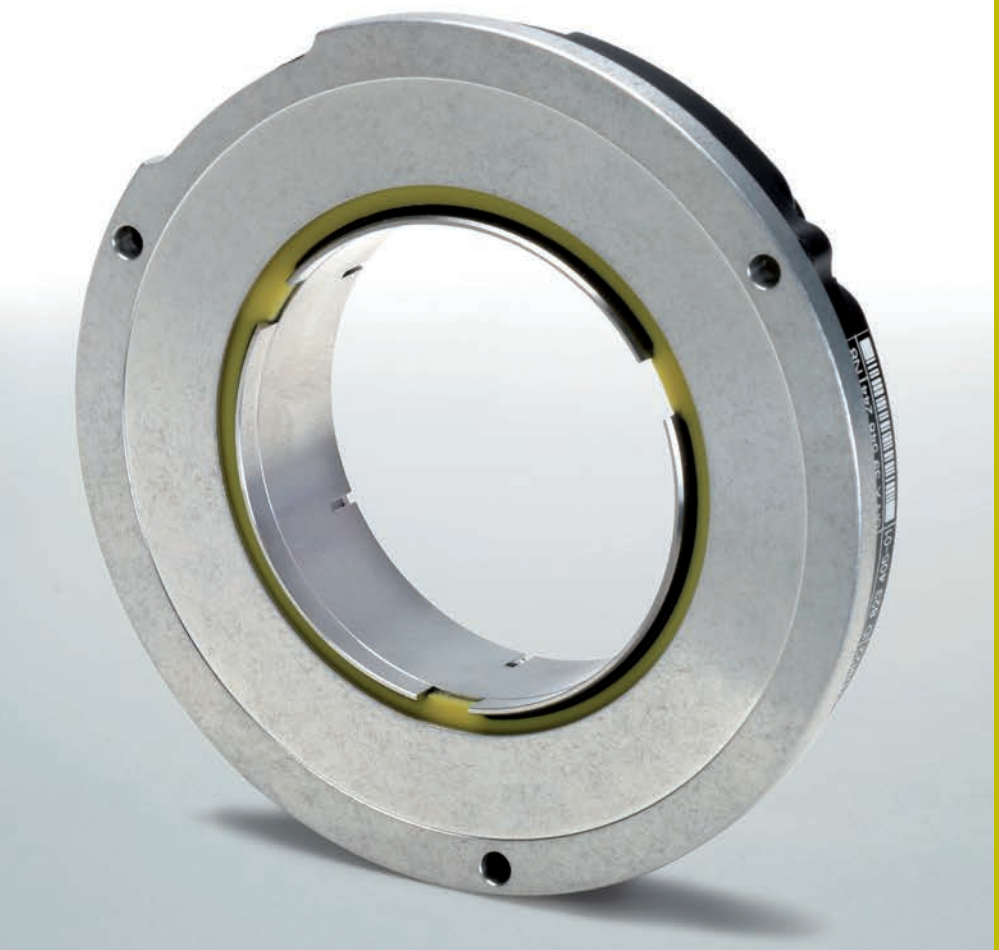
HEIDENHAIN



Preliminary
Product Information

ECI 123 S*plus*

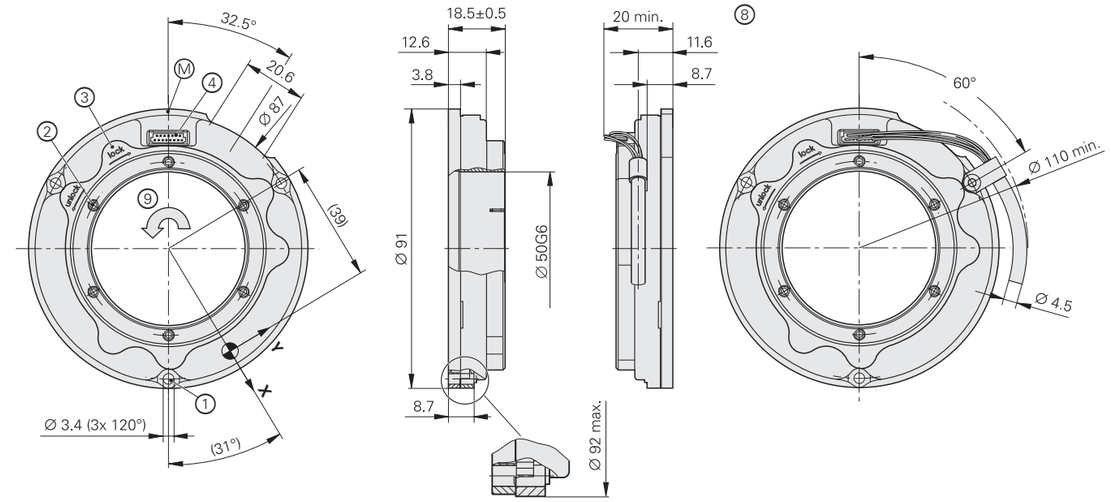
Absolute Inductive
Rotary Encoder with
Additional Functionality:
Oscillation Analysis

06/2023

ECI 123 S*plus*

Rotary encoder without integral bearing for integration in motors

- **Absolute inductive rotary encoder with additional functionality: oscillation analysis**
- **Hollow through shaft**
- **Inductive scanning principle**



mm

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

A = Bearing of mating shaft
K = Required mating dimensions
M = Measuring point for operating temperature
1 = Cylinder head screw: ISO 4762 – M3, with three ISO 7092 washers; tightening torque: 0.9 Nm ±0.05 Nm
2 = Width A/F 2.0 (6x); tighten evenly crosswise with increasing tightening torque; final tightening torque: 0.5 Nm ±0.05 Nm
3 = Shaft detent: For function, see Mounting/Removal
4 = 15-pin header (male)
5 = Compensation of mounting tolerances and thermal expansion; no dynamic motion
6 = Ensure protection against contact (EN 60529)
7 = Required up to max. Ø 92 mm
8 = Required mounting frame for output cable with cable clamp (accessory); bending radius of connecting wires: at least R3 mm
9 = Direction of shaft rotation for ascending position values

	Absolute **ECI 123 S*plus* singleturn**
Absolute position values	**EnDat 3**
Ordering designation	E30-R2
Position values per revolution	8 388 608 (23 bits)
XEL.time HPFout data rate	≤ 11 µs at 12.5 Mbit/s ≤ 8.2 µs at 25 Mbit/s
Propagation time	13.9 µs (typical)
Analog delay time (typical)	14 µs
System accuracy	± 90″
Supply voltage	DC 4 V to 14 V (recommended: 12 V)
Power consumption (maximum)	*4 V:* ≤ 580 mW *14 V:* ≤ 700 mW
Current consumption (typical)	*4 V:* ≤ 80 mA (without communication)
Electrical connection	15-pin PCB connector
Cable length	*At 12.5 Mbit/s:* ≤ 100 m; *at 24 Mbit/s:* ≤ 40 m
Shaft	Hollow through shaft (Ø 50 mm)
Speed	≤ 6000 rpm
Moment of inertia of rotor	$64 \cdot 10^{-6}$ kgm^2
Permissible axial motion of measured shaft	±0.3 mm
Vibration 55 Hz to 2000 Hz[1] **Shock** 6 ms	≤ 300 m/s^2 (EN 60068-2-6) ≤ 1000 m/s^2 (EN 60068-2-27)
Operating temperature	–20 °C to 105 °C
Trigger threshold of error message for excessive temperature	130 °C (measuring accuracy of internal temperature sensor: ±1 K)
Relative humidity	≤ 93% (40 °C/21 d as per EN 60068-2-78), condensation excluded
Protection EN 60529	IP20 when mounted[2]
Mass	≈ 0.14 kg
ID number	1391654-01

[1] 10 Hz to 55 Hz, 4.9 mm constant peak to peak
[2] CE compliance of the complete system must be ensured by taking the correct measures during installation.

Mounting instructions

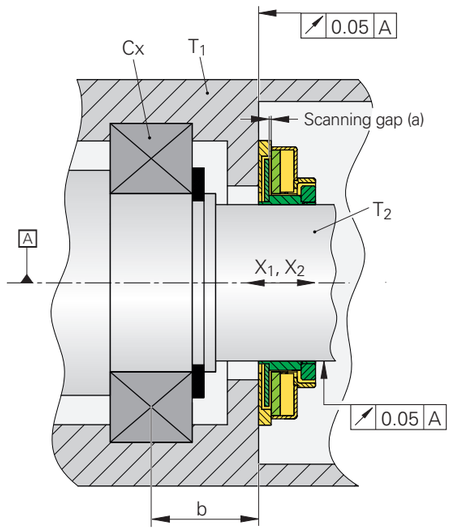
The ECI 123 S*plus* is an encoder without integral bearing. This means that mounting and operating conditions influence the functional reserves of the encoder. It is essential to ensure that the specified mating dimensions and tolerances are maintained in all operating conditions.

The following are particularly important:
- Axial runout of flange mounting surface
- Radial runout of the motor shaft
- The correct scanning gap (a), while considering any combination of, for example, the following:
  – The length ratio between the motor shaft and the motor housing under the influence of temperature (T_1; T_2; α1; α2), depending on the position of the fixed bearing (b)
  – Bearing play (Cx)
  – Non-dynamic shaft offsets due to load (X_1)
  – The effect of motor brakes engaging (X_2)

The application analysis must yield values within specification for all possible operating conditions (particularly under maximum load and at minimum and maximum operating temperature) for the ascertained
- max. radial runout of the motor shaft
- max. axial runout of the motor shaft with respect to the mounting surface
- max. scanning gap (a)
- min. scanning gap (a)

and with the signal amplitude taken into account (inspection of the scanning gap at room temperature) using the ATS software.

Furthermore, the general mechanical and electrical information in the current *Encoders for Servo Drives* brochure must be kept in mind!

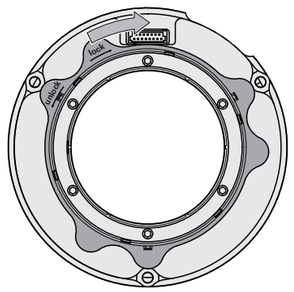


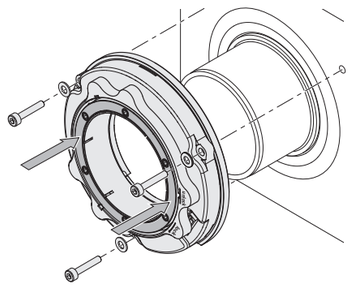
Mounting

Lock
Press the encoder housing (stator) against the bearing surface and hand-tighten the locking ring by rotating it clockwise.

Attach the rotary encoder
Press the rotary encoder onto the mating shaft without tilting it. Apply pressure only to the encoder shaft (clamping ring). Fasten the encoder housing with three screws and three washers:
- M3 screws; head Ø ≤ 5.5 mm
- Washers as per ISO 7092
- Tightening torque: 0.9 Nm ±0.05 Nm

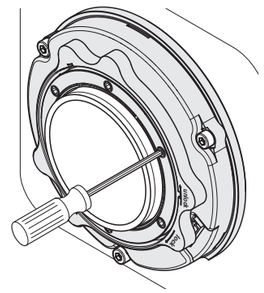
If required, fasten the clamp of the encoder cable. Appropriate tools are available from HEIDENHAIN.

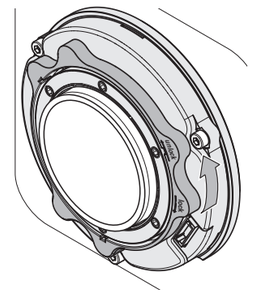




Clamp the shaft
Evenly tighten the clamping screws (width A/F 2.0, 6 x 60°) crosswise with increasing tightening torque; do not exert axial pressure; final tightening torque: 0.5 Nm ±0.05 Nm

Release the lock
Rotate the locking ring counterclockwise as far as it will go (stop point). The locking ring is now in its operating position: the connector is accessible.





Testing and inspection devices, and diagnostics

HEIDENHAIN encoders provide all of the information needed for initial setup, monitoring, and diagnostics. The type of information available depends on whether the encoder is incremental or absolute and on which interface is being used.

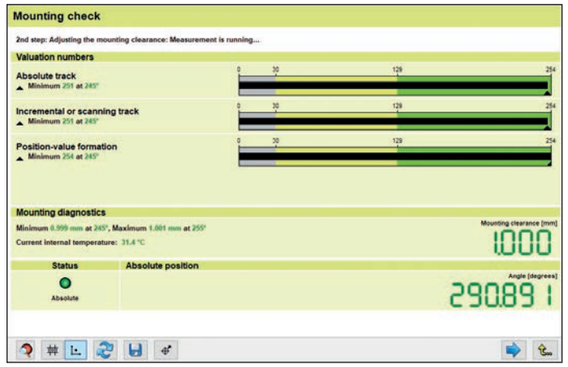
Absolute encoders employ serial data transmission. The signals are extensively monitored within the encoder. The monitoring results (particularly valuation numbers) can be transmitted to the downstream electronics along with the position values via the serial interface (**digital diagnostic interface**). The following information is available:

- Error message: position value is not reliable
- Warning: an internal functional limit of the encoder has been reached
- Valuation numbers:
  - Detailed information about the encoder's function reserve
  - Identical scaling for all HEIDENHAIN encoders
  - Cyclic reading capability

This enables the downstream electronics to evaluate the current status of the encoder with little effort, even in closed-loop mode.

For the analysis of these encoders, HEIDENHAIN offers the appropriate PWM inspection devices and PWT testing devices. Based on how these devices are integrated, a distinction is made between two types of diagnostics:

- Encoder diagnostics: the encoder is connected directly to the testing or inspection device, thereby enabling a detailed analysis of encoder functions.
- Monitoring mode: the PWM inspection device is inserted within the closed control loop (via suitable testing adapters as needed). This enables real-time diagnosis of the machine or equipment during operation. The available functions depend on the interface.



Mounting accuracy with the PWM 21 and ATS software

PWM 21
The PWM 21 phase-angle measuring unit, in conjunction with the included ATS adjusting and testing software, serves as an adjusting and testing package for the diagnosis and adjustment of HEIDENHAIN encoders.

For more information, see the *PWM 21/ ATS Software* Product Information document.

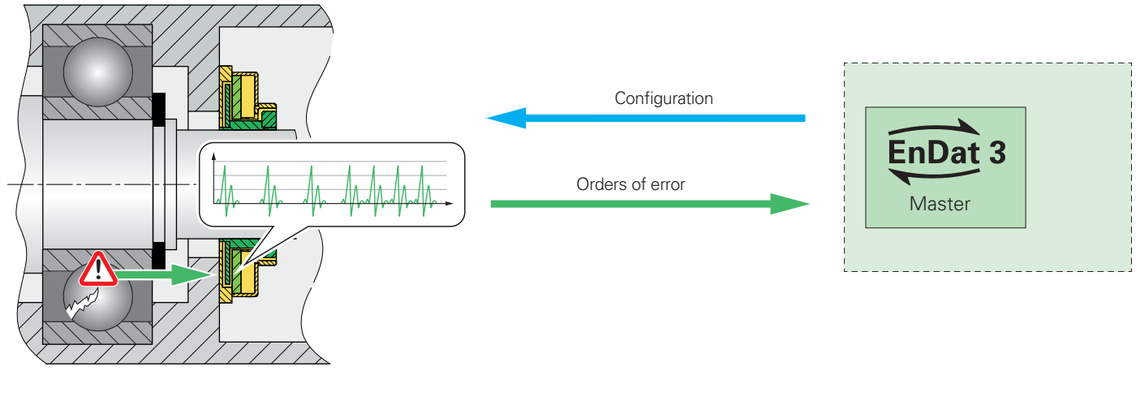
	PWM 21
Encoder input	• EnDat 2.1, EnDat 2.2, or EnDat 3 (absolute value with or without incremental signals) • DRIVE-CLiQ • Fanuc Serial Interface • Mitsubishi high speed interface • Yaskawa Serial Interface • Panasonic serial interface • SSI • 1 V_{PP}/TTL/11 μA_{PP} • HTL (via signal adapter)
Interface	USB 2.0
Supply voltage	AC 100 V to 240 V or DC 24 V
Dimensions	258 mm × 154 mm × 55 mm

DRIVE-CLiQ is a registered trademark of Siemens AG

Oscillation analysis

In order to detect damage to rotating machine elements (such as rolling bearings) at an early stage, an oscillation analysis is the method of choice on machine tools or systems. HEIDENHAIN has integrated both a 3-axis acceleration sensor for detecting oscillation accelerations and the corresponding evaluation unit in the ECI 123 S*plus*.

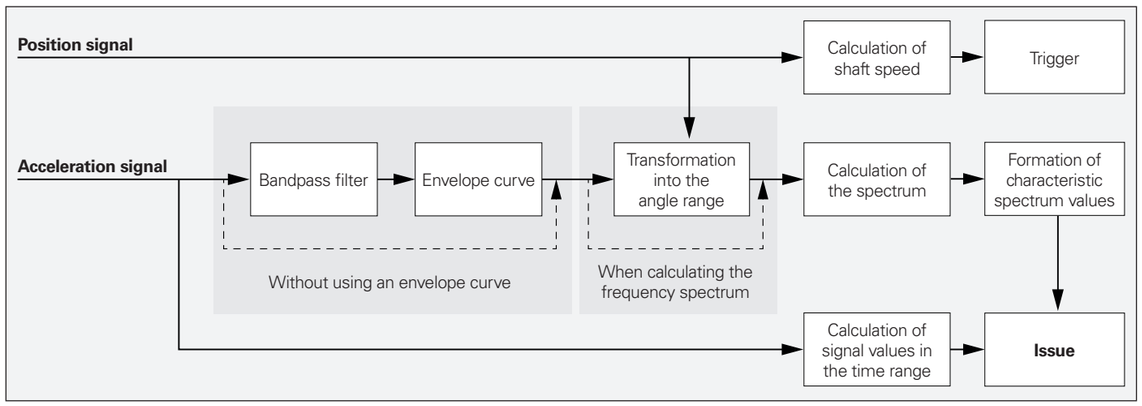
The oscillation signals and position value are acquired together, and are evaluated and transmitted to the downstream electronics via the EnDat 3 interface. The user then receives important information about online monitoring, trend analyses and forecasts about the remaining service life of his machine tool or system.



A fast Fourier transform is used to calculate a spectrum from the oscillation data acquired by the encoder. Depending on what the user has configured, the evaluation is performed either as a time-synchronous frequency analysis at constant shaft speed or as a rotational angle-synchronous order analysis (with/ without envelope analysis) at variable speed. The user must specify the error frequencies to be calculated. The orders of error can be requested from the bearing manufacturer. The encoder then returns the corresponding amplitude for each preselected order. The user can then store and evaluate these amplitudes.

To facilitate the configuration process, HEIDENHAIN provides a demo program and application notes (D1385069) for the encoder. The oscillation analysis is described in detail in document D1393075.

Direction of measurement of the acceleration sensor: the Z axis points toward the shaft.
The MEMS acceleration sensor has four scanning areas with up to ±64 g and a bandwidth of typically 5600 Hz.



Simplified block diagram of signal processing by the additional sensor

Electrical connection

Cables

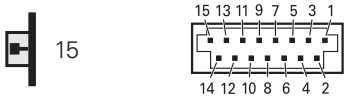
ETFE encoder cable inside the motor Ø 1.8 mm 2 x 0.15 mm^2, without shield and with ETFE wires Ø 2.2 mm 2 x 0.15 mm^2 for a temperature sensor; A_P = 0.15 mm^2		
15-pin PCB connector (female) and stripped cable ends with two twisted ETFE single wires (communication) and two ETFE single wires (length: 0.10 m) with heat shrink tubing (temperature sensor)[1]		1302347-xx
15-pin PCB connector (female) and 8-pin M12 SpeedTEC angle flange socket (male), with two twisted ETFE single wires (communication) and two ETFE single wires (length: 0.10 m) with heat shrink tubing and a 2-pin connector (male) for a temperature sensor[1]		1279930-xx

[1] No transmission of temperature data from the external temperature sensor when using a functional model or prototype
The connecting element must be suitable for the maximum clock frequency used.

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

EnDat 3 pin layout

15-pin PCB connector



	Encoder			
	Power supply / Serial data transfer		Other signals	
15	**9**	**10**	**5**	**6**
	P_SD+[1]	**P_SD–**[1]	**T+**[2]	**T–**[2]
	Violet	Yellow	Brown	Green

[1] Power supply and data: P_SD+ includes U_P; P_SD– includes 0 V
[2] Connections for external temperature sensor; evaluation optimized for KTY 84-130, PT 1000, and others; (see *Temperature measurement in motors* in the *Encoders for Servo Drives* 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:

- Application Note ECI 1xx Splus 1385069-xx
- EnDat 3 Interface Specification 3000001-xx
- EnDat 3 Interface Specification Features Addendum 3000100-xx
- EnDat 3 Interface Specification Features Addendum Oscillation Analysis 1393075-xx
- Demo program for configuring the oscillation analysis feature 1265682-xx
- Operating Instructions 1412577-xx