Installation instructions
General instructions for sensors/safety sensors
Mounting examples for rotary encoders/cam switches

SUPREME SENSORING
TWK

Document No.: AN 16169 CE
Date: 21 Feb 2023

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- Usage
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General notes

The purpose of these installation instructions is to install the product in the correct manner so that it can be put into operation safely and without danger.

These instructions are designed for TWK's product portfolio, as well for safety sensors.

In the second part of this document mounting examples for rotary encoders and cam switch units are shown, although not every individual design is discussed explicitly or separately. Due to the similarity of the products, the essential information and the associated requirements for using the product and its installation are explained. However, this document does not replace the product- and application-related documents and standards, but serves as a supplement.

Please follow the procedures and instructions given in this document to ensure the longest and most trouble-free use of the product. Until use, the product must be stored and transported properly, if possible in the original packaging. After use, the product must be disposed of in a professional and environmentally friendly manner.

Important information: Must be followed:

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40210 Düsseldorf
Tel.: +49 211 961170
info@twk.de
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Applicable documents

Applicable documents

Various documents must be observed for the intended and correct use of a product. The type and number of documents may vary depending on the design of the product and the customer's agreement. The documents are mainly addressed to the different instances/employees of the individual development stages of an application: planning, development, purchasing, production, on-site assembly, support. They can also be used interdisciplinary.
The documents also include electronic files, e.g. an EDS file.

Main documents:

- Datasheet
- Handbook
- Electrical connecting diagram TY (= pinout of connector, with presetting information, if applicable)

For explosion-protected units (ATEX) the following installation instructions must also be observed:

- Zone 1 and zone 21: “Installation instructions for ATEX / Model 78” AN16370
- Zone 2 and zone 22: “General safety instructions for TWK sensors - ATEX” ALG14080

Further documents (if available)**:**

- Installation drawing / step file for special versions with deviations from the datasheet
- Electronic datasheet for control system (e.g. EDS / ESI / GSD / GSDML / IODD etc.)
- xml file for TWK-CRC calculation programme (safety checksum)
- Variant description for special versions
- Certificates, test reports, linearity letters
- TWK factory test certificates according to EN10204-2.1 / -2.2 / -3.1
- EU declaration of conformity 12467, IHK certificate of origin, TWK terms and conditions MK15497
- Update files and associated instructions
- Documents for accessories used (e.g. gear wheel or stator coupling / torque support)

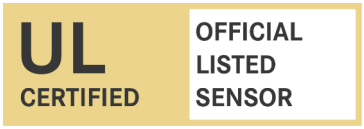
Existing certifications for increased safety level (product-dependent)

- **SIL2 according to IEC 61508**

- **ASIL-D according to ISO 26262**

- **Kat 2 / PLd according to ISO 13849-1**

- **cULus according to UL 50E and 61010-1**



- **ATEX according to EU Directive 2014/34/EU and Standard IEC 60079**
  For the following zones: gas: zone 1 und zone 2
  dust: zone 21 und zone 22

- **E1 approval according to UN-R10, 06 series of amendments**

Other measures for increased safety level:

- **R1 / R2 redundant - full redundant rotary encoder**

Within the framework of the above-mentioned standards, the corresponding procedures and measures must be observed when handling the product. In order to meet the requirements of the standards, all components used must be designed according to the application. Details can be found in the respective product datasheet and product manual.

Instructions for commissioning

Precondition

- As an electronic device, the measuring system is subject to the regulations of the EMC Directive. Commissioning of the product is only permitted once it has been ensured that the application in which the product is to be installed complies with the provisions of the EU EMC Directive, the harmonised standards, European standards or the corresponding national standards.
- Observe international, national, regional and company regulations and standards.
- Observe the regulations on accident prevention and environmental protection.
- General and current TWK terms and conditions MK15497 (e.g. warranty conditions).

Environment

- The following points in particular must be taken into account in accordance with the datasheet:
  - Sensor system → external magnetic fields (for magnetic sensors)
  - IP protection class → wetness and water pressure (also observe mating plugs and cables)
  - Operating temperature range → ambient temperature
  - EMC / ESD → surrounding electromagnetic and electrostatic fields (also supply lines)
  - Enclosure material → acids, salty environment, food suitability

Documentation

- Application-specific operating instructions for the operator
- Higher-level documentation (e.g. for the bus system used for data transmission)
- Documents assigned to the product incl. accessories (see page 2)

Responsibility

- Installation and commissioning of the product/application only by competent and trained personnel. They must be assigned and responsible.
- If necessary, a second person of staff must be present if the installation and commissioning suggests it.

Procedure

- Only use the product as intended to avoid danger to life and limb and material assets.
- Check the type plate of the product to determine whether it is the intended product.
- Observe and do not remove information signs affixed to the product. (e.g. "Not certified" in the case of prototypes of delivered devices).
- Ensure that the product is in flawless condition and may therefore be installed.
- Use suitable assembly materials (original accessories if available) and appropriate tools.
- The mounting surface and the parts to be installed must be clean and level.
- Use fixing elements according to specification (e.g. tighten screws with suitable tightening torque)
- Assemble, lay and connect cables / plugs according to specification (e.g. observe the bending radius). The IP protection class specified in the device data sheet only applies in conjunction with suitable mating connectors and proper cable installation. The mating connector must be plugged on sufficiently tightly.
- Do not use the product in potentially explosive atmospheres (ATEX) unless it has been expressly intended for this purpose. See safety instruction for ATEX zone 1/21: AN16370 and for zone 2/22: ALG14080.

Miscellaneous

- Ensure sufficient cooling of the product in hot environments.
- Do not carry out any repairs or modifications to the product (see Handling of the product).
- If necessary, dispose of the product in a professional and environmentally friendly manner.

Electrical connection

Notes on the electrical connection

The following must be observed for the electrical connection.

- Observe the pin assignment TY (pin assignment / strand colours) and the datasheet.
- Only connect or disconnect plug connections or other electrical connections when device is switched off.

- Switch the supply voltage as bounce-free as possible.
- Use metallised plugs if possible
- Connect the shielding to the connector housing
- Use shielded cables if possible - if necessary with twisted pair strands for certain functions
- Take into account the minimum bending radii of the cables used
- Use suitable cables (e.g. drag chain suitable / highly flexible). Use TWK accessories if necessary
- Mount mating connector and cable according to manufacturer's instructions for compliance with IP protection class
- Route signal cables as far away as possible from power cables (e.g. from motors)
- Make a low-impedance connection between enclosure and earth

- Use a suitable and approved power supply, fuse product separately if necessary. E.g. for **ATEX** devices and/or **UL** certified devices. See safety instructions for ATEX sensors zone 1/21: AN16370 and for zone 2/22: ALG14080.
- For electronic cam switches, ensure that the switching contacts are correctly integrated into the safety chain. If a relay/contactor (with coil) is switched with the switching contacts, **protective elements** must be used to reduce reverse voltages when the unit is switched off (diodes).

Functional Safety

available product certificates: see page 3

Notes on Functional Safety

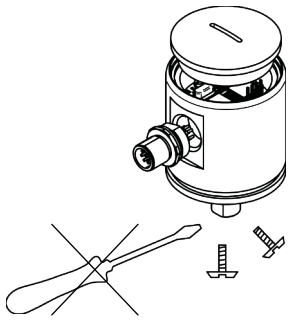
Especially for devices that are developed and used in the application within the scope of functional safety, special measures must be taken into account in order to use the safety functions and not to jeopardise their effect. However, they apply to all products and applications for professional installation.
The functional safety standards listed on page 3 *only* apply to the certified TWK product. The correct installation and connection of the product is the responsibility of the user, taking into account the standards applicable to the application (e.g. Machinery Directive, application-specific safety standards, etc.).

- Check the validity of the certificates for the product and the application and have them available
- Necessary documents and instructions for the product must be at hand
- The product must be mounted firmly and non-rotatably
- The shaft coupling must be designed to be fixed and torsion-proof/positive (e.g. feather key)
- The product must be adequately protected within the scope of its specification (environmental influences)
- The product must be connected to the control unit via a suitable and secure cable connection
- The control system must be suitable for the product and the application (safety control system)
- The control program must meet the required safety criteria (safe reading + processing of data, CRC checks)
- Access to the product (changing of parameters) may only be carried out by trained specialist personnel who are aware of the effect of the changes
- Regular checks must ensure the functional safety of the application and the product during lifetime

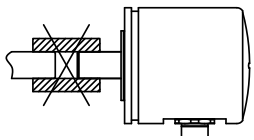
Handling the product

The following must be observed during general handling. Improper handling will result in the loss of the warranty claims. If you have any questions, please use our free advice service Tel.: +49 (0)211 96117-0.

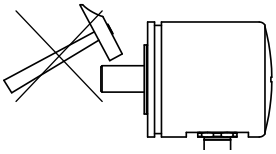
- Do not allow aggressive media (acid etc.) to act on the product.
- The unit must not be opened or dismantled. There is a risk of damage and malfunction.



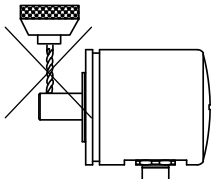
- Do not connect the unit and drive shaft with a rigid coupling. We recommend flexible and torsionally stiff couplings. Accessories available on www.twk.de.



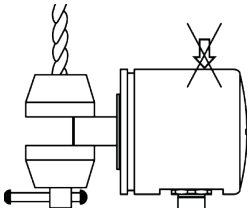
- Do not hit the shaft or the housing. There is a risk of internal damage.



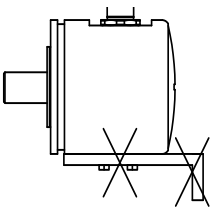
- The shaft must not be drilled or ground. There is a risk of internal damage.



- Do not apply higher axial or radial forces than specified to the shaft.



- Do not use inappropriate assembly methods. There is a risk of malfunction.



Mounting examples for rotary encoders and cam switches

Usage of rotary encoders and electronic cam switches

Rotary encoders serve the purpose of detecting a rotational movement - for example that of a mechanical output shaft of a motor or another mechanical application. This rotational movement is converted into an electrical signal (digital or analogue) by means of the encoder in order to transmit it over a certain distance and to process it with a controller assigned to the application. The control system carries out open-loop and closed-loop control processes in order to achieve the desired result of the application optimally and safely. In the case of electronic cam switch units, additional relay switching contacts are present that usually fulfil safety-related functions, for example in a safety chain that initiates an emergency shutdown of the application based on the signal of a component. Therefore, it is necessary to design the mechanical and the electrical connection of the product in a fault-free manner in terms of the specifications for avoiding damage on the encoder and application side. Actions on the product that are not permitted or recommended should be avoided.

Incorrect use and installation can also cause malfunctions of the components, making the angle of rotation detection and other functions faulty. **In addition, the listed documents and applicable standards of the respective product and application must always be observed for further details.**

Below are some examples of how an encoder can be mounted, partly with the help of accessories. Since the installation situation depends on the application, the following information does not claim to be exhaustive.

A shaft coupling (e.g. jaw coupling) is used to compensate for a static and dynamic offset of the output and encoder shaft (axial and radial). But it is torsionally stiff in order to exclude a rotation angle error. Output shaft and encoder shaft must protrude sufficiently far into the coupling (overlap >≈ 10 mm). Especially when using a feather key.

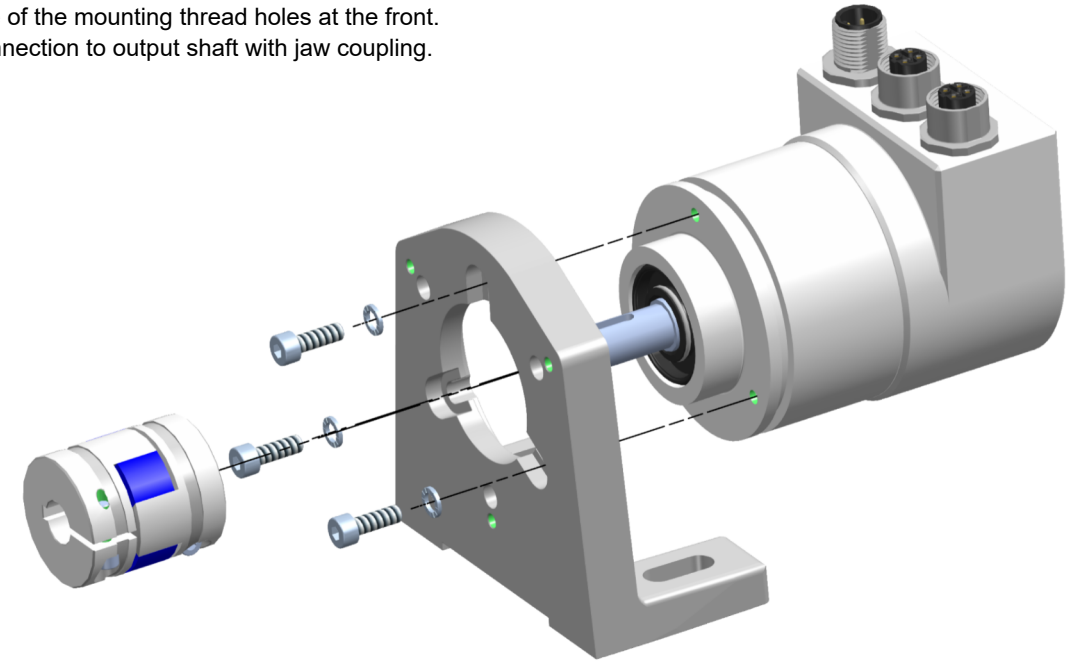
The correct tightening torque of the mounting screws must be observed. This is determined by the thread size (e.g. M4 or M6), the strength class of the screw material (e.g. 6.8 or 8.8 or A2-70) and, to a certain extent, also by the screw-in depth into the thread of the encoder or the mounting angle (→ screw length), by its strength (material) and, in some cases if applicable, by other boundary conditions. Relevant information material for the components used must be consulted. Example: screw (steel) with thread M4 and strength class 8.8: Tightening torque = 3 Nm.

Fixing material is usually not included in the scope of delivery (screws, washers, etc.). Suitable material (e.g. with sufficiently high strength class) must be used. All fastening screws must be secured against unintentional loosening, for example by gluing or other securing measures (spring washer).

Mounting examples for rotary encoders and cam switches

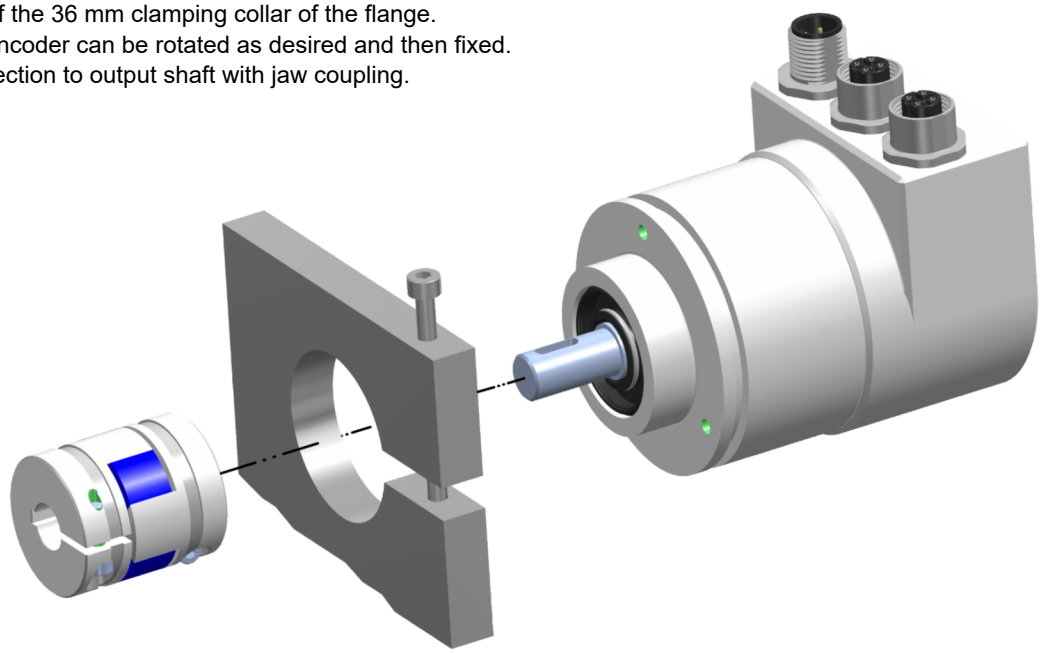
Rotary encoder with solid shaft and clamping flange on mounting bracket

Use of the mounting thread holes at the front.
Connection to output shaft with jaw coupling.



Rotary encoder with solid shaft and clamping flange on customer's clamping device

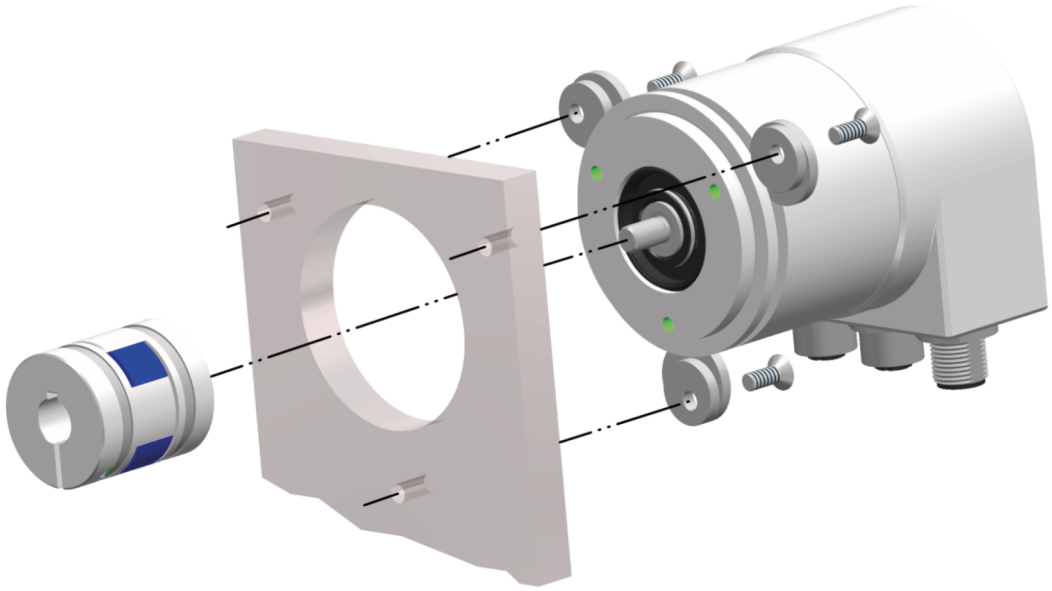
Use of the 36 mm clamping collar of the flange.
The encoder can be rotated as desired and then fixed.
Connection to output shaft with jaw coupling.



Mounting examples for rotary encoders and cam switches

Rotary encoder with solid shaft and synchro flange on customer's mounting plate

Use of synchro clamps (3 pieces). The encoder can be rotated as desired and then fixed.
Connection to output shaft with jaw coupling.

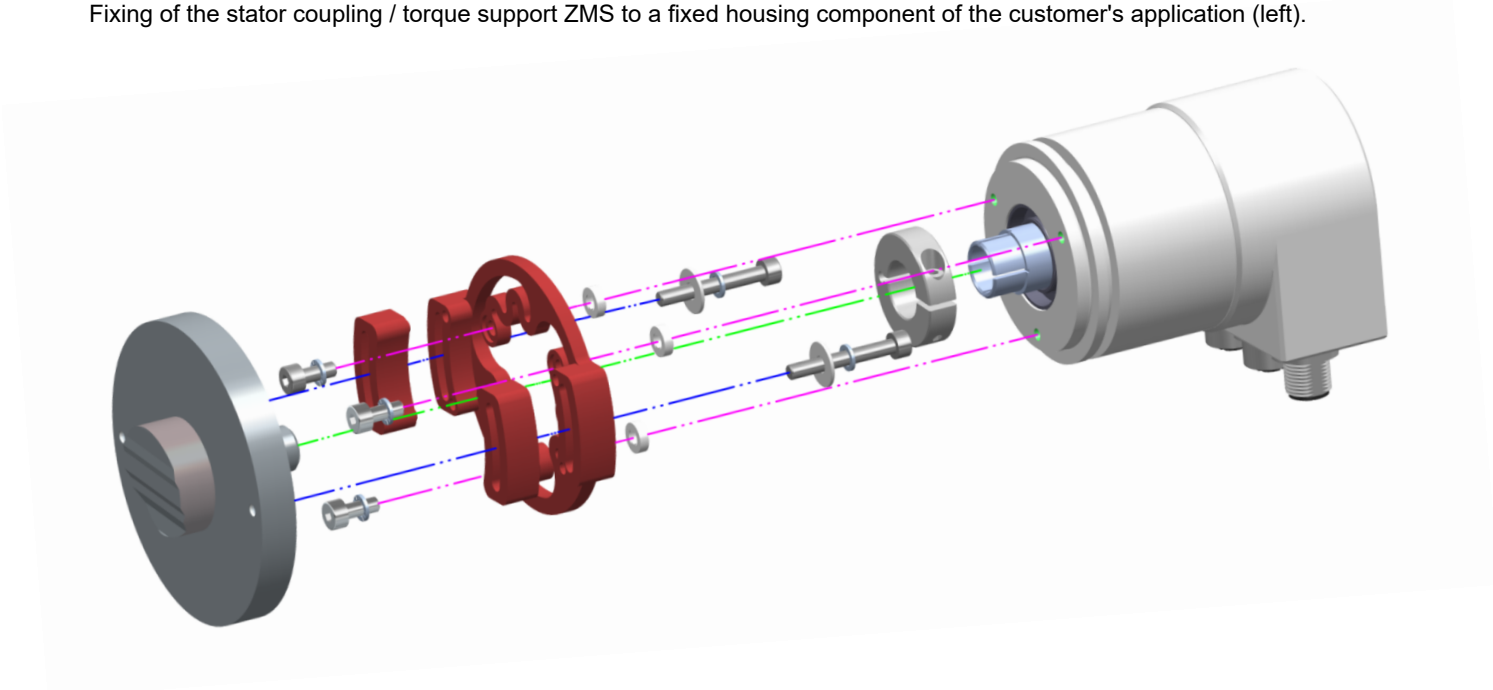


Rotary encoder with clamping shaft and stator coupling / torque support attached to the application

Direct (rigid) connection to the output shaft by means of the encoder's clamping shaft.

Tolerance compensation (e.g. eccentricity) of the shafts by flexible but torsionally stiff torque support ZMS (see datasheet 12939).

Fixing of the stator coupling / torque support ZMS to a fixed housing component of the customer's application (left).

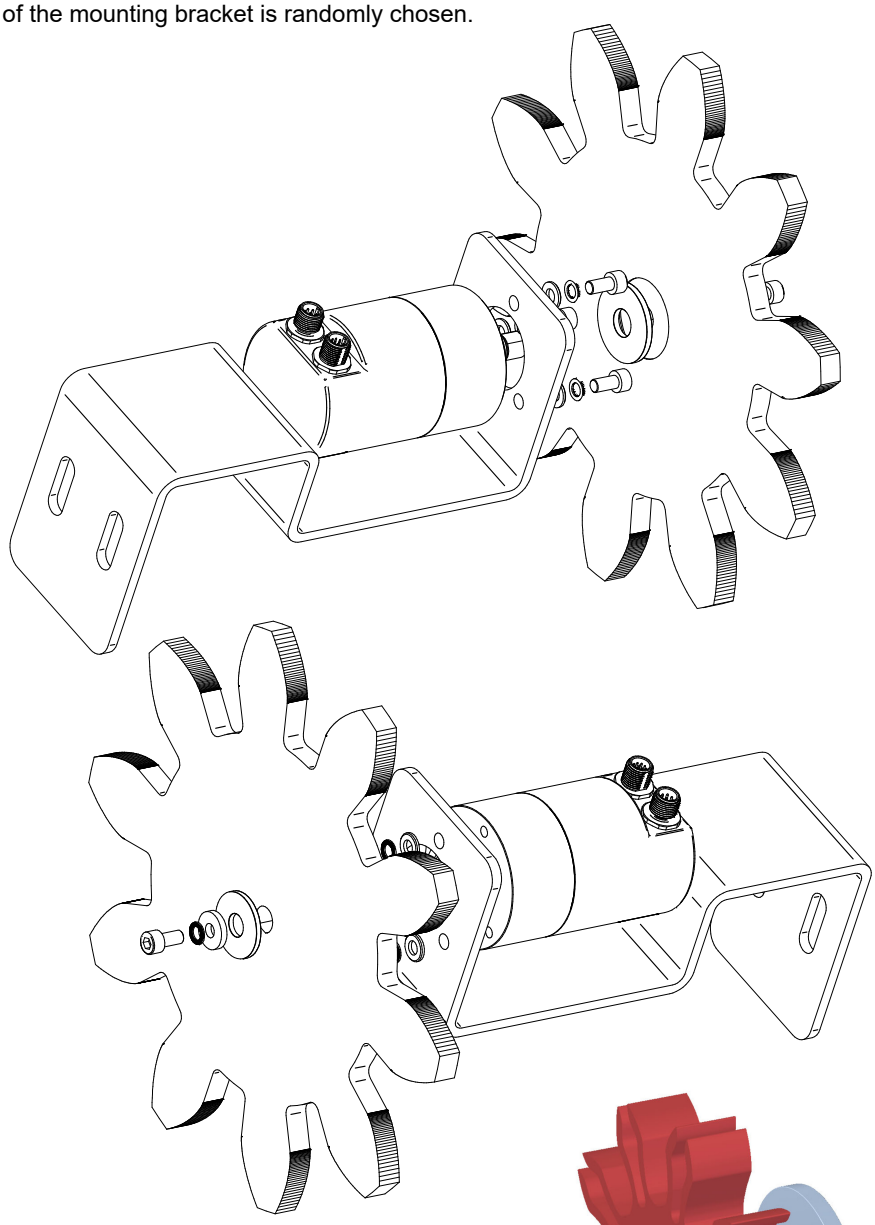


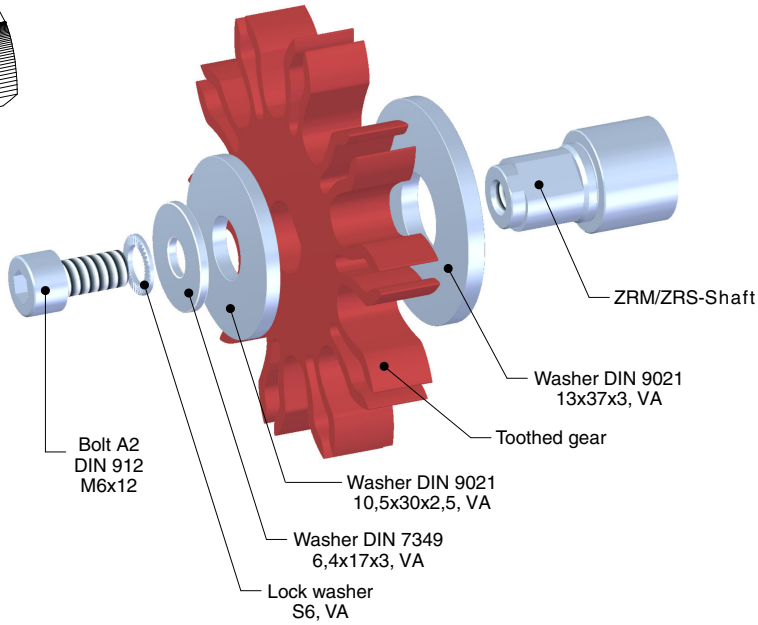
Mounting examples for rotary encoders and cam switches

Rotary encoder / cam switch with gear shaft on gear wheel and customer's mounting bracket

Gear wheels (standard: ZRM or backlash compensating: ZRS) with mounting material are available from TWK (see datasheet ZRM13229 and ZRS11877). Easy mounting is possible thanks to the special ZRM/ZRS gear shaft on the encoder.

The appearance of the mounting bracket is randomly chosen.





Right: Fastening a TWK target gear to the special gear shaft of a TWK encoder using the mounting material supplied. For the tightening torque of the M6x12 screw made of VA, **6 Nm** are recommended in this case.

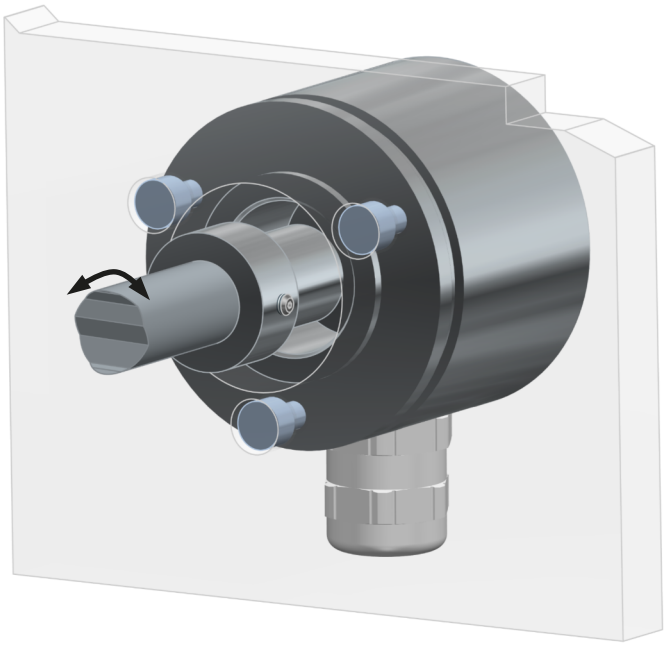
Mounting examples for rotary encoders and cam switches

Bearing-free encoder with magnetic hub on customer's mounting plate

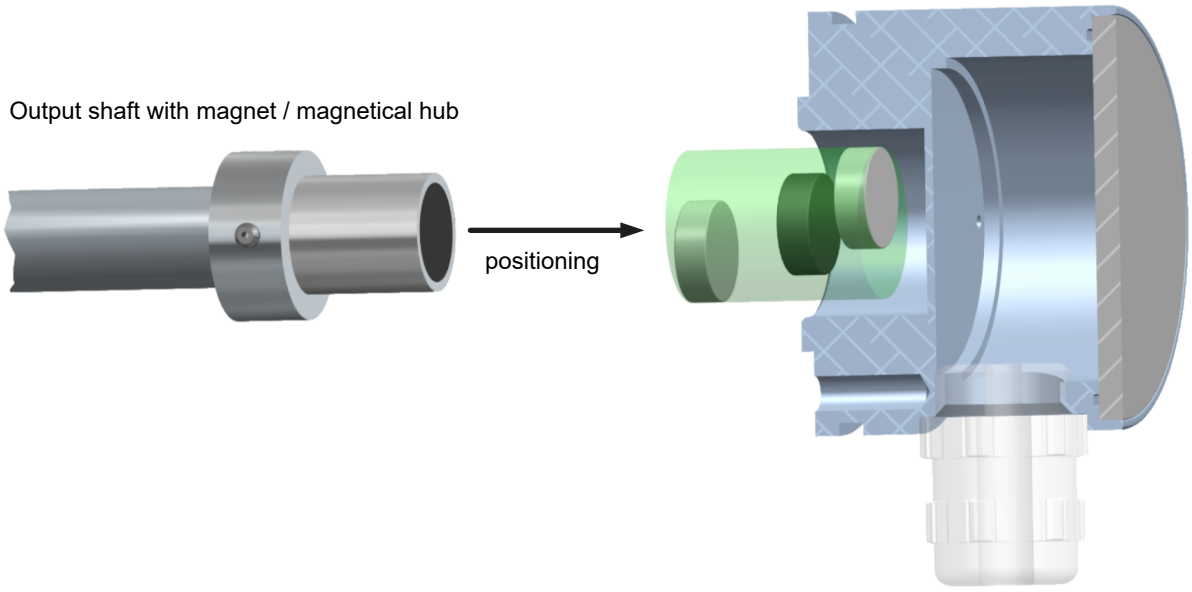
For different designs and details - e.g. exact position tolerances of the magnet / magnet hub - see datasheet 12580.

Example TBx50

Shown on the right is the fully assembled encoder on a mounting plate with the magnetic hub (attached to the output shaft) located at the recommended / optimal position. The hub now rotates without contact in the recess of the encoder.



The permitted position tolerances of the magnet hub or the supplied magnet (if the complete TWK magnet hub is not used) are shown below. All positions that lie within the cylinder indicated in green are permitted in order to obtain the specified output signal of the bearingless encoder. Shown is the recommended magnet position (black) and are two maximum offset magnet positions (grey) - each still within the green cylinder. A slight tilting of the magnet is permitted. Details and exact dimensions are given in datasheet 12580.



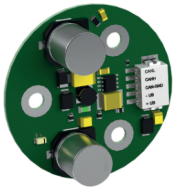
Printed circuit board (PCB) versions TKx of encoders (installation kit)

In addition to the encoders in housing discussed above, TWK also offers PCB versions of encoders with magnetic scanning. These are always specially adapted to the customer application (e.g. cable pulleys) and cannot be shown here due to the variety. The corresponding datasheet should always be consulted. Above all, the recommended **distance magnet ↔ position sensor** must be observed in order to ensure the specified accuracy.

Examples:

Interface ‘CANopen’ TKN: Datasheet 14963

Interface ‘analogue’ TKA: Datasheet 11407



General mechanical accessories

Synchro clamps, mounting brackets, adapter flanges, etc.

→ Datasheet 10111

Shaft couplings

For connecting the encoder shaft to the output shaft (others on request)

Jaw couplings

KK14 → Datasheet 12301

Bellows couplings

BKM → Datasheet 11995

BKK → Datasheet 11840

Oldham couplings

400/184 → Datasheet 13036 (at the time only in German language available)

Stator coupling / torque support

Encoder bracket for encoder version with 'clamping shaft' (see page 9)

ZMS → Datasheet 12939

Gear wheels

For easy connecting an encoder to a gear rim / gear wheel (see page 10)

ZRS → Datasheet 11877 (backlash compensating)

ZRM → Datasheet 13229 (standard)

Pre-flanges

To increase axial and radial shaft load capacity

ZHF → Datasheet 13508

Protective housings

For protection against extreme environmental conditions

SGWC → Datasheet 13405 (at the time only in German language available)

History of changings

Changing	Date	Index
Creation	14th July 2021	A
E1 Rev. from 5 to 6, reference to ATEX topic with documents 14080 and 16370 and their linking.	26th January 2022	B
General installation instructions no longer limited to encoders. Note that the specification of the IP protection class in data sheets is only valid when using and installing corresponding mating connectors / cables correctly.	14th February 2023	C