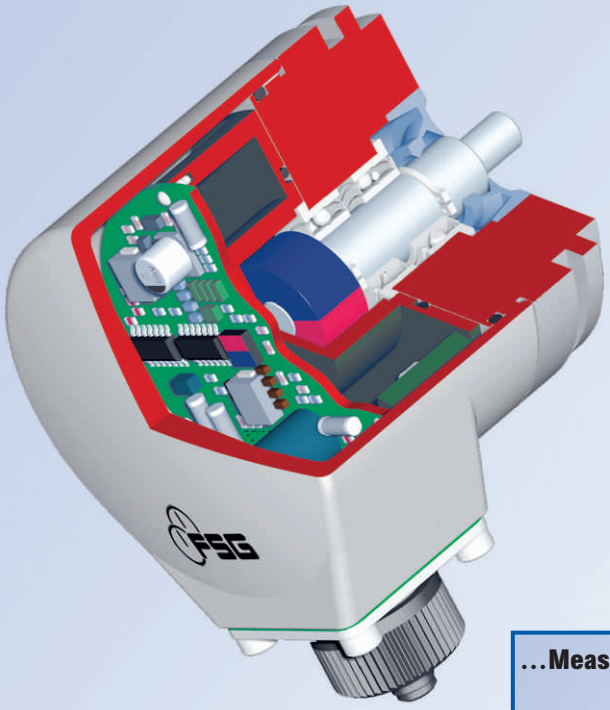
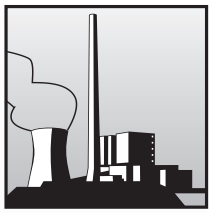
# Angular Position Transducers


FSG
FERNSTEUERGERÄTE

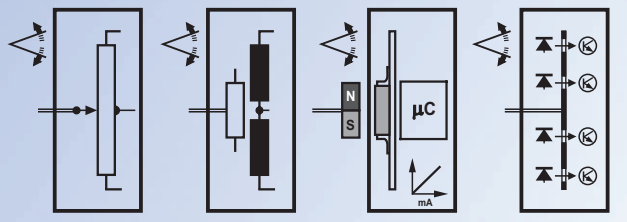
# Angular Position Transducers

**…Construction**





**…Measuring systems**




For measuring angular positions and converting them into electrical signals for teletransmission purposes, either **potentiometric** (see data sheet „precision rotary potentiometer"), **inductive, magnetic, incrementally** or **absolutely coded** angular position transducers can be used according to the particular application.

**Inductive angular position transducers** of the non-contacting type are preferably used on measuring points, which are exposed to extreme vibration or shock or to aggressive atmospheres.

This applies mainly to measurement problems one is confronted with in energy industry and chemical plants, for instance while measuring the actual value of the position of variable speed drives, or of machines in paper-processing and textile industry, while measuring the position of dancer rollers and very frequently in pendulum systems for measuring tilt angles on cranes and excavators.

**Optoelectronic angular position transducers** possess code disks, whose tracks are digitally scanned.

They are high-resolution measuring systems with low temperature coefficient, available in a single- or multi-turn version, outputting analogue or digitally coded signals.

Single-turn transducers are used e. g. in the railway vehicle domain in connection with master controllers or on cranes as slewing ring transmitters.

Multi-turn transducers are preferably used together with rope length measuring systems on hauling plants, bearer cable winches of crane systems or in the field of machine tool engineering for sensing the tool position.

**Magnetic angular position transducers** are extremely robust measuring systems completely hermetically encapsulated of two-chamber design with a protection degree of IP 68.

In shaft exit design e. g. they are used to record the angular position of a permanent magnet mounted on the measuring object.

Transducers of this type are predominately used in commercial vehicles for sensing the position of steering type axles or the angle of the articulated arm of excavators.

Transducers with shaft exit also contain a hermetically encapsulated electronic unit. They are universally used in mechanical engineering exposed to extreme atmospheres in order to record angular positions.

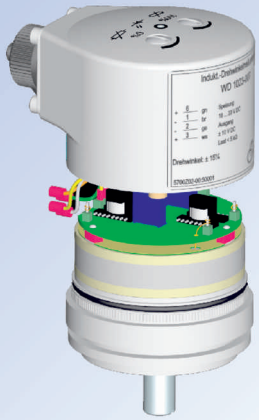
Signals of the single- or multi-turn version are output either analogue as current or voltage signals or digital as CAN open configuration.

**Potentiometric angular position transducers** contain a high-resolution resistance element of conductive plastic with a linearity of ± 0.1 %.

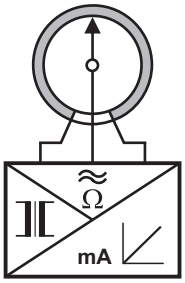
Signals are output either in form of a resistance, current or voltage variation.

# ...System versions

**series WD and PK**



**differential inductor or resistance element**

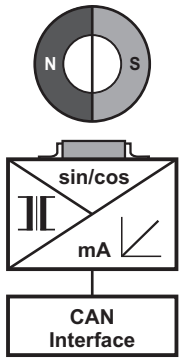



**Inductive transducer systems (WD)**
are available as models of synchro size 20 (series 620) and synchro size 23 (series 1023). They contain a differential inductor designed in form of a ring winding with a non-contact tapping.
The electrical output signals representing zero and final value of the mechanical drive shaft angle are available within a broad range of limits via trimming potentiometers of the incorporated or separate electronics.
For use in explosive installations, transducer systems as well as electronic components are available with a degree of protection EEx and Exd with ATEX approval.

**Potentiometric transducer systems (PK)**
are also available in synchro sizes 20 and 23. They contain an incorporated signal converter with current or voltage signal output.

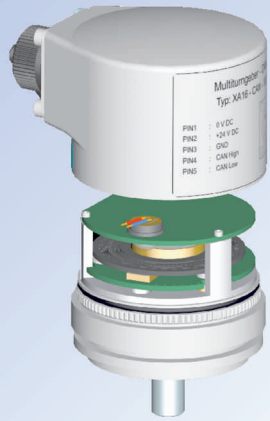
**series MR and MH**

**permanent magnet**

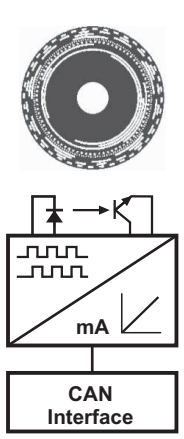



**Magnetic transducer systems (MR and MH)**
are available as models of synchro sizes 9, 13, 20 and 23.
They are fully enclosed in an aluminium casing of two chamber design and contain a permanent magnet with a high-precision angular encoder.
Signals are output either analogue, e. g. with 4 - 20 mA, or digitally coded (CAN open standard).
Output signal of transducers with analogue output can be programmed via rear keys of transducer to the respective measuring range.
For safety-relevant applications these systems are also available in redundant version according to IEC 61508 (SIL).

**series Xi and XA**



**coded disk**




**Optoelectronic transducer systems (XI and XA)**
are available as models of synchro size 23 in incremental of absolutely coded design.
Incremental systems convert the angle to be measured into a proportional number of pulses, appearing in two tracks A and B with an offset of 90° for identification of direction.
Absolutely coded systems are available as single- or multi-turn encoders.
They contain a gray-coded rotating disk whose 12 concentric tracks are optically scanned by infrared diodes and phototransistors.
Signals are output parallel via NPN or PNP transistors or analogue via a digital-to-analogue converter with current output 4 - 20 mA.
All transducers can also be supplied with field bus interface CAN open standard and in user-specific data format respectively.

# ...Specifications

| System versions | Magnetic systems | | | | | | | | | | 2-fold system |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Models |  | |  | |  | |  | |  | |  |
| **Series** | **MH 609** | | **MH 613** | | **MH 620** | | **MR 1023** | | **MR 1023 ext** | | **Xi / MR 1023** |
| Single-turn / multi-turn | single-turn | multi-turn | single-turn | multi-turn | single-turn | | single-turn | multi-turn | single-turn | | single-turn |
| Synchro size | 9 | | 13 | | 20 | | 20 | | special size | | 23 |
| Casing - ⌀ | 22.2 mm | | 36.5 mm | | 50.8 mm | | 60 mm | | 60 mm | | 60 mm |
| Shaft - ⌀ | 6 mm | | 6 mm | | 6 mm | | 6 / 10 mm | | external magnet | | 6 / 10 mm |
| Dimensional sketch page 6/7 | 1 | | 2 | | 5 | | 7 and 8 | | 6 | | 7 |
| Angle of rotation max. | 360° | 1080° | 360° | 5760° | 360° | | 360° | 23040° | 360° | | 360° |
| Revolution max. | 1 | 3 | 1 | 16 | 1 | | 1 | 64 | 1 | | 1 |
| Voltage output | 0.5 - 4.5 V | | | | | | | | | | |
| Current output | | | 4 - 20 mA | | 1 x 4 - 20 mA | | 4 - 20 mA | | 4 - 20 mA | | |
| Pulse output | | | | | | | | | | | |
| Bus output | | | | | | | CANopen | | | | |
| Redundant electronics | | | | | 2 x 4 - 20 mA | | | | | | 4 - 20 mA / 720 pulses |
| Signal adjustment via | fixed alignment | | keys | | cable | | keys or CAN-Bus | | fixed alignment | | fixed alignment |
| Linearity | ± 0.5 % | ± 1 % | ± 0.3 % | | ± 0.2 % | | ± 0.2 % | | ± 0.2 % | | ± 0.2 % |
| Resolution | 12 bit | | 12 bit | 16 bit | 12 bit | | 14 bit | | 14 bit | | 14 bit / 720 pulses |
| Supply | 5 V DC | | 24 V DC | | 1 x or 2 x 24 V DC | | 24 V DC | | 24 V DC | | 2 x 24 V DC |
| Current consumption | < 80 mA | | < 80 mA | | < 80 mA | | < 80 mA | | < 80 mA | | < 80 mA |
| IP code of casing up to | IP 67 | | IP 65 | | IP 67 | | IP68 | | IP68 | | IP68 |
| Connection | stranded wire | | solder-type terminals | | cable | | plug / cable | | plug / cable | | plug / cable |
| Weight | 100 g | | 100 g | | 200 g | | 400 g | | 400 g | | 500 g |
| Approval | | | | | | | | | TÜV | | |
| Root of FSG ident # | 1130Z01 | 1140Z01 | 2740Z01 | 2750Z01 | 2845Z01 | | 5750Z02 | 5755Z02 | 5850Z01 | | 5770Z02 |

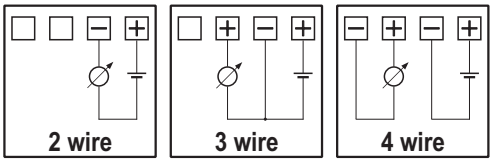
## General data

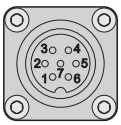
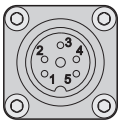
| | |
|---|---|
| Casing material | alu, anodized, partly vanished, special version: saline-resistant coating HART-COAT |
| Shaft material | stainless steel |
| Shaft bearing | ball bearing |
| Temperature range | -30°C up to +70°C, other ranges on request |
| Test voltage | 500 V, 50 Hz, 1 min |
| Immunity standard | EN 50 082-2 |
| Emission standard | EN 50 081-1 |
| Shock | 50 g, 6 ms |
| Vibration | 4 g Sinus 5 - 100 Hz |
| Current output | $R_L \leqq 600\ \Omega$ 3 wire system, 2 and 4 wire system on request |
| Voltage output | $R_L \geqq 10\ k\Omega$ 4 wire system |
| Supply voltage | 18 - 33 V DC, other supply on request |

| System versions | optoelectronic systems | | | inductive systems | | | potentiometric systems | |
|---|---|---|---|---|---|---|---|---|
| **Models** |  | |  |  | |  |  |  |
| **Series** | **XA 1023** | | **Xi 1023** | **WD 620*** | | **WD 1023*** | **PK 620** | **PK 1023** |
| Single-turn / multi-turn | single-turn | multi-turn | incremental | single-turn | | single-turn | single-turn | single-turn |
| Synchro size | 23 | | 23 | 20 | | 23 | 20 | 23 |
| Casing - ⌀ | 60 mm | | 60 mm | 50.8 mm | | 60 mm | 50.8 mm | 60 mm |
| Shaft - ⌀ | 6 / 10 mm | | 6 / 10 mm | 6 mm | | 6 / 10 mm | 6 mm | 6 / 10 mm |
| Dimensional sketch page 6/7 | 7 / 8 | | 7 | 3 | 4 | 7 | 4 | 7 |
| Angle of rotation max. | 360° | 23040° | n x 360° | 360° | | 360° | 355° | 355° |
| Revolution max. | 1 | 64 | continuous | 1 | | 1 | 1 | 1 |
| Voltage output | | | | external electronics see page 8 | 0 - 10 V | 0 - 10 V | 0 - 10 V | 0 - 10 V |
| Current output | 4 - 20 mA | | | | 4 - 20 mA | 4 - 20 mA | 4 - 20 mA | 4 - 20 mA |
| Pulse output | | | A, B and zero track | | | | | |
| Bus output | CANopen | | | | | | | |
| Redundant electronics | | | | | | | | |
| Signal adjustment via | fixed alignment | | fixed alignment | ext. electronic | trimmer | trimmer | trimmer | trimmer |
| Linearity | ± 0,2 % | | | ± 0.5 % | | ± 0.5 % | ± 0.1 % | ± 0.1 % |
| Resolution | 12 bit | 16 bit | 1800 pulses / 360° | ∞ | | ∞ | ∞ | ∞ |
| Supply | 24 V DC | | 24 V DC | ext. electronic | 24 V DC | 24 V DC | 24 V DC | 24 V DC |
| Current consumption | < 80 mA | | < 50 mA | | < 60 mA | 60 mA | 60 mA | 60 mA |
| IP code of casing up to | IP67 | | IP67 | IP30 | | IP67 | IP 30 | IP 67 |
| Connection | plug | | plug | solder-type terminals | | plug | solder-type terminals | plug |
| Weight | 400 g | | 400 g | 60 g | 120 g | 400 g | 120 g | 400 g |
| Approval | | | | Atex | | Atex | | |
| Root of FSG ident # | 5740Z02 | 5730Z02 | 5760Z02 | 2810Z50 | 9252Z10 | 5700Z02 | 1572Z02 | 5710Z02 |

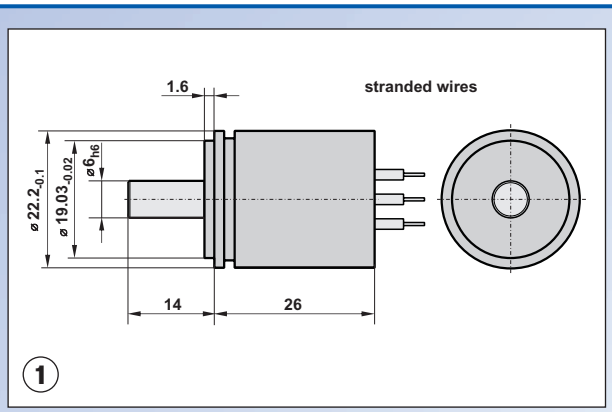
* series WD also available in intrinsically safe version, see page 8

## Switching version

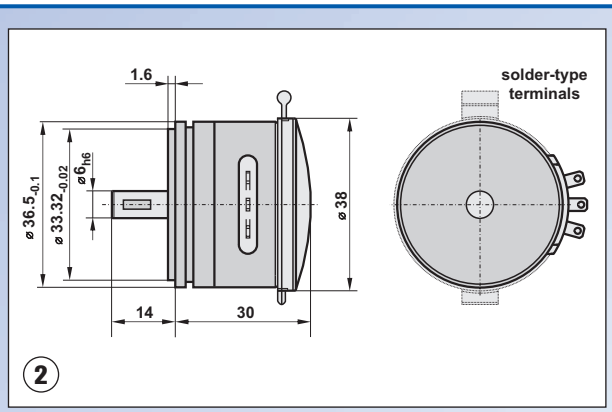



| Terminal connecting plan | | | | color of stranded wire or cable | solder-type terminals |
|---|---|---|---|---|---|
| cable / stranded wire | supply | $U_S$ | + | Green | 5 |
| | | 0 V | | Brown | 4 |
| V- or mA | output | | + | Yellow | 25 |
| | | | - | White | 24 |
| plug | supply | $U_S$ | + | 6 |  |
| 7-poles | | 0 V | | 1 | |
| V- or mA | output | | + | 2 | |
| | | | - | 4 | |
| plug | supply | $U_S$ | + | 2 |  |
| 5-poles | | 0 V | | 3 | |
| | CAN output | Low | | 5 | |
| | | High | | 4 | |

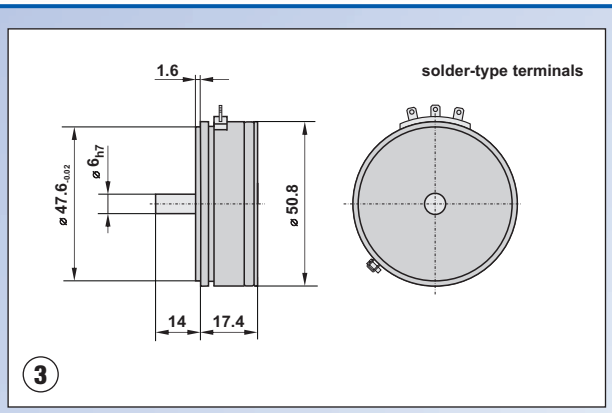
# ...Models




**MH 609 - MU**
**MH 609 - 3 - MU**

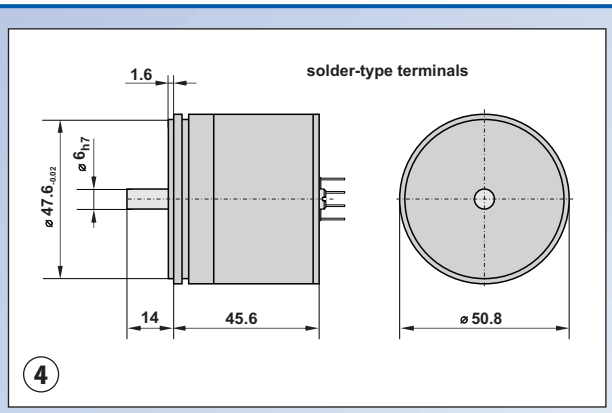



**MH 613 - MU**
**MH 613 - 16 - MU**

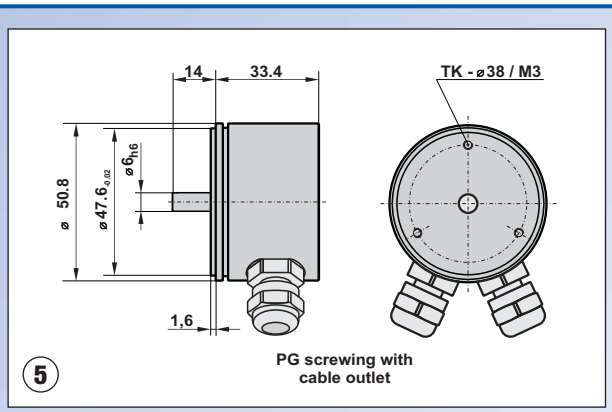




**WD 620**
**WDG 620**




**WD 620 - MU**
**WDG 620 - MU**
**PK 620 - MU**

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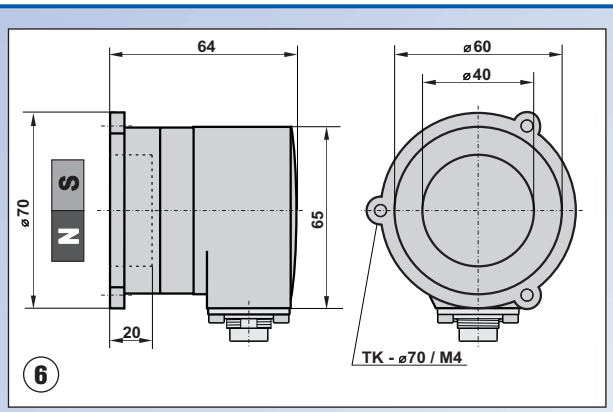
**MH 620 - MU**
**MH 620 II - MU**

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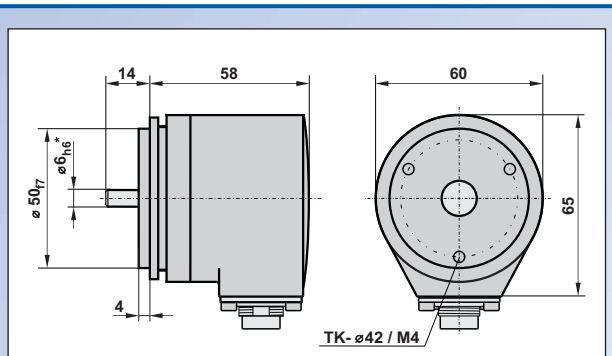
**MR 1023 - MU ext**

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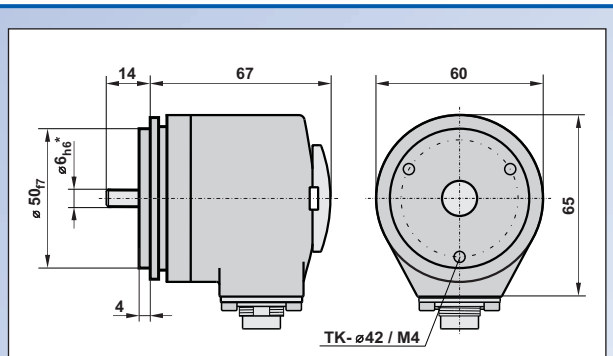
* also ø10 h6

**WD 1023**
**WDG 1023**
**PK 1023**

**XA 12 - 1023 - CAN**
**XA 16 - 1023 - CAN**
**MR 1023 - CAN**
**MH 1023 - CAN**
**XI 1023**
**XI / MR 1023**

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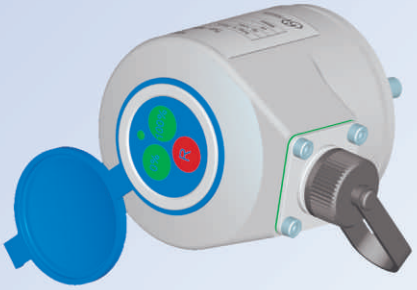
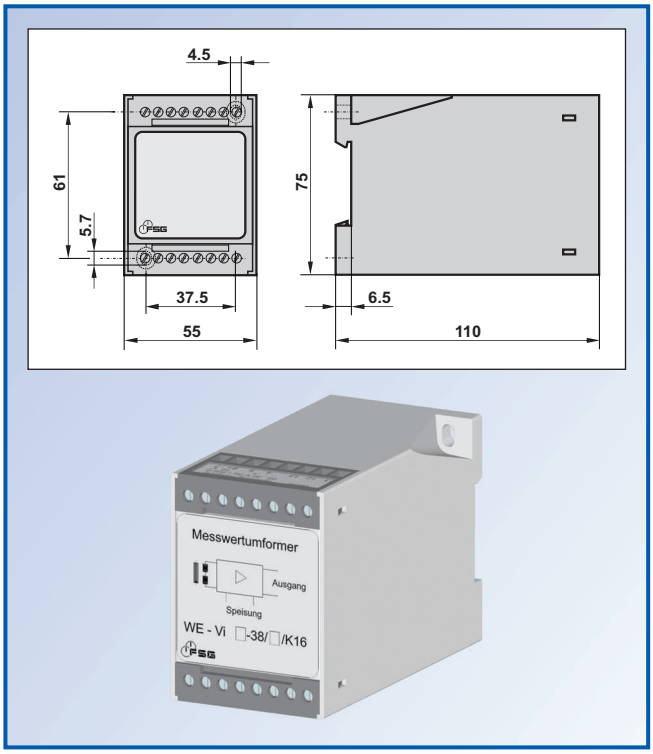
* also ø10 h6



**MR 1023 - MU**
**MH 1023 - 64 - MU**
**XA 12 - 1023 - MU**
**XA 16 - 1023 - MU**

# ...Characteristics of separate components




**Signal converter**
**Type WEVI ... / K16**

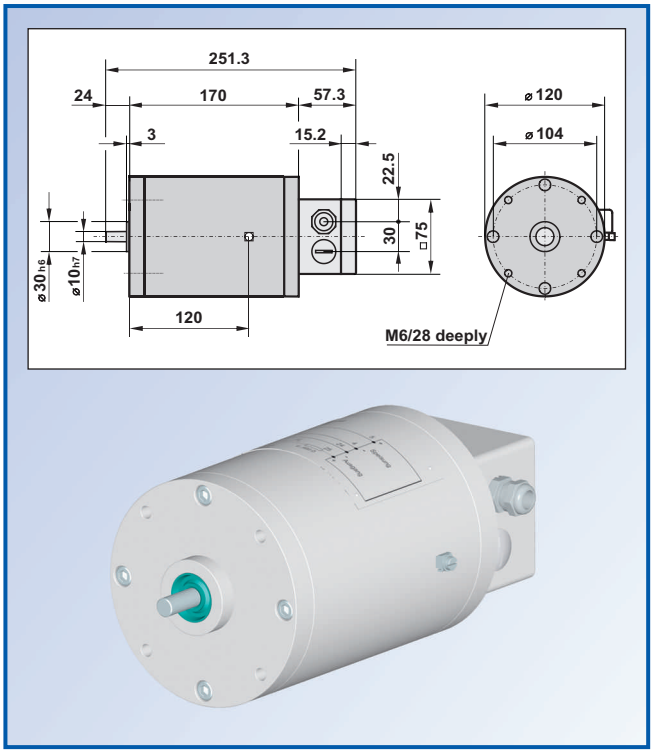
| | |
|---|---|
| Input: | signal from transducer series WD |
| Output: | 0 or 4 - 20 mA, $R_L$ ≦600 Ω |
| Supply: | 18 - 33 V DC or 230 V AC |
| Weight: | 300 g |
| Root of FSG ident #: | 9242Z03 |

**Signal converter**
**Type WEVI ... EEX / K16**

| | |
|---|---|
| Input: | signal from transducer series WD |
| Output: | 0 or 4 - 20 mA, $R_L$ ≦600 Ω intrinsically safe |
| Supply: | 18 - 24 V DC intrinsically safe from NBW |
| Type of protection: | CE0102 EXII(2)G[EExib]IIc; PTB-Nr. 04 ATEX 2061X |
| Weight: | 300 g |
| Root of FSG ident #: | 9249Z51 |

**Power supply with signal isolator**
**Type NBW ... EEX / K16**

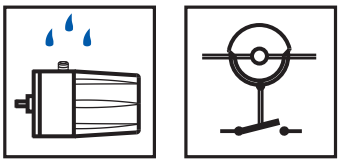
| | |
|---|---|
| Input: | 4 - 20 mA intrinsically safe |
| Output: | 4 - 20 mA electrically isolated from input $R_L$ ≦450 Ω |
| Supply: | 230 V AC |
| Type of protection: | CE0102 EXII(2)G[EExib]IIc; PTB-Nr. 04 ATEX 2050 |
| Weight: | 300 g |
| Root of FSG ident #: | 8249Z02 |




**Protective casing**
Pressure-tight protection for mounting of all angular position transducers
**Type ... / GS120 EEX**

| | |
|---|---|
| IP code of casing: | IP65 |
| Type of protection: | EXII 2G EEX de IIc T5<br>PTB-Nr. 03 ATEX 1062 |
| Weight: | 5.000 g |
| Root of FSG ident #: | 1785Z02 |

Further protective casings are available which can partly be equipped with gearings and limit switches, degree of protection up to IP 68 for mounting in installations with increased mechanical and climatic stress (see data sheet “protective casings”).

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