



HEIDENHAIN



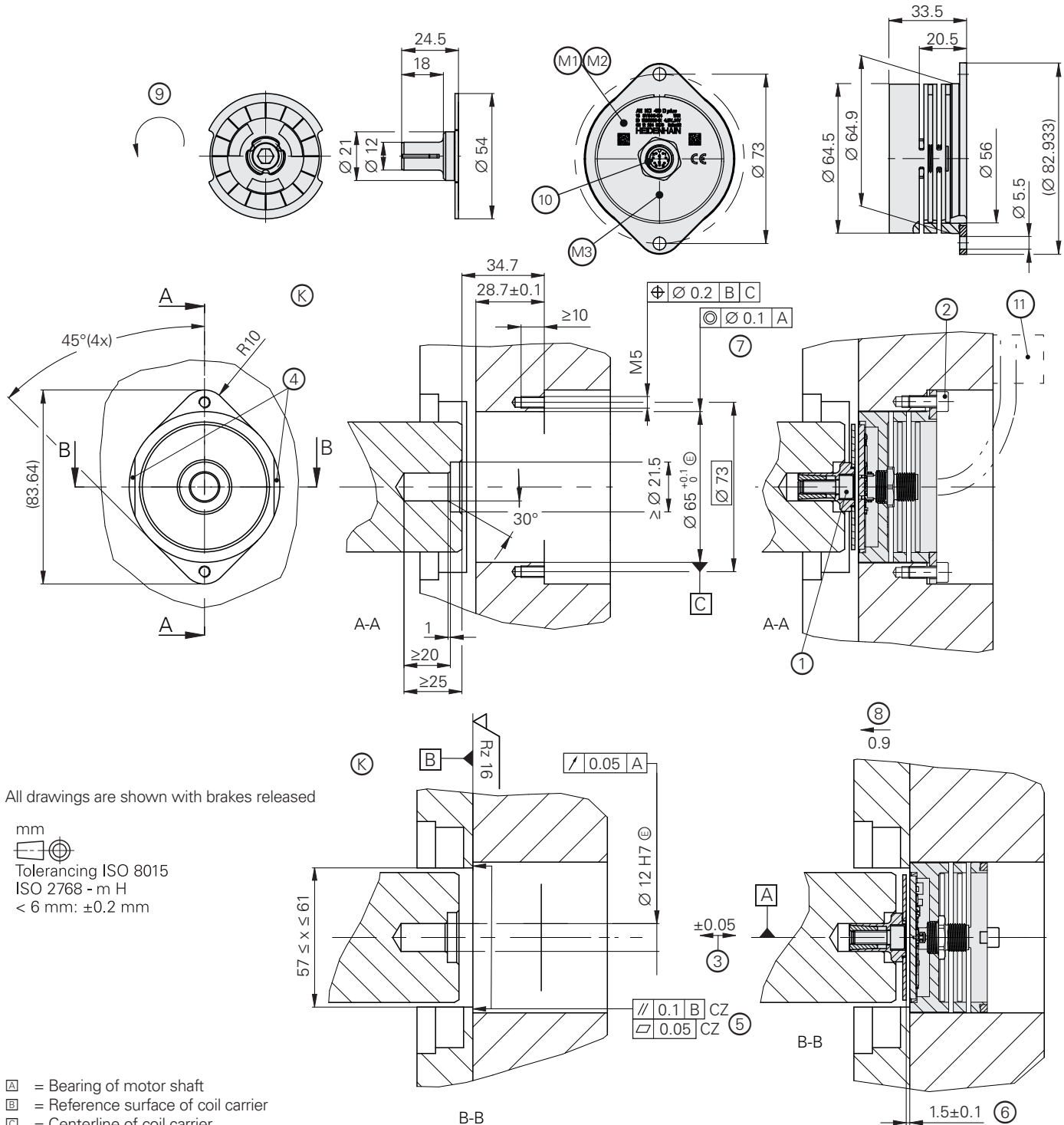
Product Information

KCI 419 Dplus

Absolute Inductive
Rotary Encoder with
Additional Axial
Distance Measurement

KCI 419 Dplus: motor control

- Absolute inductive rotary encoder with additional functionality
- Axial distance measurement
- Robust inductive scanning principle
- Consists of a scanning unit (AE) and a rotor unit (TKW circular scale shaft)



All drawings are shown with brakes released

mm

 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ±0.2 mm

- ▣ = Bearing of motor shaft
- ▣ = Reference surface of coil carrier
- ▣ = Centerline of coil carrier
- ⊙ = Required mating dimensions
- M1 = Measuring point for operating temperature on flange
- M2 = Measuring point for operating temperature on PCB
- M3 = Measuring point for vibration
- 1 = Cylinder head screw: ISO 4762 – M6x16 – 8.8; tightening torque: 8.5 Nm ±0.5 Nm
- 2 = Cylinder head screw: ISO 4762 – M5x12 – 8.8; tightening torque: 4.5 Nm ±0.3 Nm
- 3 = Permissible axial motion of the motor shaft
- 4 = Surface of rotary encoder flange
- 5 = Parallelism/Flatness of the two armature plates in the area of the bearing surface of the encoder flange
- 6 = Nominal scanning gap between the graduation and scanning unit (adjustable with the mounting aid)
- 7 = Coaxiality of the hole (Ø 65) of the coil carrier with respect to the bearing of the motor shaft

- 8 = Maximum permissible stroke of the armature plates: 0.9 mm
- 9 = Direction of shaft rotation for ascending position values
- 10 = 8-pin M12 circular connector
- 11 = Provide strain relief for the cable near the rotary encoder (≤ 0.2 m); the strain relief must not hinder movement of the scanning unit in the axial direction.

Motor control

Specifications	KCI 419 Dplus singletum For position measurement and motor control (rotatory)
Interface	EnDat 2.2
Ordering designation	EnDat22
Position values per revolution	524288 (19 bits)
Calculation time t_{cal} Clock frequency	$\leq 5 \mu s$ $\leq 16 \text{ MHz}$
Data age (typical)	14 μs
System accuracy (typical)	$\pm 90''$
Electrical connection	8-pin M12 flange socket, axial
Supply voltage	DC 4.5 V to 14 V
Cable length	$\leq 15 \text{ m}$
Power consumption (max.)	At 4.5 V: $\leq 0.65 \text{ W}$; at 14 V: $\leq 0.7 \text{ W}$
Current consumption (typical)	At 5 V: 95 mA (without load)
Shaft	$\varnothing 12 \text{ mm}$ with axial clamping via expansion cone
Shaft speed	$\leq 1500 \text{ rpm}$
Moment of inertia	AE scanning unit: $2.1 \cdot 10^{-4} \text{ kgm}^2$; rotor unit TKW (2KA): $3 \cdot 10^{-6} \text{ kgm}^2$
Angular acceleration of rotor	$1 \cdot 10^5 \text{ rad/s}^2$
Natural frequency of the stator coupling (typical)	730 Hz
Axial motion of measured shaft	$\pm 0.05 \text{ mm}$ (see ☉ in the "Motor control" drawing)
Vibration 55 Hz to 2000 Hz Shock 6 ms	AE scanning unit: $\leq 300 \text{ m/s}^2$; TKW rotor unit: $\leq 600 \text{ m/s}^2$ (EN 60068-2-6) ²⁾ $\leq 2000 \text{ m/s}^2$ (EN 60068-2-27)
Operating temperature	-40 °C to 100 °C (at the measuring point (M1) and on the TKW rotor unit)
Relative humidity	$\leq 93 \%$ (40 °C/21 d as per EN 60068-2-78), without condensation
Protection EN 60529	Complete encoder, mounted: IP37 ¹⁾ ; AE scanning unit: IP67 (read about "insulation" under "Electrical safety" in the Interfaces of HEIDENHAIN Encoders brochure)
Mass	AE scanning unit: 0.28 kg; TKW rotor unit: 0.03 kg
ID number	AE scanning unit for KCI 419 Dplus: ID 1282569-01 TKW rotor unit for KCI 419 Dplus: ID 1282571-01

¹⁾ The encoder must be protected from abrasive and harmful media in the application. Use an appropriate enclosure as needed.

²⁾ 10 Hz to 55 Hz, 5 mm constant peak to peak at the scanning unit (AE);
10 Hz to 55 Hz, 10 mm constant peak to peak at the rotor unit (TKW)

KCI 419 Dplus: axial distance measurement

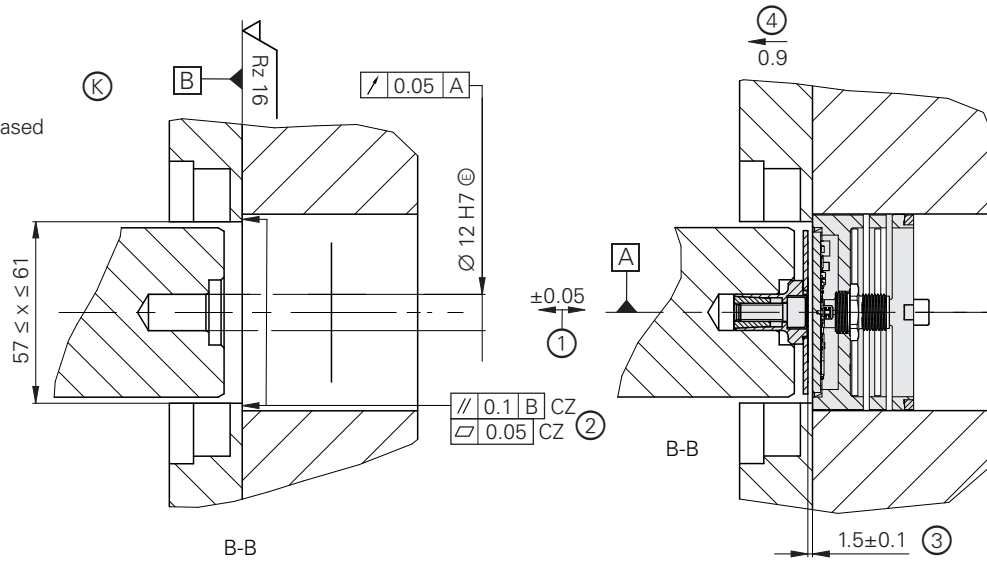
- Absolute inductive rotary encoder with additional functionality
- Axial distance measurement
- Robust inductive scanning principle
- Consists of a scanning unit (AE) and a rotor unit (TKW circular scale shaft)



All drawings are shown with brakes released

mm

 Tolerancing ISO 8015
 ISO 2768 - m H
 < 6 mm: ±0.2 mm



- Ⓐ = Bearing of motor shaft
- Ⓑ = Reference surface of coil carrier
- Ⓚ = Required mating dimensions
- 1 = Permissible axial motion of the motor shaft
- 2 = Parallelism/Flatness of the two armature plates in the area of the bearing surface of the rotary encoder flange
- 3 = Nominal scanning gap between the graduation and the scanning unit; adjustable with the mounting aid
- 4 = Maximum permissible stroke of the armature plates: 0.9 mm

Axial distance measurement

Specifications	KCI 419 <i>Dplus</i> : linear measurement Additional functionality of axial distance measurement
Interface	EnDat 2.2 (for additional data 1, data format, and description, see EnDat Application Note)
Reproducibility of the distance measurement (typical)	$\pm 100 \mu\text{m}$
Axial spring rate (typical)	105 N/mm
Data age	1.9 ms
Natural frequency of the stator coupling (axial)	730 Hz
Measuring range	0.5 mm to 1.6 mm ¹⁾
Measuring step	4 μm
Measuring strokes (typical)	10 ⁷

¹⁾ Under ideal conditions: measuring range of 0.2 mm to 2.1 mm

Intelligent integration of position values, brake-stroke monitoring, and temperature monitoring

In addition to providing motor feedback, the new KCI 419 *Dplus* considerably enhances availability and safety by providing data for monitoring the safety brake and the temperature. It also features comprehensive online self-diagnostic functionality. Normally required microswitches are eliminated, along with the cost and effort of mounting, wiring, adjusting, and maintaining them.

In addition to transmitting rotational position values, the KCI 419 *Dplus* inductive rotary encoder for elevators also measures distance in the **axial direction**. When mechanically coupled with the armature plate of the brake, the KCI 419 *Dplus* can detect the brake stroke. Based on this information, the subsequent electronics can determine the state of the brake (released or engaged) and the level of brake wear.

By virtue of its direct proximity to the motor and brake, the KCI 419 *Dplus* elevator rotary encoder also provides meaningful temperature monitoring data without additional cabling. The temperature data can then be used to infer the presence of malfunctions. Further benefits include improved remote monitoring and predictive maintenance capabilities. Its inductive scanning method is highly immune to contamination and vibration, and is known for its operational reliability.

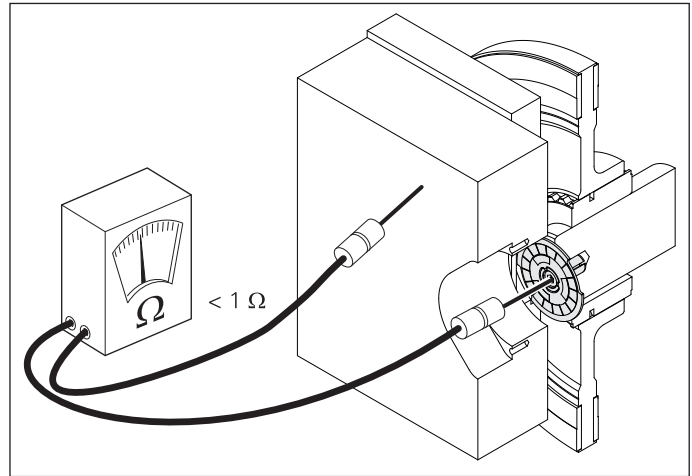
Data age

Due to the influence of propagation delay times in the electronics, the position value that is formed deviates from the actual physical position of the encoder. These deviations arise in the encoder during analog-to-digital conversion and through propagation times from the serial interface to the subsequent electronics. The sum of these propagation influences is referred to as the data age. These influences lead to a speed-dependent deviation of the determined position from the actual physical position of the encoder.

Electrical resistance

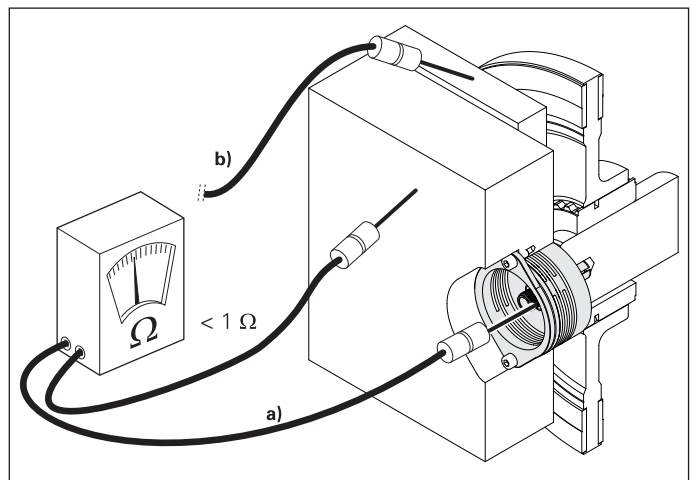
Check the electrical resistance between the coil carrier and the screw of the rotor unit.

Nominal value: < 1 ohm



Check the electrical resistance between the coil carrier and the M12 housing screw **a)** as well as the armature plate **b)**.

Nominal value: < 1 ohm



Transmission of temperature values

To protect the motor from overloads, the motor manufacturer usually monitors the temperature of the motor winding. In conventional applications, the temperature sensor data are sent via two separate lines to the subsequent electronics, where they are then evaluated. Depending on their configuration, HEIDENHAIN rotary encoders with the EnDat 2.2 interface may feature an **internal** temperature sensor integrated into the encoder electronics, as well as an evaluation circuit to which an additional temperature sensor can be connected. In the case of the KCI 419 *Dplus*, an additional temperature sensor is provided on the PCB for temperature monitoring of the brake. The coil carrier of the brake encloses the scanning unit of the KCI 419 *Dplus* and is connected in a thermally conductive manner via its fastening. Both sensor values are transmitted purely serially as digitized temperature values via the EnDat protocol (as part of the additional data).

In compliance with the EnDat specification, when the temperature reaches the warning threshold for the temperature exceedance of the **internal** temperature sensor, an **EnDat warning** is issued (EnDat memory area "Operating status," word 1 "Warnings," bit 2¹ "Temperature exceeded"). This warning threshold for the **internal** temperature sensor is stored in the EnDat memory area "Operating parameters," word 6 "Trigger threshold warning bit for excessive temperature," and can be individually adjusted. At the time the encoder is shipped, a default value equivalent to the maximum permissible operating temperature is stored here (temperature at measuring point M1 as per the dimension drawing). The temperatures measured by the internal temperature sensor (Temp. 2) and the PCB temperature sensor (Temp. 1) are higher by device-specific values than the temperature at measuring point M1.

Accuracy of the Temp. 1 temperature sensor

- -40 °C to 80 °C: ±7 K
- 80 °C to 100 °C: ±5 K

Accuracy of the Temp. 2 temperature sensor

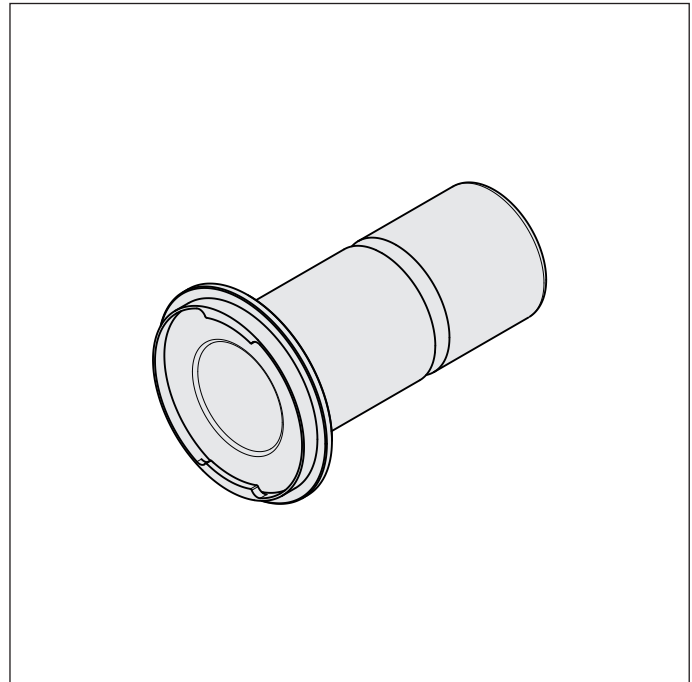
- At 100 °C: ±1 K

Mounting

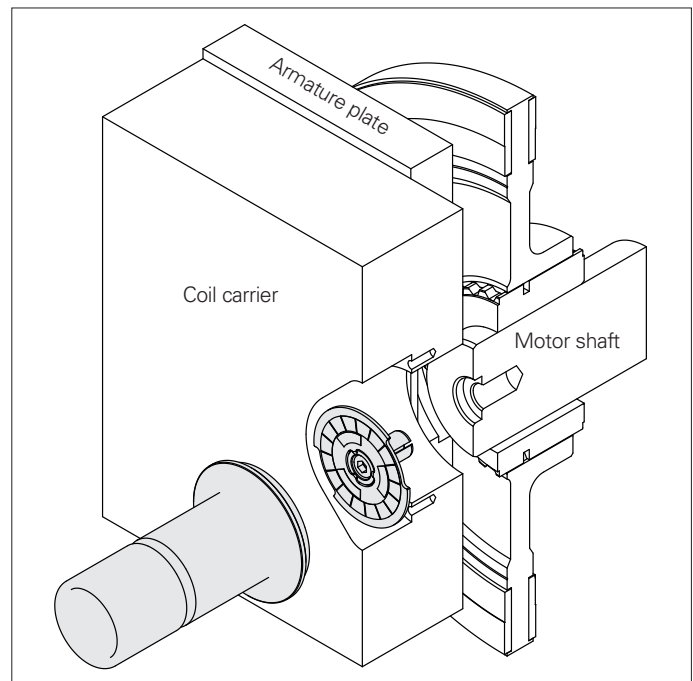
Accessory

The mounting aid facilitates handling of the rotor unit during mounting and also sets the scanning gap of 1.5 mm.

Mounting aid 1274500-60



The mounting aid is used to simply press the rotor unit into the cylindrical hole of the motor shaft. This automatically sets the correct distance for the scanning gap. When the central screw is tightened, the rotor unit is splayed by the internal taper, clamping the rotor unit within the motor shaft.

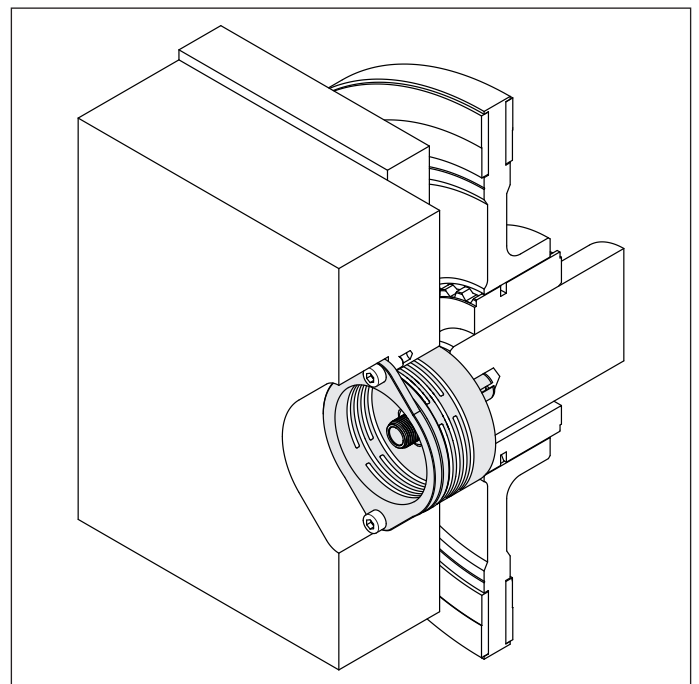
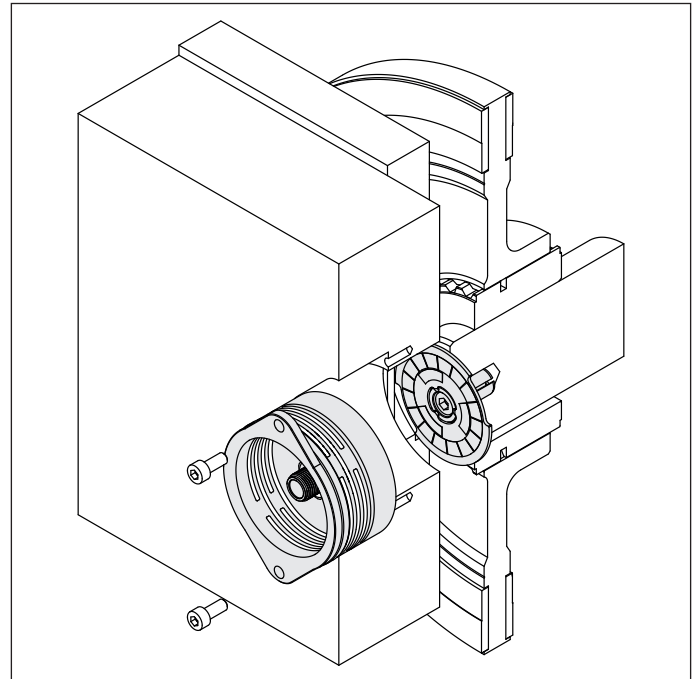


The scanning unit is press-fitted onto the coil carrier until stopping at the armature plates. It is attached with two screws, by which the cross-slotted coupling is pre-loaded.

The axial change in position of the scanning unit relative to the rotor unit can now be measured. The position of the scanning unit changes by the same amount as the position of the armature plates relative to the coil carrier of the brakes (brake stroke).

Protection against contact (EN 60529)

After encoder installation, all rotating parts must be protected from accidental touching during operation.



Further information:

For further mounting information and mounting aids, please refer to the relevant mounting instructions and the *Encoders for Servo Drives* brochure.

Diagnostics, inspection, and testing devices

HEIDENHAIN encoders provide all of the information needed for commissioning, 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 comprehensively monitored within the encoder. The monitoring results (particularly valuation numbers) can be transmitted to the subsequent electronics along with the position values via the serial interface (**digital diagnostics interface**). The following information is available:

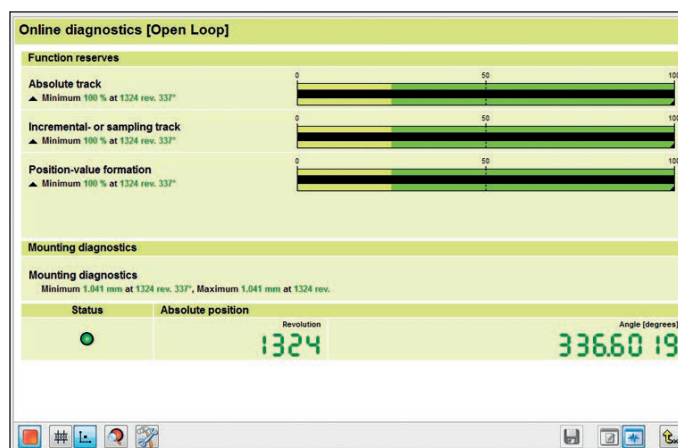
- Error message: position value is not reliable
- Warning: an internal functional limit of the encoder has been reached
- Valuation numbers:
 - Detailed information on the encoder's function reserve
 - Identical scaling for all HEIDENHAIN encoders
 - Cyclic reading is possible

This enables the subsequent 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 interposed 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.



Diagnostics with the PWM 21 and ATS software

PWM 21

The PWM 21 phase-angle measuring unit, in conjunction with the 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	<ul style="list-style-type: none">• EnDat 2.1 or EnDat 2.2 (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_{SS}• 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

Electrical connection



Adapter cables and connecting cables

Connecting cable, adapter cable 2 (2 × 0.09 mm ²) + 2 (2 × 0.16 mm ²); A _P = 2 × 0.16 mm ²		
Connecting cable with 8-pin M12 connector (female) and 8-pin M12 coupling (male)		ID 1036372-xx
Connecting cable with 8-pin M12 connector (female) and unstripped cable end		ID 1129581-xx ¹⁾
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (female)		ID 1036521-xx
Adapter cable with 8-pin M12 connector (female) and 15-pin D-sub connector (male)		ID 1036526-xx

A_P: Cross section of power supply lines

¹⁾ Connecting element must be suitable for the maximum clock frequency used!

EnDat22 pin layout

8-pin M12 coupling or flange socket								
	Power supply				Serial data transmission			
	8	2	5	1	3	4	7	6
	U _P	Sensor U _P	0V	Sensor 0V	DATA	DATA	CLOCK	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!

HEIDENHAIN

DR. JOHANNES HEIDENHAIN GmbH

Dr.-Johannes-Heidenhain-Straße 5

83301 Traunreut, Germany

☎ +49 8669 31-0

FAX +49 8669 32-5061

E-mail: info@heidenhain.de

www.heidenhain.de

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.



Further information:

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

- Brochure: *Encoders for Servo Drives* 208922-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
- Brochure: *Cables and Connectors* 1206103-xx
- Mounting instructions: KCI 419 *Dplus* 1298987-xx/1299278-xx
- EnDat Application Notes 722024-xx
- KCI 419 *Dplus* Application Notes 1283658-xx