



# HEIDENHAIN



Product Information

## **ECI 1119/ECI 1122 EQI 1131/EQI 1134**

Absolute Rotary Encoders  
without Integral Bearing

For safety-related  
applications with  
SIL 2 or SIL 3

EnDat 3

70C flange (82A)

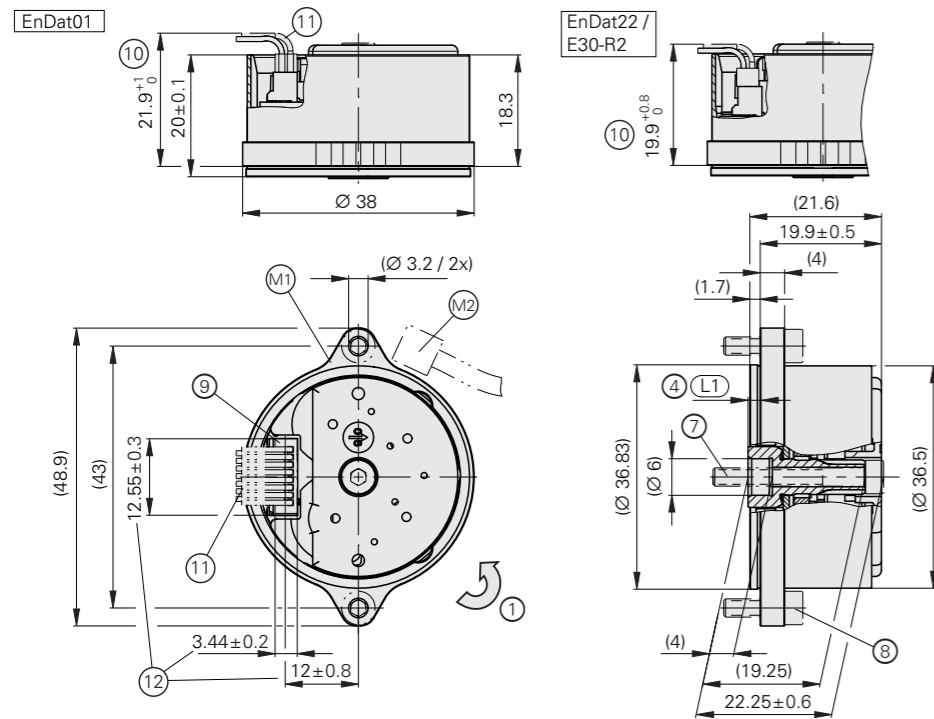
For HMC 2 connection  
technology

01/2024

# ECI 1119, ECI 1122, EQI 1131, EQI 1134

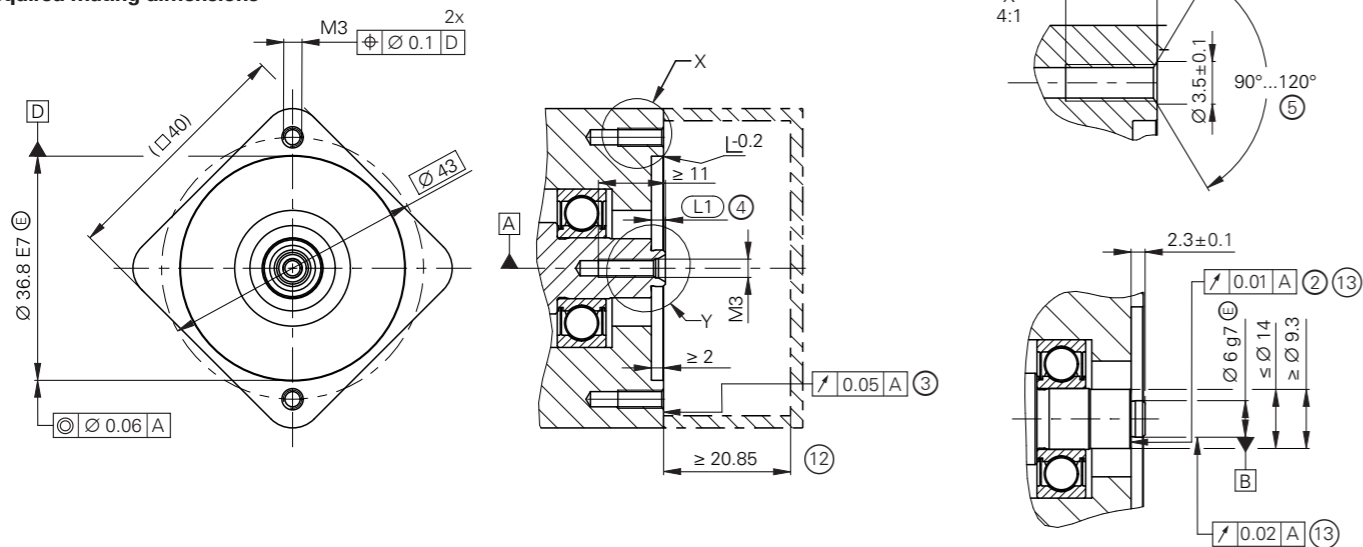
Rotary encoders for absolute position feedback with safe singleturn information

- Robust inductive scanning principle
- 70C mounting flange
- 82A blind hollow shaft (Ø 6 mm) for axial clamping
- Mounting-compatible with photoelectric rotary encoders with a 75A stator coupling
- Other mating dimensions available upon request for versatile mounting of various HEIDENHAIN rotary encoders



	L1
E30-R2	2±0.4
EnDat22	2±0.4
EnDat01	2±0.3

## Required mating dimensions



- ☐ = Bearing of mating shaft
- M1 = Measuring point for operating temperature
- M2 = Measuring point for vibration
- 1 = Direction of shaft rotation for output signals as per the interface description
- 2 = Shaft surface; ensure full-surface contact!
- 3 = Flange surface; ensure full-surface contact!
- 4 = Maximum permissible deviation between shaft surface and flange surface; compensation of mounting tolerances and thermal expansion
- 5 = Chamfer at start of thread is mandatory for material-bonding anti-rotation lock
- 6 = Possible centering hole
- 7 = Screw: ISO 4762 – M3x25 – 8.8 – MKL; tightening torque: 1 Nm ±0.1 Nm
- 8 = Screw: ISO 4762 – M3x10 – 8.8 – MKL; tightening torque: 1 Nm ±0.1 Nm
- 9 = 15-pin PCB connector
- 10 = Dimension for standard HEIDENHAIN cable
- 11 = Ensure space for cable!
- 12 = Distance to cover; note the opening for PCB connector and wires!
- 13 = Uncoated; no coating permissible
- 14 = Undercut

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

# Collecting operating data

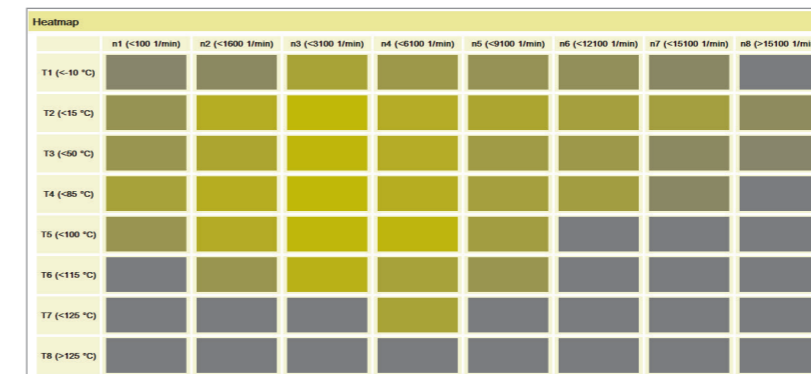


HEIDENHAIN encoders support the collection of operating data. This data is collected during operation of the encoder within the application and then stored in the encoder (data logger function).

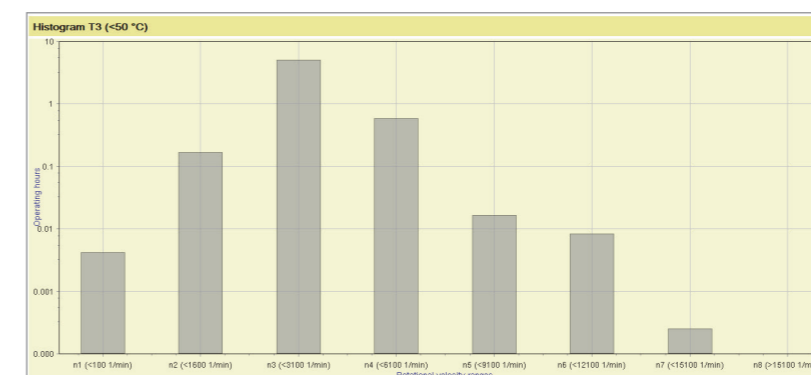
The resulting application-specific data can be used for ongoing analysis of the application or as an input value for higher-level condition monitoring. The data can also be output to help during servicing or quality management. In such cases, the specific mounting situation of the encoder must be taken into account because it may affect the collected values (especially temperatures).

The data can be output directly via the EnDat 3 interface or via an inspection or testing device from HEIDENHAIN (EnDat 3 and EnDat 22). The software belonging to the inspection or testing device (such as the ATS software for the PWM 21) enables visualization of the collected data in the form of tables and histograms. Access to the data depends on the specific encoder.

Collecting operating data (data logger function)	
<b>Operating statuses</b>	<ul style="list-style-type: none"> <li>• Operating time</li> <li>• Active time</li> <li>• Distance traveled</li> <li>• Number of reservations</li> <li>• Number of strokes</li> </ul>
<b>Extreme values</b>	<ul style="list-style-type: none"> <li>• Max. external temperature</li> <li>• Max. internal temperature</li> <li>• Min. internal temperature</li> <li>• Max. shaft speed</li> <li>• Max. acceleration</li> <li>• Min. mounting clearance</li> <li>• Max. mounting clearance</li> </ul>
<b>Alarm-triggered data</b>	<ul style="list-style-type: none"> <li>• Timestamp</li> <li>• External temperature</li> <li>• Internal temperature</li> <li>• Valuation numbers</li> <li>• Mounting clearance</li> <li>• Position</li> <li>• Shaft speed</li> </ul>
<b>Heat map and histogram</b>	<ul style="list-style-type: none"> <li>• Heat map: Operating times in relation to 8 temperature ranges and 8 speed ranges</li> <li>• Histogram: one operating time per temperature range in relation to 8 speed ranges</li> </ul>
<b>Status</b>	<ul style="list-style-type: none"> <li>• Number of write-accesses to the OEM memory</li> <li>• Number of restarts</li> </ul>



Typical heat map



Typical histogram

# Specifications

Specifications	ECI 1119 SIL 2 singletum	ECI 1122 SIL 2 singletum	ECI 1122 SIL 3 singletum	EQI 1131 SIL 2 multitum	EQI 1134 SIL 2 multitum	EQI 1134 SIL 3 multitum
<b>Functional safety</b> for applications with up to	As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> <li>SIL 2 as per EN 61508:2010 and IEC 61800-5-3:2021</li> <li>Category 3, PL d, in accordance with EN ISO 13849-1:2015</li> </ul> Safe in the singletum range		As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> <li>SIL 3 as per EN 61508:2010 and IEC 61800-5-3:2021</li> <li>Category 3, PL e as per EN ISO 13849-1:2015</li> </ul> Safe in the singletum range	As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> <li>SIL 2 as per EN 61508:2010 and IEC 61800-5-3:2021</li> <li>Category 3, PL d, in accordance with EN ISO 13849-1:2015</li> </ul> Safe in the singletum range		As a single-encoder system for monitoring functions and control-loop functions: <ul style="list-style-type: none"> <li>SIL 3 as per EN 61508:2010 and IEC 61800-5-3:2021</li> <li>Category 3, PL e as per EN ISO 13849-1:2015</li> </ul> Safe in the singletum range
PFH <sup>1)</sup>	$\leq 15 \cdot 10^{-9}$ (probability of dangerous failure per hour)		$\leq 10 \cdot 10^{-9}$ (probability of dangerous failure per hour)	$\leq 15 \cdot 10^{-9}$ (probability of dangerous failure per hour)		$\leq 10 \cdot 10^{-9}$ (probability of dangerous failure per hour)
	With additional measures as per Document 3000006, suitable for safety-related applications with up to SIL 3 or Category 4, PL e $2 \cdot 10^{-9}$ (probability of dangerous failure per hour)			With additional measures as per Document 3000006, suitable for safety-related applications with up to SIL 3 or Category 4, PL e $2 \cdot 10^{-9}$ (probability of dangerous failure per hour)		
Safe position <sup>2)</sup>	<i>Encoder</i> : $\pm 1.16^\circ$ (safety-related measuring step SM = 0.35°) <i>Mechanical coupling of 82A shaft</i> : $\pm 0^\circ$ ; (fault exclusion for the loosening of the shaft coupling and stator coupling; designed for accelerations at the stator of $\leq 400 \text{ m/s}^2$ ; at the rotor: $\leq 600 \text{ m/s}^2$ )			<i>Encoder</i> : $\pm 1.16^\circ$ (safety-related measuring step SM = 0.35°) <i>Mechanical coupling of 82A shaft</i> : $\pm 0^\circ$ ; (fault exclusion for the loosening of the shaft coupling and stator coupling; designed for accelerations at the stator of $\leq 400 \text{ m/s}^2$ ; at the rotor: $\leq 600 \text{ m/s}^2$ )		
<b>Interface</b>	EnDat 3			EnDat 3		
Ordering designation	E30-R2			E30-R2		
Position values per rev.	524288 (19 bits)	4 194 304 (22 bits)		524288 (19 bits)	4 194 304 (22 bits)	
Revolutions	–			4096 (12 bits)		
XEL.time HPFout data rate	$\leq 11 \mu\text{s}$ at 12.5 Mbit/s $\leq 8.2 \mu\text{s}$ at 25 Mbit/s			$\leq 11 \mu\text{s}$ at 12.5 Mbit/s $\leq 8.2 \mu\text{s}$ at 25 Mbit/s		
Analog delay time tAD	22.9 $\mu\text{s}$			22.9 $\mu\text{s}$		
System accuracy	$\pm 120''$	$\pm 65''$		$\pm 120''$	$\pm 65''$	
<b>Electrical connection</b>	15-pin PCB connector (with connection for external temperature sensor) <sup>3)</sup>			15-pin PCB connector (with connection for external temperature sensor) <sup>3)</sup>		
<b>External temperature sensor</b>	PT 1000			PT 1000		
Cable length	At 12.5 Mbit/s: $\leq 100 \text{ m}$ ; at 25 Mbit/s: $\leq 40 \text{ m}$			At 12.5 Mbit/s: $\leq 100 \text{ m}$ ; at 25 Mbit/s: $\leq 40 \text{ m}$		
Supply voltage	DC 4 V to 14 V			DC 4 V to 14 V		
Current consumption (typical)	At 12 V: 28 mA			At 12 V: 53 mA		
Power consumption <sup>4)</sup> (max.)	At 4 V: $\leq 350 \text{ mW}$ ; at 14 V: $\leq 340 \text{ mW}$			At 4 V: $\leq 650 \text{ mW}$ ; at 14 V: $\leq 660 \text{ mW}$		

<sup>1)</sup> For use at  $\leq 2000 \text{ m}$  above sea level

<sup>2)</sup> Further tolerances may arise in the downstream electronics after position value comparison (contact mfr. of the downstream electronics)

<sup>3)</sup> See *Temperature measurement in motors* in the *Encoders for Servo Drives* brochure

<sup>4)</sup> See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure

# Specifications

Specifications	ECI 1119 SIL 2 singletum	ECI 1122 SIL 2 singletum	ECI 1122 SIL 3 singletum	EQI 1131 SIL 2 multitum	EQI 1134 SIL 2 multitum	EQI 1134 SIL 3 multitum
<b>Shaft</b>	82A blind hollow shaft (Ø 6 mm) for axial clamping, without positive-locking element			82A blind hollow shaft (Ø 6 mm) for axial clamping, without positive-locking element		
Operating status data	–	Available		–	Available	
Spindle speed	≤ 15000 rpm			≤ 12000 rpm		
Moment of inertia of rotor	0.2 · 10 <sup>-6</sup> kgm <sup>2</sup>			0.2 · 10 <sup>-6</sup> kgm <sup>2</sup>		
Angular acceleration of rotor	≤ 1 · 10 <sup>5</sup> rad/s <sup>2</sup>			≤ 1 · 10 <sup>5</sup> rad/s <sup>2</sup>		
Axial motion of measured shaft	≤ ±0.4 mm			≤ ±0.4 mm		
<b>Vibration</b> 55 Hz to 2000 Hz <sup>5)</sup> <b>Shock</b> 6 ms	Stator: ≤ 400 m/s <sup>2</sup> ; rotor: ≤ 600 m/s <sup>2</sup> (EN 60068-2-6) ≤ 2000 m/s <sup>2</sup> (EN 60068-2-27)			Stator: ≤ 400 m/s <sup>2</sup> ; rotor: ≤ 600 m/s <sup>2</sup> (EN 60068-2-6) ≤ 2000 m/s <sup>2</sup> (EN 60068-2-27)		
<b>Operating temperature</b>	–40 °C to 110 °C	–40 °C to 115 °C		–40 °C to 110 °C	–40 °C to 115 °C	
<b>Trigger threshold</b> of error message for excessive temperature	128 °C (measuring accuracy of the internal temperature sensor: ±1 K)			128 °C (measuring accuracy of the internal temperature sensor: ±1 K)		
<b>Relative humidity</b>	≤ 93% (40 °C/21 d as per EN 60068-2-78); without condensation			≤ 93% (40 °C/21 d as per EN 60068-2-78); without condensation		
<b>Protection</b> EN 60529	IP00			IP00		
<b>Mass</b>	≈ 0.04 kg			≈ 0.04 kg		
<b>ID number</b>	1391210-01 1391210-51 <sup>6)</sup>	1391210-02 1391210-52 <sup>6)</sup>	1334662-03 1334662-53 <sup>6)</sup>	1391216-01 1391216-51 <sup>6)</sup>	1391216-02 1391216-52 <sup>6)</sup>	1334664-03 1334664-53 <sup>6)</sup>

<sup>5)</sup> At 10 Hz to 55 Hz, constant over 6.5 mm peak to peak (stator), 10 mm peak to peak (rotor)

<sup>6)</sup> Rotary encoders in collective package

## Mounting

The blind hollow shaft of the rotary encoder is pressed onto the measured shaft and fastened with a central screw. The stator is positioned for mounting via a centering diameter and fastened with two mounting screws. In each case, use screws with material-bonding anti-rotation lock.

### Online diagnostics

With EnDat 3 encoders, valuation numbers can be read cyclically from the encoder in order to evaluate its functionality. These valuation numbers indicate the encoder's current status and can be used to determine its "function reserves." Further information is available from HEIDENHAIN upon request.

## Mounting accessories

### Fastening elements

Screws (central screw, mounting screws) are not included in delivery. They can be ordered separately.

ECI 1119/ECI 1122 EQI 1131/EQI 1134	Screws <sup>1)</sup>
<b>Central screw</b> for shaft fastening	ISO 4762-M3x25-8.8-MKL
<b>Mounting screw</b> for flange	ISO 4762-M3x10-8.8-MKL

<sup>1)</sup> With coating for material-bonding anti-rotation lock

Please note the information on screws from HEIDENHAIN in the *Encoders for Servo Drives* brochure, under *General mechanical information*.

### Mounting aid

To avoid damage to the cable, use the mounting aid to connect and disconnect the cable assembly. Apply pulling force solely to the connector and not to the wires.

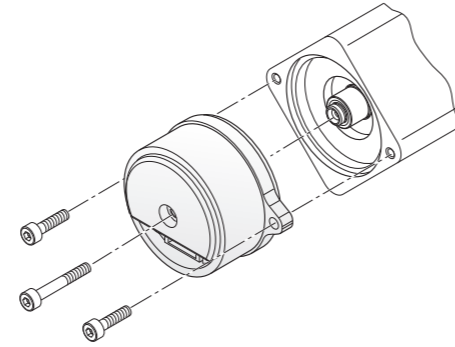
ID 1075573-01

**For more mounting information and mounting aids, see the Mounting Instructions and the *Encoders for Servo Drives* brochure. The installation can be inspected with the PWM 21 and the ATS software (see Document 1082415).**

### EnDat 3 adapter

Adapter for connecting an encoder with EnDat 3 (E30-R2) to the PWM 21.

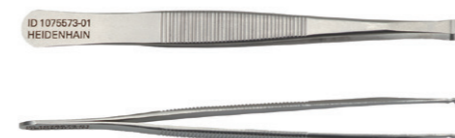
ID 1317260-01



### More information:

For the customer-side mounting design, aluminum and steel are permissible materials for the customer-side shaft and stator.

In addition, comply with the material specifications and other material characteristics in the *Encoders for Servo Drives* brochure (ID 208922-xx).



## Integrated temperature evaluation

This rotary encoder features an internal temperature sensor integrated into the encoder electronics and an evaluation circuit for an external temperature sensor. In both cases, the respective digitized temperature value is transmitted purely serially over the EnDat protocol. Please bear in mind that neither the temperature measurement nor the transmission of the temperature value is safe in terms of functional safety. With regard to the internal temperature sensor (FID 0x21 SENSOR\_TEMP\_INT), the rotary encoder supports the two-stage cascaded signaling of a temperature exceedance. It consists of an EnDat warning and an EnDat error message. In compliance with the EnDat specification, when the temperature

reaches the warning threshold for temperature exceedance of the internal temperature sensor, an EnDat warning is issued (HPF.STATUS.W "collective warning bit"). In addition, bit 26 (W10) "Temperature warning threshold exceeded" is set in the LPF with the FID=ERRMSG. This warning threshold for the internal temperature sensor is stored in the parameter SET.tempWarnLevel and can be individually adjusted. A device-specific default value is saved here before shipping. The temperature measured by the internal temperature sensor is higher by a device-specific and application-specific amount than the temperature at measuring point M1 (as shown in the dimension drawing).

The encoder features a second, albeit non-adjustable trigger threshold for the EnDat error message (HPF.STATUS.F "collective error bit"). In addition, bit 8 (A8) "Permissible ambient conditions exceeded" is set in the LPF with the FID=ERRMSG. This trigger threshold may vary depending on the encoder model and is stated in the specifications. HEIDENHAIN recommends adjusting the warning threshold based on the application such that this threshold is sufficiently below the trigger threshold for the "Temperature exceeded" EnDat error message. Fulfillment of the encoder's intended use requires adherence to the operating temperature at measuring point M1.

### Connectible external temperature sensors

The following external temperature sensors can be evaluated in the encoder:

- PT 1000 (activated by default)
- KTY84-130
- KTY83-110

See *Sensor settings* in the EnDat 3 interface specification (Document 3000001).

# Electrical connection

## Cables

<b>ETFE output cables inside the motor</b> $\varnothing$ 1.8 mm $2 \times 0.15$ mm <sup>2</sup> , without shield and with ETFE wires $\varnothing$ 2.2 mm $2 \times 0.15$ mm <sup>2</sup> for temperature sensor; $A_P = 0.15$ mm <sup>2</sup>		
15-pin PCB connector (female) and stripped cable end 2 x ETFE twisted single wires (communication); 2 x ETFE single wires (length: 0.10 m) with heat-shrink tubing (temperature sensor)		1302347-xx
15-pin PCB connector (female) and 8-pin M12 SpeedTec angle flange socket (male) 2 x ETFE twisted single wires (communication); 2 x ETFE single wires (length: 0.10 m) with heat-shrink tubing and 2-pin connector (male, for a temperature sensor)		1279930-xx
<b>PUR adapter cable</b> $\varnothing$ 9.3 mm with external shield 4 x 0.5 mm <sup>2</sup> (power wires) 2 x 0.34 mm <sup>2</sup> (brake wires, shielded) 2 x 0.14 mm <sup>2</sup> (communication wires, shielded); $A_P = 0.14$ mm <sup>2</sup>		
8-pin M12 SpeedTEC straight connector (female), and 3-pin header connector (power), and 4-pin header (brake wires), and 15-pin D-sub connector (male, for communication)		1279881-xx

The connecting element must be suitable for the maximum clock frequency used.

### Note for safety-related applications:

- Conformity with the EMC Directive must be ensured in the complete system!

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.



### More information:

For connecting cables and adapter cables, see the *Cables and Connectors* brochure (ID 1206103-xx).

## Pin layout of ECI, EQI

8-pin M12 SpeedTEC angle flange socket		15-pin PCB connector	
<b>Encoder</b>			
	Power supply / Serial data transfer		Other signals
	<b>A</b>	<b>B</b>	/
	<b>9</b>	<b>10</b>	<b>5</b>
	-	-	<b>2</b>
	<b>P_SD+</b> <sup>1)</sup>	<b>P_SD-</b> <sup>1)</sup>	<b>T+</b> <sup>2)</sup>
	Violet	Yellow	Brown
			<b>T-</b> <sup>2)</sup>
			Green

<b>Motor</b>						
	Brake		Power supply			
	<b>C</b>	<b>D</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
	<b>Brake +</b>	<b>Brake -</b>	<b>U</b>	<b>V</b>	<b>W</b>	<b>PE</b>

<sup>1)</sup> Power supply and data: P\_SD+ includes U<sub>P</sub>; P\_SD- includes 0 V

<sup>2)</sup> Connections for an external temperature sensor

**Cable shield** connected to housing; **U<sub>P</sub>** = Power supply voltage

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!

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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:

- Operating Instructions

1409623-xx