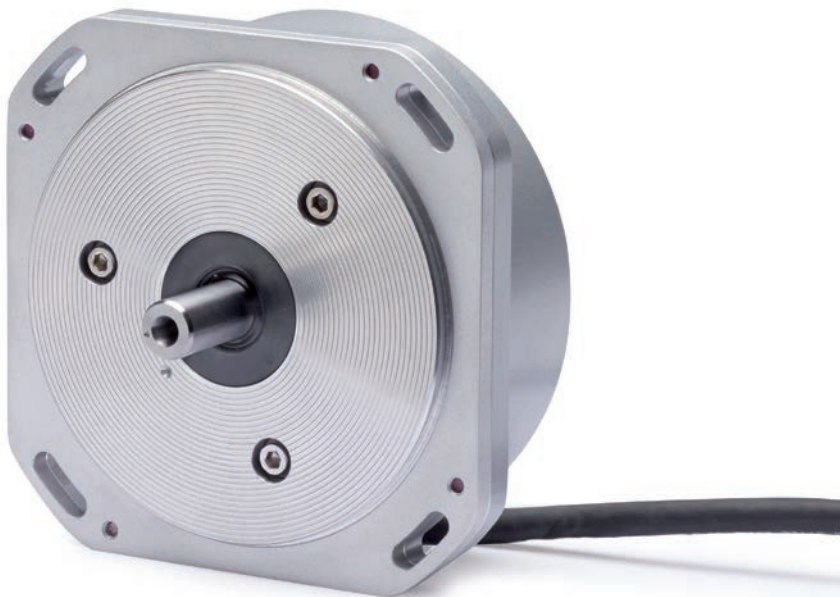




HEIDENHAIN



Product Information

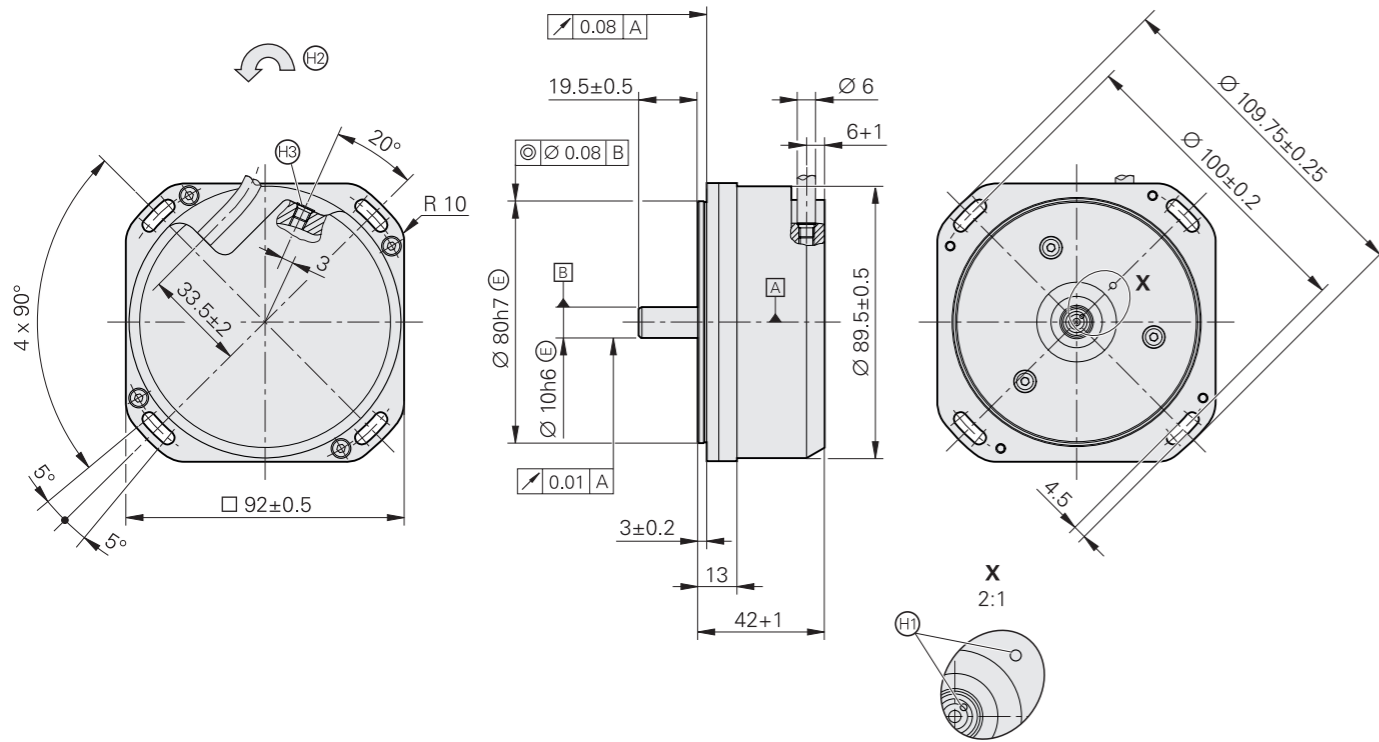
ROC 2000

ROC 7000

Absolute Angle Encoders
with Integral Bearing for
Separate Shaft Coupling

ROC 2000 series

- For a separate shaft coupling
- System accuracy: $\pm 5''$



mm
 Tolerancing ISO 8015
 ISO 2768:1989-mH
 ≤ 6 mm: ± 0.2 mm

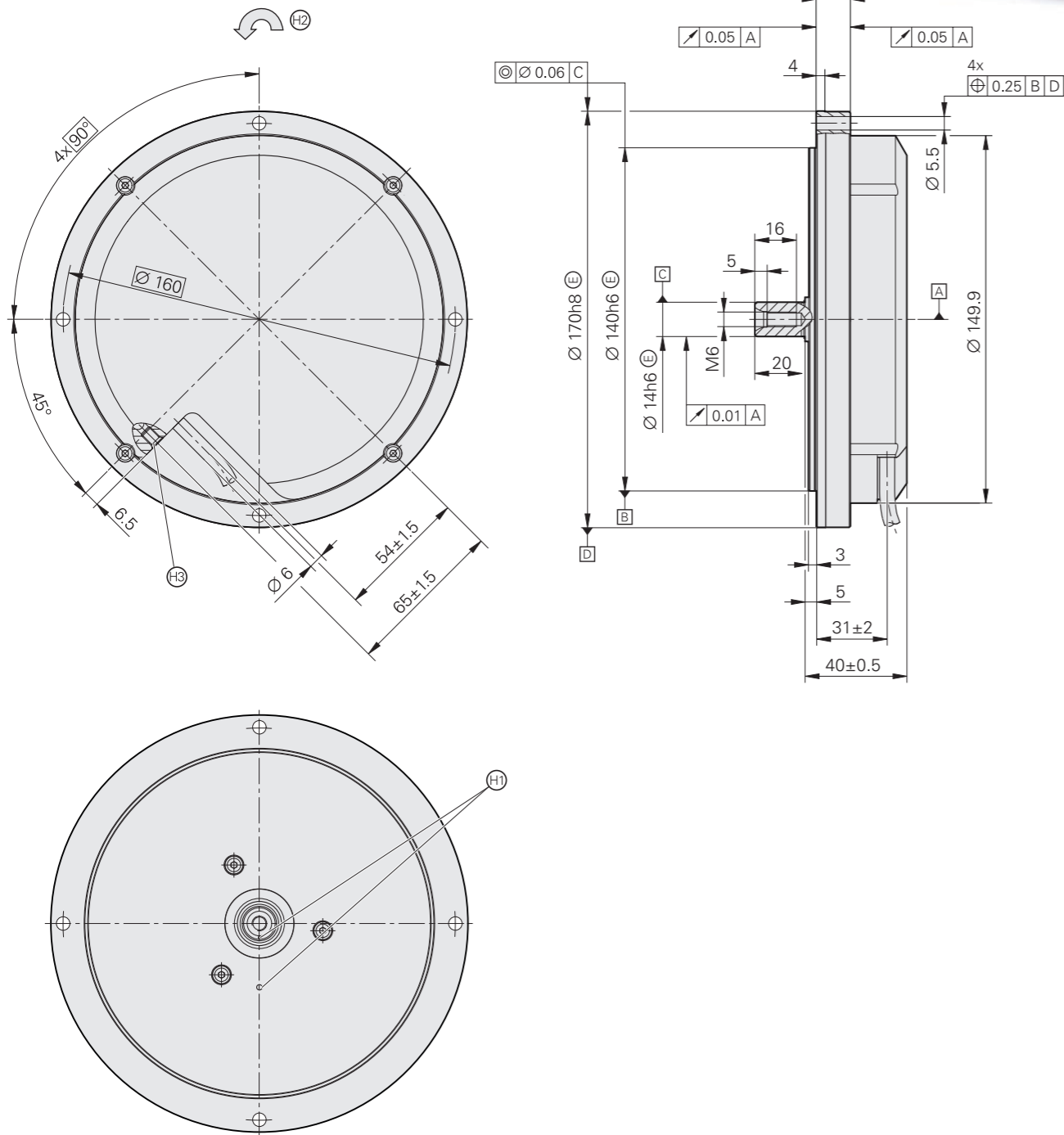
- ▣ = Bearing
- ⊕ = Position of the reference mark signal $\pm 5^\circ$
- ⊙ = Direction of shaft rotation for output signals in accordance with the interface description
- ⊕ = M5 compressed-air inlet

| | Absolute ROC 2310 | ROC 2380 | ROC 2390F | ROC 2390M |
|--|---|--|--|---------------------------------|
| Measuring standard | DIADUR circular scale with absolute track and incremental track (16 384 lines) | | | |
| System accuracy | $\pm 5''$ | | | |
| Position error per signal period | $\pm 0.4''$ | | | |
| Interface | EnDat 2.2 | | Fanuc serial interface α i interface | Mitsubishi high speed interface |
| Ordering designation | EnDat22 | EnDat02 | Fanuc05 | Mit03-4 |
| Position values per rev. | 67 108 864 (26 bits); <i>Fanuc α interface</i> : 8 388 608 (23 bits) | | | |
| Electrically permissible speed | ≤ 3000 rpm for continuous position values | ≤ 1500 rpm for continuous position values | ≤ 3000 rpm for continuous position values | |
| Clock frequency Calculation time t_{cal} | ≤ 16 MHz $\leq 5 \mu s$ | ≤ 2 MHz $\leq 5 \mu s$ | - | |
| Incremental signals Cutoff frequency -3 dB | - | $\sim 1 V_{PP}$ ≥ 400 kHz | - | |
| Electrical connection | Cable (1 m) with M12 coupling (male) <i>With EnDat02</i> : cable (1 m) with 17-pin M23 coupling (male) | | | |
| Cable length ¹⁾ | ≤ 150 m | | ≤ 50 m | ≤ 30 m |
| Supply voltage | DC 3.6 V to 14 V | | | |
| Power consumption ²⁾ (max.) | 3.6 V: ≤ 1.1 W; 14 V: ≤ 1.3 W | | | |
| Current consumption (typical) | 5 V: 140 mA (without load) | | | |
| Shaft | Solid shaft D = 10 mm | | | |
| Mech. permissible speed | ≤ 3000 rpm | | | |
| Starting torque | ≤ 0.02 Nm at 20 °C | | | |
| Moment of inertia of rotor | $50.0 \cdot 10^{-6}$ kgm ² | | | |
| Permissible shaft load | <i>Axial</i> : 30 N <i>Radial</i> : 30 N at shaft end | | | |
| Vibration 55 Hz to 2000 Hz Shock 6 ms | ≤ 200 m/s ² (EN 60068-2-6) ≤ 200 m/s ² (EN 60068-2-27) | | | |
| Operating temperature | <i>Moving cable</i> : -10 °C to 60 °C <i>Fixed cable</i> : -20 °C to 60 °C | | | |
| Protection EN 60529 | IP64 | | | |
| Mass | ≈ 1.0 kg | | | |

* Please select when ordering
 1) With HEIDENHAIN cable; ≤ 8 MHz
 2) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

ROC 7000

- For a separate shaft coupling
- System accuracy $\pm 2''$



mm
 Tolerancing ISO 8015
 ISO 2768:1989-mH
 ≤ 6 mm: ±0.2 mm

- \square = Bearing
- \oplus = Position of the reference mark signal $\pm 5^\circ$
- \odot = Direction of shaft rotation for output signals in accordance with the interface description
- \odot = M5 compressed-air inlet

| | Absolute ROC 7310 | ROC 7380 | ROC 7390F | ROC 7390M |
|--|---|---|--|---------------------------------|
| Measuring standard | DIADUR circular scale with absolute track and incremental track (16 384 lines) | | | |
| System accuracy | $\pm 2''$ | | | |
| Position error per signal period | $\pm 0.4''$ | | | |
| Interface | EnDat 2.2 | | Fanuc serial interface α i interface | Mitsubishi high speed interface |
| Ordering designation | EnDat22 | EnDat02 | Fanuc05 | Mit03-4 |
| Position values per rev. | 268 435 456 (28 bits); <i>Fanuc α interface</i> : 134 217 728 (27 bits) | | | |
| Electrically permissible speed | ≤ 3000 rpm for continuous position values | ≤ 1500 rpm for continuous position values | ≤ 3000 rpm for continuous position values | |
| Clock frequency Calculation time t_{cal} | ≤ 16 MHz ≤ 5 μ s | ≤ 2 MHz ≤ 5 μ s | - | |
| Incremental signals Cutoff frequency -3 dB | - | $\sim 1 V_{pp}$ ≥ 400 kHz | - | |
| Electrical connection | Cable (1 m) with M12 coupling (male) With <i>EnDat02</i> : cable (1 m) with 17-pin M23 coupling (male) | | | |
| Cable length ¹⁾ | ≤ 150 m | | ≤ 50 m | ≤ 30 m |
| Supply voltage | DC 3.6 V to 14 V | | | |
| Power consumption ²⁾ (max.) | 3.6 V: ≤ 1.1 W; 14 V: ≤ 1.3 W | | | |
| Current consumption (typical) | 5 V: 140 mA (without load) | | | |
| Shaft | Solid shaft D = 14 mm | | | |
| Mech. permissible speed | ≤ 3000 rpm | | | |
| Starting torque | ≤ 0.025 Nm at 20 °C | | | |
| Moment of inertia of rotor | $65.0 \cdot 10^{-6} \text{ kgm}^2$ | | | |
| Permissible shaft load | <i>Axial</i> : 30 N <i>Radial</i> : 30 N at shaft end | | | |
| Vibration 55 Hz to 2000 Hz Shock 6 ms | ≤ 200 m/s^2 (EN 60068-2-6) ≤ 200 m/s^2 (EN 60068-2-27) | | | |
| Operating temperature | 0 °C to 50 °C | | | |
| Protection EN 60529 | IP64 | | | |
| Mass | ≈ 1.6 kg | | | |

* Please select when ordering
¹⁾ With HEIDENHAIN cable; ≤ 8 MHz
²⁾ See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

Shaft coupling

Angle encoders of the **ROC** product family require a separate coupling for connection to the drive shaft. The shaft coupling compensates for axial movement and misalignment between the shafts, thereby preventing an excessive load on the bearing of the angle encoder. For realizing high accuracies, it is necessary that the shaft of the angle encoder is optimally aligned with the shaft of the machine. The HEIDENHAIN product portfolio includes diaphragm couplings and flat couplings designed for connecting the shaft of the ROC angle encoder to the drive shaft.

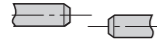
Mounting

ROC angle encoders have an integral mounting flange with a centering collar. The encoder shaft is connected to the machine shaft by means of a diaphragm coupling or flat coupling.

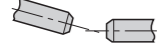
Shaft couplings

The shaft coupling compensates for axial movement and misalignment between the encoder shaft and the drive shaft, thereby preventing excessive encoder bearing loads.

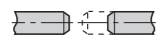
Radial offset λ



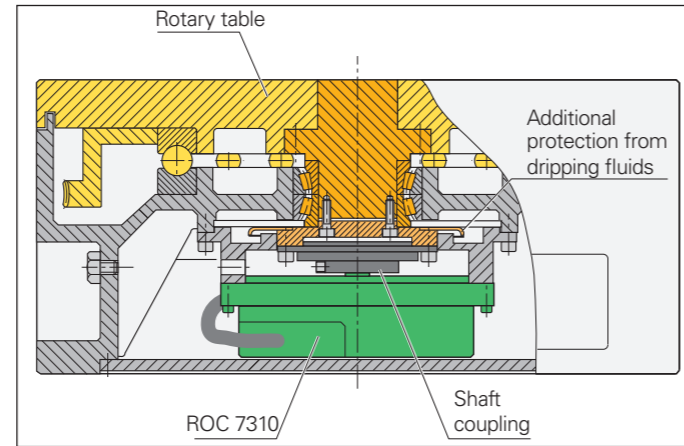
Angular error α



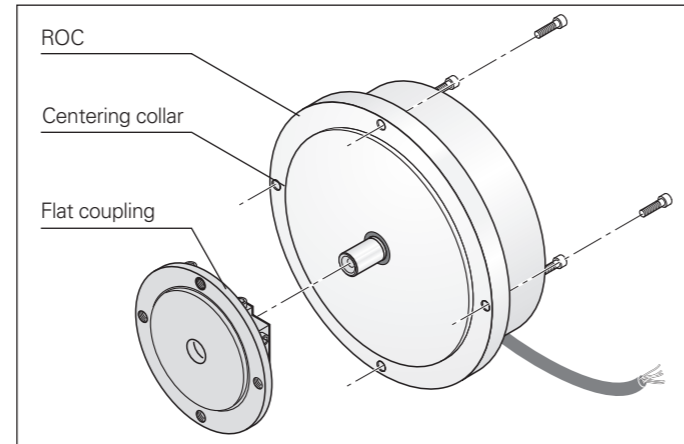
Axial offset δ



Mounting example
ROC 7310



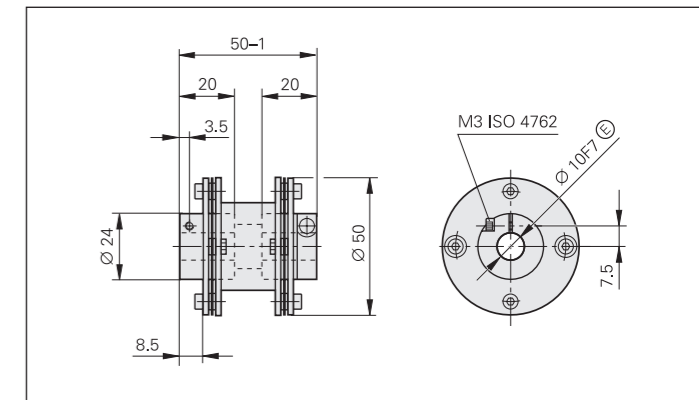
Mounting an ROC
with a flat coupling



| Shaft coupling | ROC 2000 series | | ROC 7000 series | | |
|--|--|-------------------------------------|--------------------------------------|---|--------------------------------------|
| | K 03 Diaphragm coupling | K 18 Flat coupling | K 01 Diaphragm coupling | K 15 Flat coupling | K 16 Flat coupling |
| Hub bore | 10 mm | | 14 mm | | |
| Kinematic transfer error | $\pm 2''$ At $\lambda \leq 0.1$ mm and $\alpha \leq 0.09^\circ$ | | $\pm 1''$ | $\pm 0.5''$ At $\lambda \leq 0.05$ mm and $\alpha \leq 0.03^\circ$ | |
| Torsional rigidity | 1500 Nm/rad | 1200 Nm/rad | 4000 Nm/rad | 6000 Nm/rad | 4000 Nm/rad |
| Permissible torque | 0.2 Nm | 0.5 Nm | | | |
| Perm. radial offset λ | ≤ 0.3 mm | | | | |
| Perm. angular error α | $\leq 0.5^\circ$ | | | $\leq 0.2^\circ$ | $\leq 0.5^\circ$ |
| Perm. axial offset δ | ≤ 0.2 mm | | | ≤ 0.1 mm | ≤ 1 mm |
| Moment of inertia (approx.) | $20 \cdot 10^{-6}$ kgm ² | $75 \cdot 10^{-6}$ kgm ² | $200 \cdot 10^{-6}$ kgm ² | | $400 \cdot 10^{-6}$ kgm ² |
| Permissible shaft speed | 10000 rpm | 1000 rpm | 3000 rpm | 1000 rpm | |
| Tightening torque of clamping screws (approx.) | 1.2 Nm | | 2.5 Nm | 1.2 Nm | |
| Mass | 100 g | 117 g | 180 g | 250 g | 410 g |

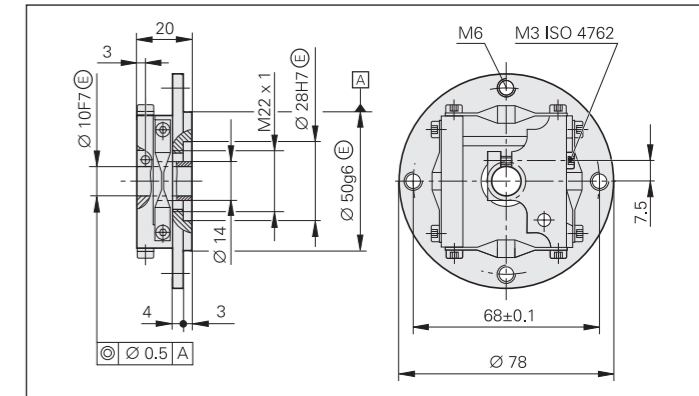
K 03 diaphragm coupling

ID 200313-04



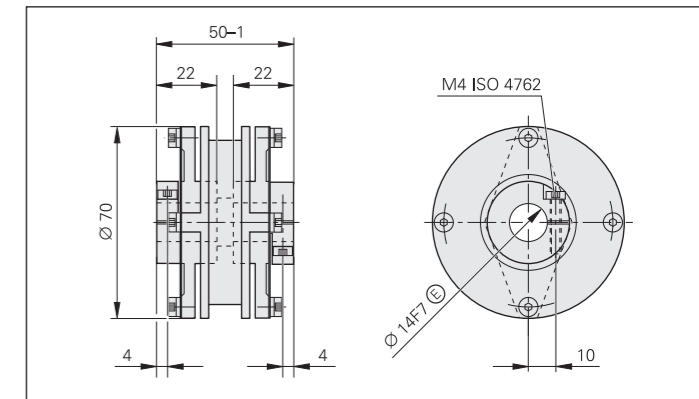
K 18 flat coupling

ID 202227-01



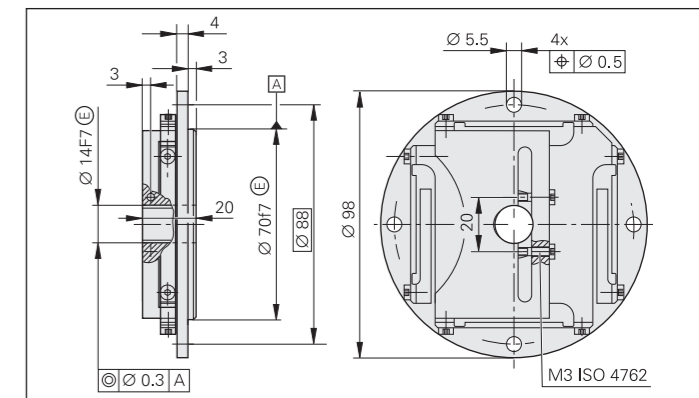
K 01 diaphragm coupling

ID 200301-02



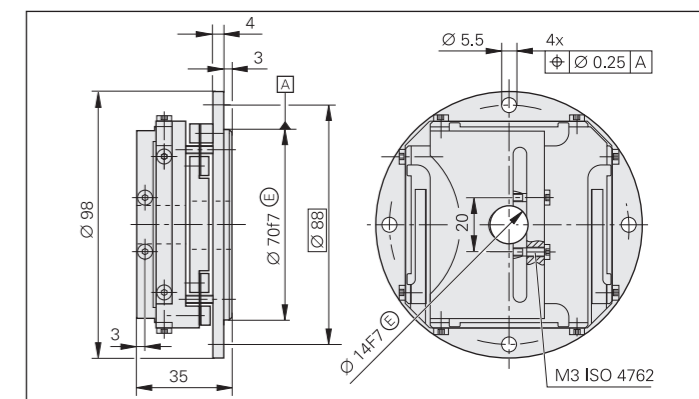
K 15 flat coupling

ID 255797-01



K 16 flat coupling

ID 258878-01

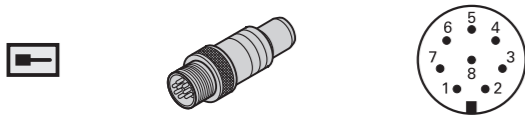




mm
Tolerancing ISO 8015
ISO 2768:1989-mH
 ≤ 6 mm: ± 0.2 mm

Electrical connection

EnDat pin layout without incremental signals

8-pin M12 coupling



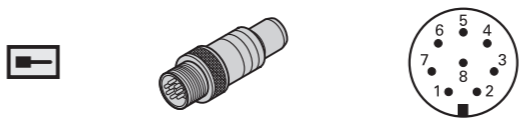
| | Power supply | | | | Serial data transmission | | | |
|--|--------------|--------------|-------------|-----------|--------------------------|--------------------------|--------|---------------------------|
|  | 8 | 2 | 5 | 1 | 3 | 4 | 7 | 6 |
| | U_P | Sensor U_P | 0V | Sensor 0V | DATA | $\overline{\text{DATA}}$ | CLOCK | $\overline{\text{CLOCK}}$ |
|  | Brown/Green | Blue | White/Green | White | Gray | Pink | Violet | Yellow |



Cable shield connected to housing; U_P = Power supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Fanuc pin layout

8-pin M12 coupling



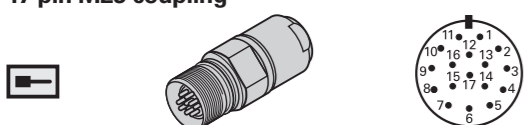
| | Power supply | | | | | Serial data transmission | | | |
|---|--------------|--------------|-------------|-----------|--------|--------------------------|---------------------------------|---------|-----------------------------|
|  | 8 | 2 | 5 | 1 | - | 3 | 4 | 7 | 6 |
| | U_P | Sensor U_P | 0V | Sensor 0V | Shield | Serial DATA | $\overline{\text{Serial DATA}}$ | Request | $\overline{\text{Request}}$ |
|  | Brown/Green | Blue | White/Green | White | - | Gray | Pink | Violet | Yellow |



Cable shield connected to housing; U_P = Power supply voltage

Sensor: The sense line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

EnDat pin layout with incremental signals

17-pin M23 coupling



| | Power supply | | | | | Incremental signals ¹⁾ | | | | Serial data transfer | | | |
|--|--------------|--------------|-------------|-----------|-----------------|-----------------------------------|--------------|------------|-----------|----------------------|--------------------------|--------|---------------------------|
|  | 7 | 1 | 10 | 4 | 11 | 15 | 16 | 12 | 13 | 14 | 17 | 8 | 9 |
| | U_P | Sensor U_P | 0V | Sensor 0V | Internal shield | A+ | A- | B+ | B- | DATA | $\overline{\text{DATA}}$ | CLOCK | $\overline{\text{CLOCK}}$ |
|  | Brown/Green | Blue | White/Green | White | / | Green/Black | Yellow/Black | Blue/Black | Red/Black | Gray | Pink | Violet | Yellow |


Cable shield connected to housing; U_P = Power supply voltage



Sensor: The sense line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

¹⁾ Only with ordering designations EnDat01 and EnDat02

Mitsubishi pin layout

8-pin M12 coupling






| | Power supply | | | | Serial data transmission | | | |
|---|--------------|--------------|-------------|-----------|--------------------------|---------------------------------|---------------|-----------------------------------|
|  | 8 | 2 | 5 | 1 | 3 | 4 | 7 | 6 |
| | U_P | Sensor U_P | 0V | Sensor 0V | Serial DATA | $\overline{\text{Serial DATA}}$ | Request Frame | $\overline{\text{Request Frame}}$ |
|  | Brown/Green | Blue | White/Green | White | Gray | Pink | Violet | Yellow |

Cable shield connected to housing; U_P = Power supply voltage




Sensor: The sense line is connected in the encoder with the corresponding power line.
Vacant pins or wires must not be used!

Adapter cables and connecting cables


EnDat adapter cables and connecting cable without incremental signals

| | | |
|--|---|------------------------------------|
| PUR connecting cable | $\varnothing 6 \text{ mm}; 2 \times (2 \times 0.09 \text{ mm}^2) + 2 \times (2 \times 0.16 \text{ mm}^2)$ | $A_P = 2 \times 0.16 \text{ mm}^2$ |
| Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (female) |  | 1036521-xx |
| Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male) |  | 1036526-xx |
| Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male) |  | 1036372-xx |

EnDat adapter cables and connecting cable with incremental signals

| | | |
|---|--|-----------------------------------|
| PUR connecting cable | $\varnothing 8 \text{ mm}; 4 \times (2 \times 0.16 \text{ mm}^2) + 4 \times 0.5 \text{ mm}^2 + 4 \times 0.16 \text{ mm}^2$ | $A_P = 2 \times 0.5 \text{ mm}^2$ |
| Adapter cable with 17-pin M23 connector (female) and 15-pin D-sub connector (female) |  | 332115-xx |
| Adapter cable with 17-pin M23 connector (female) and 15-pin D-sub connector (male) |  | 324544-xx |
| Connecting cable with 17-pin M23 connector (female) and stripped cable end |  | 309778-xx |

Fanuc/Mitsubishi connecting cables

| | | |
|---|---|------------------------------------|
| PUR cable | $\varnothing 6 \text{ mm}; 2 \times (2 \times 0.09 \text{ mm}^2) + 2 \times (2 \times 0.16 \text{ mm}^2)$ | $A_P = 2 \times 0.16 \text{ mm}^2$ |
| Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male) |  | 1036372-xx |

A_P : Cross section of power supply lines

\varnothing : Cable diameter (for bend radii, see the *Interfaces of HEIDENHAIN Encoders* brochure)

For other cables, see the *Cables and Connectors* brochure.

HEIDENHAIN

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This Product Information document supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information document edition valid when the order is placed.



More information:

Comply with the requirements described in the following documents to ensure correct and intended operation:

- Brochure: *Angle Encoders with Integral Bearing* 591109-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Brochure: *Cables and Connectors* 1206103-xx

For brochures and Product Information documents, visit www.heidenhain.com.