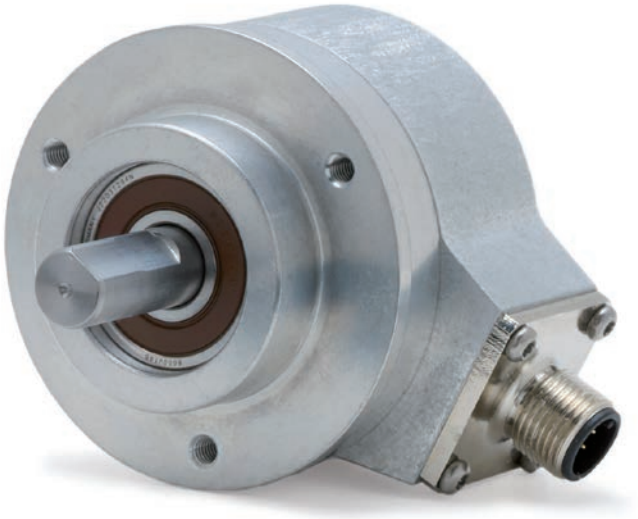
HEIDENHAIN



Functional Safety

Product Information

ROC 425
ROQ 437

Absolute Rotary Encoders with EnDat 2.2 for Safety-Related Applications

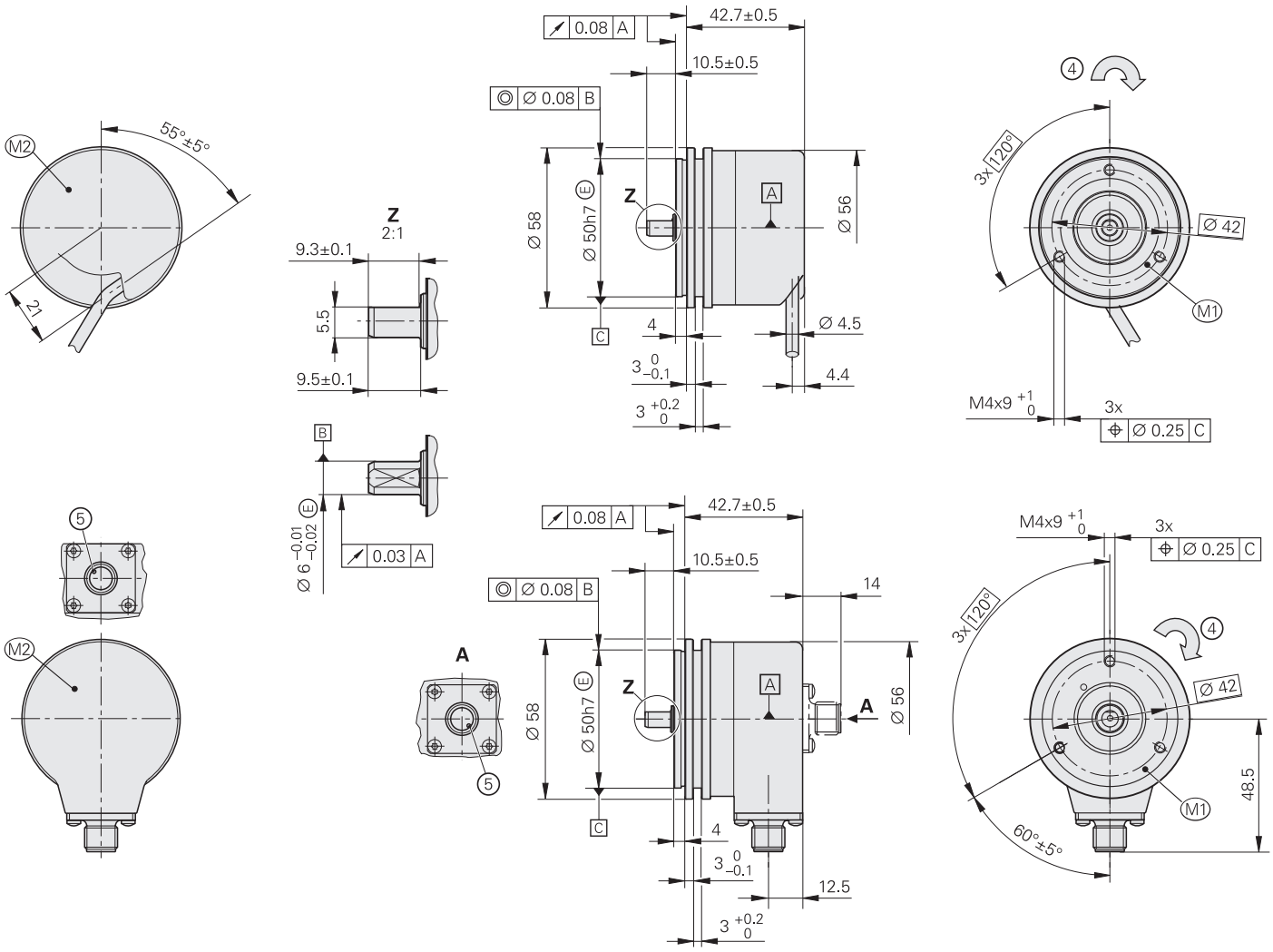
ID 1322270-xx
ID 1322271-xx
ID 1322275-xx
ID 1322276-xx

06/2022

ROC 425, ROQ 437 with synchro flange

Rotary encoders for absolute position measurement with safe singleturn information

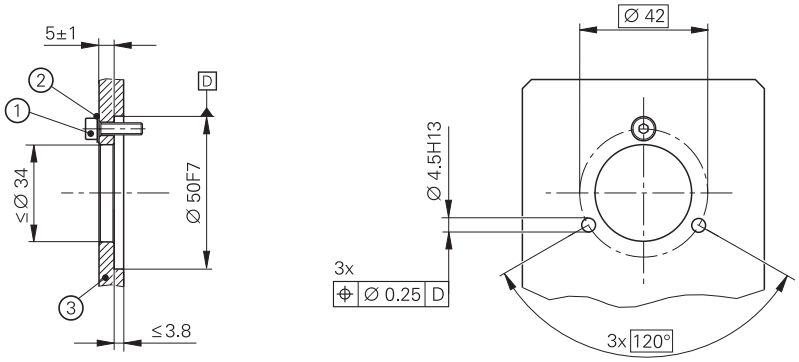
- **Rotary encoders for separate shaft coupling**
- **01C synchro flange**
- **92A solid shaft with flat**



Required mating dimensions

mm

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



A = Encoder bearing
M1 = Measuring point for operating temperature
M2 = Measuring point for vibration; see also D 741714
1 = M4 – 8.8 screw with material bonding anti-rotation lock; tightening torque: 2.65 Nm ±0.1 Nm; minimum engagement depth: 6 mm
2 = At a permissible interface pressure PG of ≤ 280 N/mm^2, use a washer
3 = For material properites, see *Mounting*
4 = Direction of shaft rotation for ascending position values
5 = Connector coding

Specifications	ROC 425 singleturn	ROQ 437 multiturn
Functional safety for applications with up to	For monitoring and closed-loop functions in the singleturn range: • SIL 2 as per EN 61508 (further basis for testing: IEC 61800-5-3) • Category 3, PL d, according to EN ISO 13849-1:2015	
PFH[1]	≤ $10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[2]	*Encoder:* ± 1.76° (safety-related measuring step: SM = 0.7°); *mechanical coupling:* ±0° (fault exclusion for stator coupling and shaft breakage, designed for accelerations ≤ 300 m/s^2)	
Interface	EnDat 2.2	
Ordering designation	EnDat22	
Position values per revolution	33 554 432 (25 bits)	
Revolutions	–	4096 (12 bits)
Calc. time t_{cal}/ clock freq.	≤ 7 µs / ≤ 16 MHz	
System accuracy	±20″	
Electrical connection**	8-pin M12 radial* or axial flange socket (male), or 1 m PUR cable with 8-pin M12 coupling (male)	
Cable length[3]	≤ 100 m (at clock frequency ≤ 8 MHz) ≤ 20 m (at clock frequency ≤ 16 MHz)	
Supply voltage	DC 3.6 V to 14 V	
Power consumption[4](maximum)	*At 3.6 V:* ≤ 600 mW; *at 14 V:* ≤ 700 mW	*At 3.6 V:* ≤ 700 mW; *at 14 V:* ≤ 800 mW
Current consumption (typical)	*5 V:* 80 mA (without load)	*5 V:* 95 mA (without load)
Shaft	92A solid shaft ∅ 6 mm with flat	
Shaft speed	≤ 15 000 rpm	≤ 12 000 rpm
Starting torque (typical)	0.01 Nm (at 20 °C)	
Moment of inertia of rotor	$2.9 \cdot 10^{-6}$ kgm^2	
Angular acceleration of rotor	≤ $1 \cdot 10^5$ rad/s^2	
Shaft load	*Axial:* ≤ 40 N; *radial:* ≤ 60 N at shaft end	
Vibration 55 Hz to 2000 Hz **Shock** 6 ms	≤ 300 m/s^2 (EN 60068-2-6); 10 Hz to 55 Hz constant over 4.9 mm peak to peak ≤ 2000 m/s^2 (EN 60068-2-27)	
Min. operating temp.	*Flange socket or fixed cable:* –40 °C; *moving cable:* –10 °C	
Max. operating temp.[5]	100 °C	
Trigger threshold[6] for exceeded temperature error message	125 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: ±1 K)	
Relative humidity	≤ 93 % (40 °C/21 d as per EN 60068-2-78); without condensation	
Protection EN 60529	Housing: IP67; shaft inlet: IP64 (read about insulation under *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochure; contamination from the ingress of fluids must be avoided)	
Mass	≈ 0.3 kg	
ID number	1322270-01* / 1322270-02	1322275-01* / 1322275-02

***** This preferred version is available on short notice ****** Please select when ordering

[1] For use at ≤ 2000 m above sea level (≤ 6000 m above sea level upon request)

[2] Further tolerances may arise in subsequent electronics after position value comparison (contact mfr. of subsequent electronics)

[3] See the EnDat description in the *Interfaces of HEIDENHAIN Encoders* brochure

[4] See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

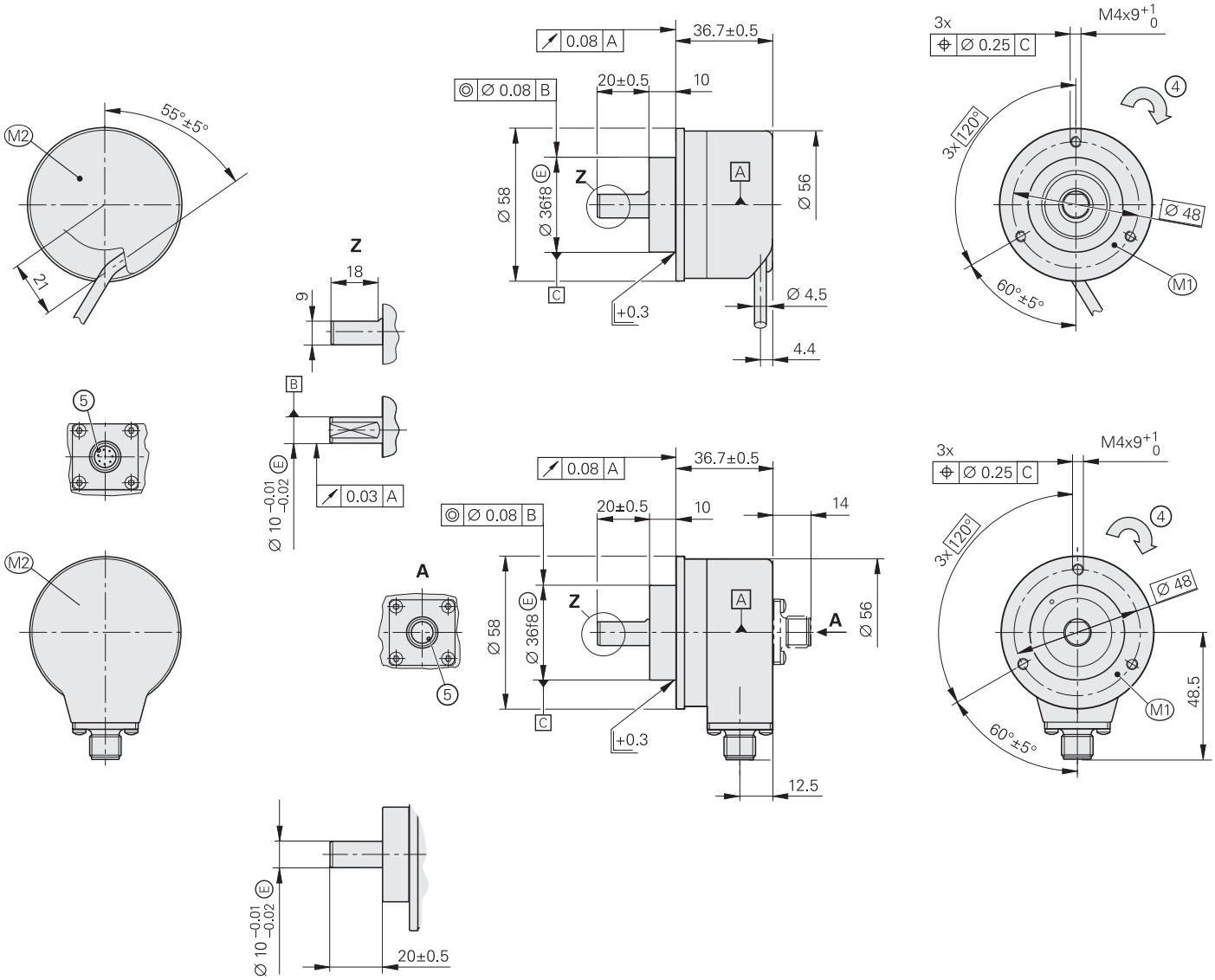
[5] For the relationship between operating temperature / shaft speed / supply voltage, see *General mechanical information* in the *Rotary Encoders* brochure

[6] The internal temperature evaluation is not designed for functional safety

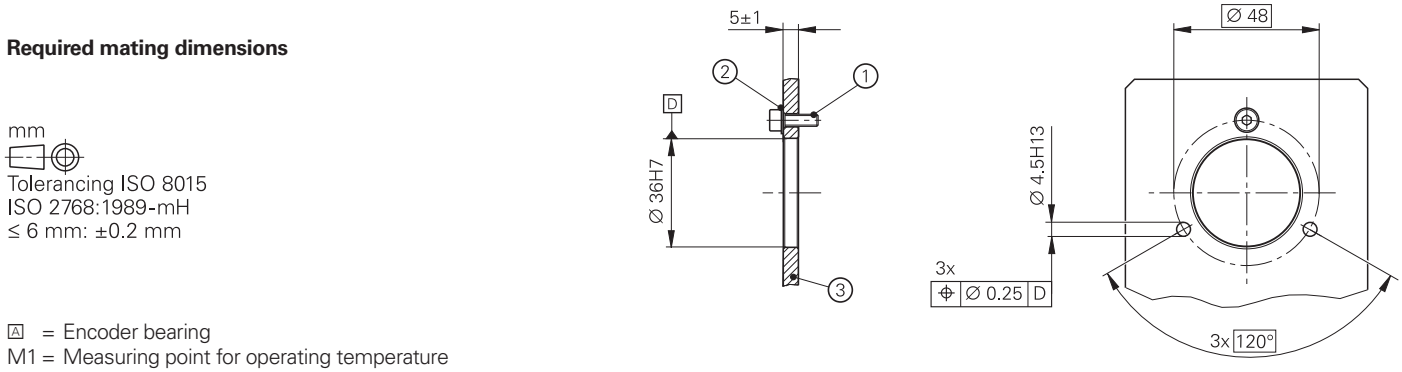
ROC 425, ROQ 437 with clamping flange

Rotary encoders for absolute position measurement with safe singleturn information

- **Rotary encoders for separate shaft coupling**
- **03C clamping flange**
- **03D solid shaft with flat**



Required mating dimensions



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M1 = Measuring point for operating temperature
M2 = Measuring point for vibration; see also D 741714
1 = M4 – 8.8 screw with material bonding anti-rotation lock; tightening torque: 2.65 Nm ±0.1 Nm; minimum engagement depth: 6 mm
2 = At a permissible interface pressure PG of ≤ 280 N/mm^2, use a washer
3 = For material properties, see *Mounting*
4 = Direction of shaft rotation for ascending position values
5 = Connector coding

Specifications	ROC 425 singleturn	ROQ 437 multiturn
Functional safety for applications with up to	For monitoring and closed-loop functions in the singleturn range: • SIL 2 as per EN 61508 (further basis for testing: IEC 61800-5-3) • Category 3, PL d, according to EN ISO 13849-1:2015	
PFH[1]	≤ $10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	
Safe position[2]	*Encoder:* ± 1.76° (safety-related measuring step: SM = 0.7°); *mechanical coupling:* ±0° (fault exclusion for stator coupling and shaft breakage, designed for accelerations ≤ 300 m/s^2)	
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System accuracy	±20″	
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Supply voltage	DC 3.6 V to 14 V	
Power consumption[4] (maximum)	*At 3.6 V:* ≤ 600 mW; *at 14 V:* ≤ 700 mW	*At 3.6 V:* ≤ 700 mW; *at 14 V:* ≤ 800 mW
Current consumption (typical)	*5 V:* 80 mA (without load)	*5 V:* 95 mA (without load)
Shaft	03 D solid shaft ∅ 10 mm with flat	
Shaft speed	≤ 15 000 rpm	≤ 12 000 rpm
Starting torque (typical)	0.01 Nm (at 20 °C)	
Moment of inertia of rotor	$2.9 \cdot 10^{-6}$ kgm^2	
Angular acceleration of rotor	≤ $1 \cdot 10^5$ rad/s^2	
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Max. operating temp.[5]	100 °C	
Trigger threshold[6] of temperature exceedance error message	125 °C in the scanning ASIC (measuring accuracy of the internal temperature sensor: ±1 K)	
Relative humidity	≤ 93 % (40 °C/21 d as per EN 60068-2-78); without condensation	
Protection EN 60529	Housing: IP67; shaft inlet: IP64 (read about insulation under *Electrical safety* in the *Interfaces of HEIDENHAIN Encoders* brochure; contamination from the ingress of fluids must be avoided)	
Mass	≈ 0.3 kg	
ID number	1322271-01* / 1322271-02 / 1322271-03	1322276-01* / 1322276-02

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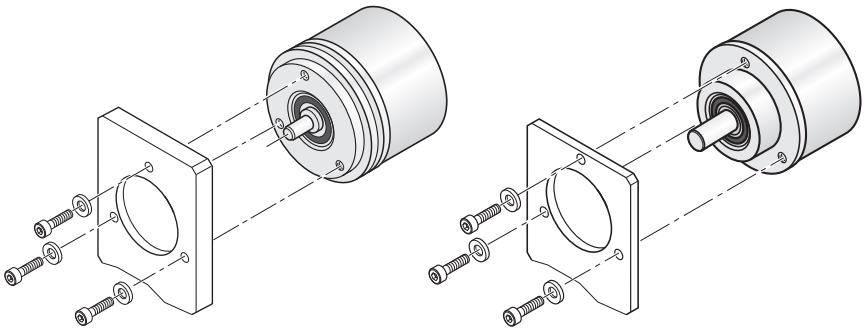
1) For use at ≤ 2000 m above sea level (≤ 6000 m above sea level upon request)
2) Further tolerances may arise in subsequent electronics after position value comparison (contact mfr. of subsequent electronics)
3) See the EnDat description in the *Interfaces of HEIDENHAIN Encoders* brochure
4) See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure
5) For the relationship between operating temperature / shaft speed / supply voltage, see *General mechanical information* in the *Rotary Encoders* brochure
6) The internal temperature evaluation is not designed for functional safety

Mounting

Mounting
The rotary encoders are centered by means of the centering collar of the synchro flange or of the clamping flange and are secured with screws at their front. Mechanical fault exclusion can be ensured only when mounting with three M4 screws of strength class 8.8 and at a minimum engagement depth of 6 mm in the rotary encoder flange. Screws are not included in delivery. The machine designer is responsible for specifying a material bonding anti-rotation lock for the screws depending on the application.

Fault exclusion was calculated based on a material bonding anti-rotation lock with a thread friction coefficient of between 0.1 and 0.16. The holes for the screws must be designed in accordance with EN 20273 (medium). The washers must be used for materials with permissible interface pressures of ≤ 280 N/mm^2.



Rotary encoder with synchro flange

Rotary encoder with clamping flange

Further information:

For the customer-side mounting design, the material specifications for steel apply to the customer-side shaft. For the customer-side stator, the material specifications for aluminum apply.

Note the other material properties in the *Rotary Encoders* brochure (ID349529-xx).

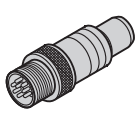
Further information:

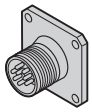
For mounting information and mounting aids, see the mounting instructions in the *Rotary Encoders* brochure.

Electrical connection

Pin layout

8-pin M12 coupling





	Power supply				Serial data transmission			
	8	**2**	**5**	**1**	**3**	**4**	**7**	**6**
	U_P	**Sensor** U_P	**0 V**	**Sensor** 0 V	**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!
Note for safety-related applications: Only completely assembled HEIDENHAIN cables are qualified.
Do not modify cables or exchange their connectors without first consulting with HEIDENHAIN Traunreut!

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH
Dr.-Johannes-Heidenhain-Str. 5
83301 Traunreut, Germany
☎ +49 8669 31-0
FAX +49 8669 32-5061
info@heidenhain.de

www.heidenhain.com

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:

- Operating Instructions 1379860