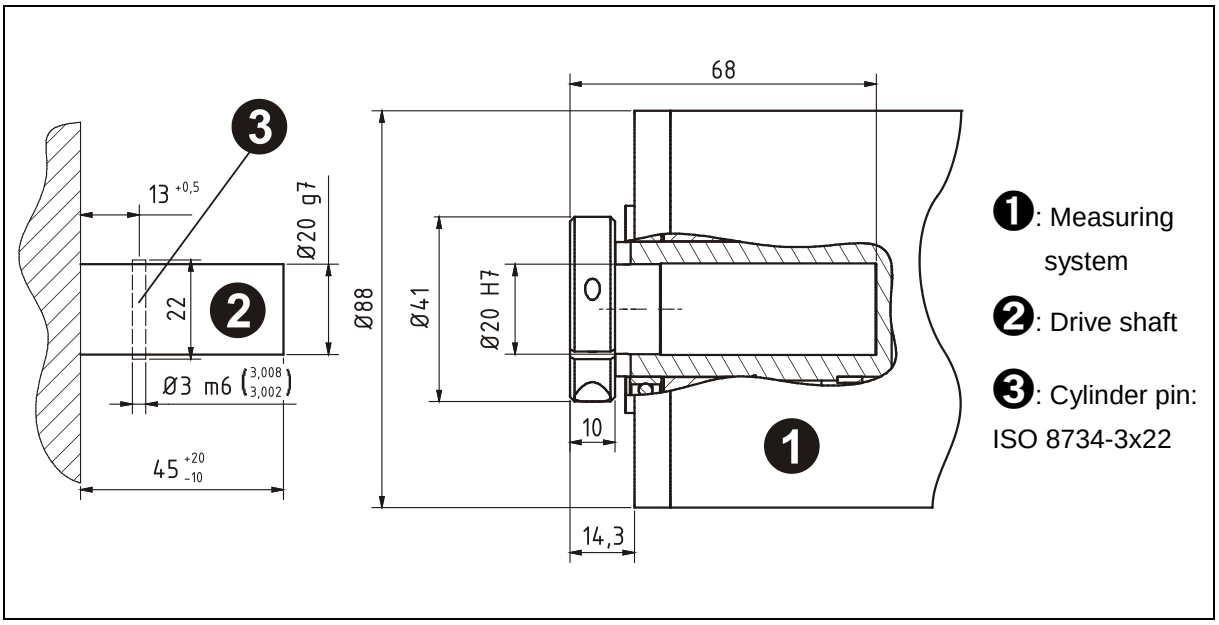

Figure 12: Shaft receptacle requirements

6 Replacing the measuring system

Ensure that you meet the following requirements while replacing the measuring system:

- The new measuring system must have the same article number as the measuring system being replaced; any deviations must be expressly clarified with TR Electronic.
- When the new measuring system is used, it must be ensured that the hardware switch settings comply with the previous settings.
- The new measuring system must be installed in accordance with the specifications and requirements in chapter “Assembly” on page 20.
- The new measuring system must be connected in accordance with the specifications in the interface-specific User Manual.
- Since the parameters of the measuring system are usually stored in the control, the new measuring system is parameterized with the projected settings in the start-up phase. If this mechanism fails, it must be ensured that the settings for the new measuring system are the same as those for the old one.
- Depending on the application, the output position value must possibly be adjusted to the reference position of the machine. The position value must be adjusted as specified in the interface-specific User Manual.
- Before the replaced measuring system is recommissioned, its proper functioning must be verified in a protected test run.

7 Checklist, part 1 of 2

We recommend that you print out and work through the checklist when commissioning and replacing the measuring system and when changing the parameterization of a previously accepted system and store it as part of the overall system documentation.

Documentation reason	Date	Processed	Reviewed

Sub-item	Please ensure	Can be found under	Yes
The present Safety Manual has been read and understood	–	Document no.: TR-ECE-BA-GB-0107	☐
Interface-specific User Manual	• Go through and use the checklist part 2 of 2	See chapter Accessories / download on page 31	☐
Verify that the measuring system can be used for the present automation task on the basis of the specified safety requirements	• Intended use • Comply with all technical data	• Chapter Intended use, page 10 • Chapter General technical data, page 17 • Interface-specific User Manual (checklist part 2 of 2)	☐
Meet the assembly requirements defined in the Safety Manual	• Safe mechanical attachment of the measuring system. General recommendation: Form-locking connection of the driving shaft to the measuring system	• Chapter Assembly, page 20	☐
Power supply requirements	• The power supply unit used must meet the requirements of SELV/PELV (IEC 60364-4-41:2005)	• Chapter Supply, page 17 • Interface-specific User Manual (checklist part 2 of 2)	☐
Correct – electric installation (shielding) – network installation	• Comply with general installation rules • Comply with wiring standards • Comply with the guidelines provided by the particular field bus user organizations	• Interface-specific User Manual (checklist part 2 of 2)	☐
System test according to commissioning and parameter changes	• During commissioning and whenever parameters have been changed all safety functions involved must be checked	• Interface-specific User Manual (checklist part 2 of 2)	☐
Preset adjustment function	• The preset adjustment function may only be executed when the axis in question is at standstill • Ensure that the preset adjustment function is prevented from being triggered accidentally • After execution of the preset adjustment function, the new position must be checked before restarting	• Interface-specific User Manual (checklist part 2 of 2)	☐
Device replacement	• Ensure that the new device corresponds to the replaced device • Check all safety functions involved	• Chapter Replacing the measuring system, page 29 • Interface-specific User Manual (checklist part 2 of 2)	☐

8 Accessories / download

Accessories

Description	Order no.:
Protective cap yellow, M12x1 female thread with O-ring, IP65. Suitable for supply voltage connector	62-000-1664
Protective cap black, M12x1 male thread without O-ring, IP50. Suitable for bus and incremental interface connector	62-000-1344
O-ring DIN-3771 7x1 NBR 70 SHORE Suitable for protective cap 62-000-1344 --> IP65	26-000-332
Joint head M5	49-280-002
Threaded rod M5, ⌀ 10 mm x 60 mm	49-917-026
Threaded rod M5, ⌀ 10 mm x 105 mm	49-995-200
Threaded rod M5, ⌀ 10 mm x 360 mm	49-917-022

Download interface-specific User Manual

Designation	Link
PROFIBUS/PROFIsafe	www.tr-electronic.de/f/TR-ECE-BA-GB-0092
PROFINET/PROFIsafe	www.tr-electronic.de/f/TR-ECE-BA-GB-0095
POWERLINK/openSAFETY	www.tr-electronic.de/f/TR-ECE-BA-GB-0110
EtherCAT/FSoE	www.tr-electronic.de/f/TR-ECE-BA-GB-0118

9 EU Declaration of conformity

EC / EU Declaration of Conformity

The Rotative Measuring Systems **CD_75M(M) and CDV115M(M)**

Type: CDV75M, CDH75M, CDV115M
Order-No.: CDV75M-xxxxx, CDH75M-xxxxx, 0002-00019, 0002-00028, 0002-00035, 0002-00038, CDV115M-xxxxx

was developed, designed and manufactured to comply with the EU-Directives

Electromagnetic Compatibility (EMC)	**2014/30/EU**	(L 96/79)
Machinery Directive	**2006/42/EC**	(L 157/24)
Restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)	**2011/65/EU**	(L 174/88)

under the sole responsibility of

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Tel.: +49 7425/228-0
Fax: +49 7425/228-33
Germany

The following harmonized standards were applied:

EN 61000-6-2:2005/AC:2005 with increased test standards: DIN EN 61326-3-1:2018	Generic standards - Electromagnetic compatibility, Immunity (Industrial environments)
EN 61000-6-3:2007/A1:2011	Generic standards - Electromagnetic compatibility, Emissions (Commercial environments)
EN 61800-5-2:2007	Adjustable speed electrical power drive systems Safety requirements - Functional
EN ISO 13849-1:2023	Safety of machinery - Safety-related parts of control systems General principles for design
EN 60204-1:2018 (in extracts)	Safety of machinery - Electrical equipment of machines General requirements
EN IEC 62061:2021	Safety of machinery - Functional safety of safety-related control systems
EN ISO 20607:2019	Safety of machinery - Instruction handbook - General drafting principles
EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Other applied standards:

DIN EN 61508 Part 1-7:2011	Functional safety of electrical/electronic/programmable electronic safety-related systems

The EC type examination and certification according to the EC machinery directive as Logic Unit For Safety Functions was carried out by the notified body:

NB0035, TÜV Rheinland Industrie Service GmbH,
Alboinstr. 56,
12103 Berlin
Certificate-No.: 01/205/5518.00/16

Authorized to compile the technical file:

TR Electronic GmbH, Eglishalde 6, 78647 Trossingen, Germany

Trossingen, 04/23/2025

Mr. Klaus Tessari, CEO

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