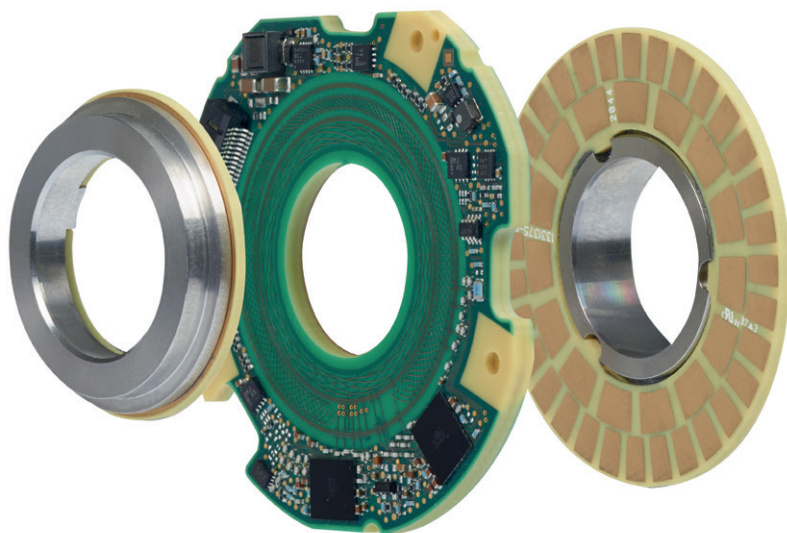




HEIDENHAIN



Product Information

KCI 120D*plus*

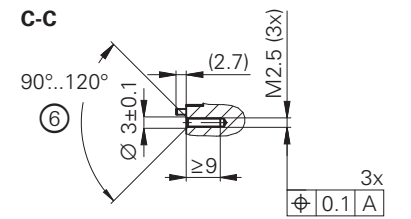
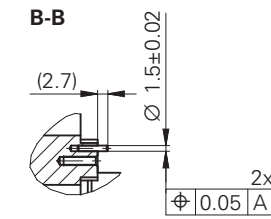
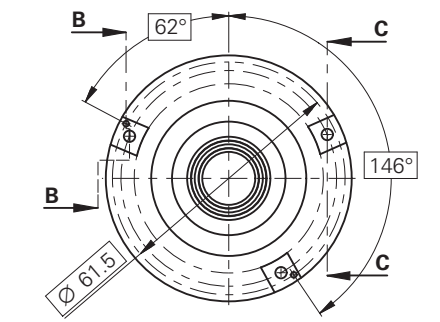
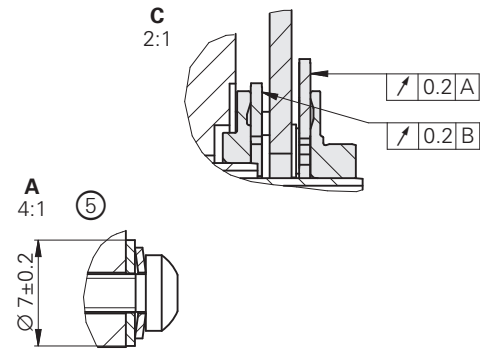
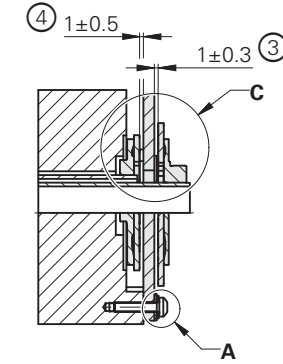
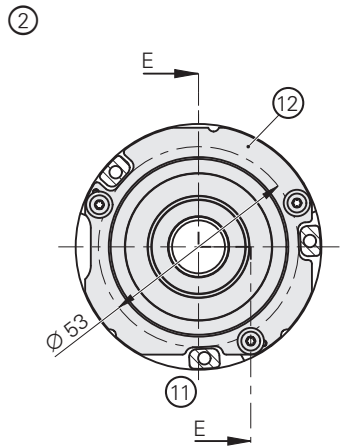
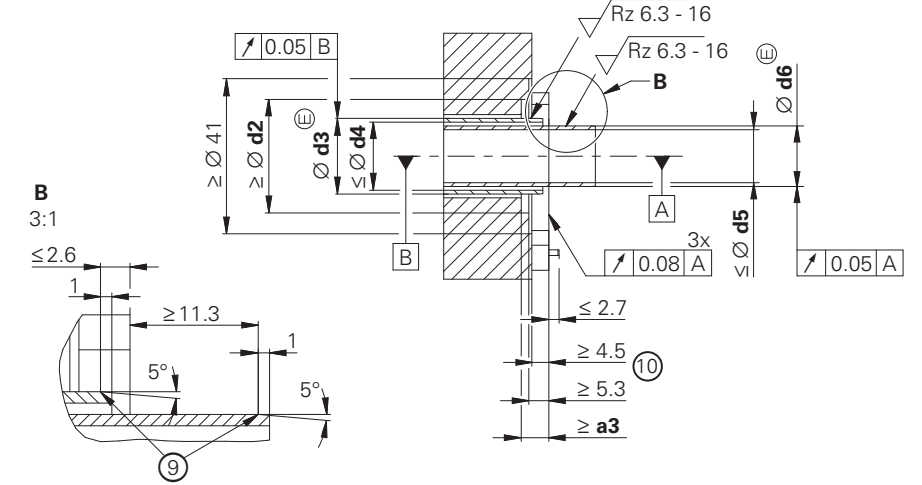
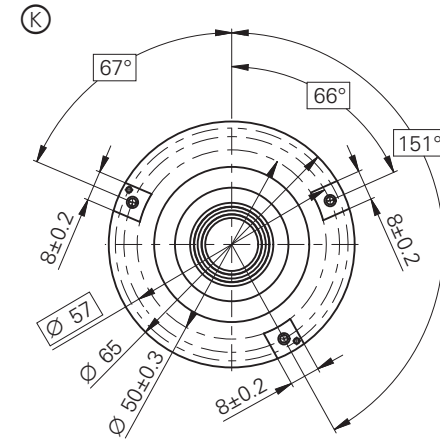
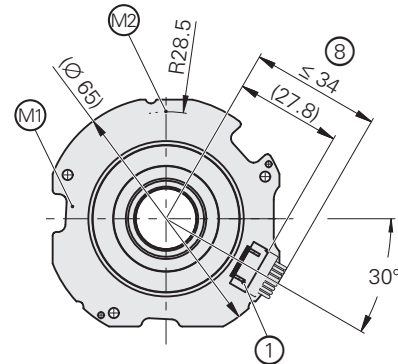
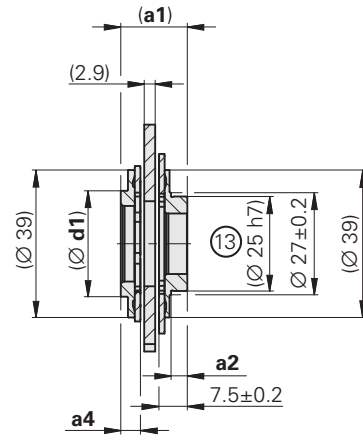
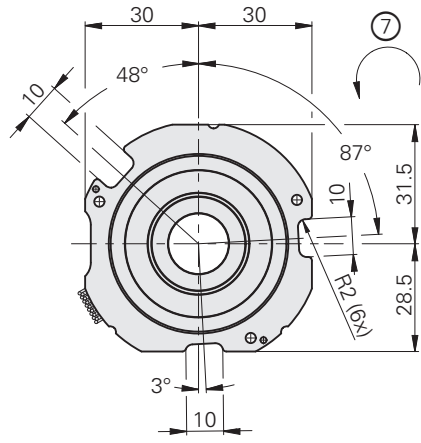
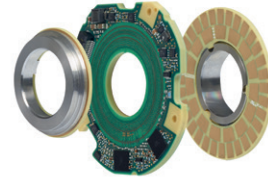
Absolute Inductive Rotary
Encoder with Additional
Functionality:

Position measurement
of output side

KCI 120Dplus

Absolute inductive rotary encoder with additional functionality

- Robust inductive scanning principle
- Consisting of an AE scanning unit and two rotor units (disk/hub assembly)
- Position measurement of output side



- ▣ = Bearing of Rotor A
- ▣ = Bearing of Rotor B
- ⊙ = Required mating dimensions
- M1 = Measuring point for operating temperature
- M2 = Vibration measuring point
- 1 = 15-pin PCB connector
- 2 = Shown with the customer side
- 3 = Rotor A mounting dimension: tolerance includes compensation of mounting tolerances and thermal expansion
- 4 = Rotor B mounting dimension: tolerance includes compensation of mounting tolerances and thermal expansion
- 5 = M2, 5x12 ISO 4762 or ISO 14583 – 8.8 – MKL * (3x) with spring washer: DIN 6796 – 2.5 – FSt (3x) and washer: ID1334909-01; tightening torque: 0.7 ±0.05 Nm; pay attention to the installation position of the spring washer
- 6 = Chamfer at start of thread is obligatory for materially bonding anti-rotation lock
- 7 = Direction of rotation of both shafts for ascending position values
- 8 = Ensure installation space for cable
- 9 = Rounded transition
- 10 = Ensure space for electronics
- 11 = Avoid collision with the scanning unit
- 12 = Distance for air creepage >1 mm
- 13 = Permissible forces and torques at Hub A (bearing):
 - Axial force ≤ 60 N,
 - Radial force ≤ 60 N,
 - Torque ≤ 0.5 Nm
- 14 = Material characteristics of customer shafts:
 - Tensile strength ≥ 700 N/mm²,
 - Yield point ≥ 490 N/mm²,
 - CTE = 10-12 ppm/K

| | FOROA1: 06A, 06B | FOROA1: 07A, 07B |
|----|-----------------------------------|-----------------------------------|
| a1 | 17.6 | 18.1 |
| a2 | 4.3 | 4 |
| a3 | 7.3 | 7.8 |
| a4 | 5.2±0.2 | 5.7±0.2 |
| d1 | 28 | 33 |
| d2 | 30 | 35 |
| d3 | 20 ⁰ _{-0.02} | 25 ⁰ _{-0.02} |
| d4 | 18 | 21 |
| d5 | 14 | 18 |
| d6 | 16 ⁰ _{-0.014} | 20 ⁰ _{-0.017} |

mm

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

* For instructions on using screws with material bonding anti-rotation lock as per DIN 267-27, see "General mechanical information" in the Rotary Encoders brochure (these screws not included in delivery!)

General information

| Specifications | KCI 120Dplus | |
|---|--|--|
| Interface | EnDat 2.2 | |
| Ordering designation | EnDat22 | |
| Calculation time t_{cal} Clock frequency | $\leq 5 \mu s$ $\leq 16 \text{ MHz}$ | |
| Electrical connection | 15-pin PCB connector (radial); cable length $\leq 10 \text{ m}^1$ | |
| Supply voltage | DC 3.6 V to 14 V (for both axes together) | |
| Power consumption (max.) ²⁾ | At 3.6 V: $\leq 1.2 \text{ W}$ At 14 V: $\leq 1.4 \text{ W}$ | |
| Current consumption (typical) | At 5 V: 200 mA (without load) | |
| Angular acceleration of rotors | $\leq 1 \cdot 10^5 \text{ rad/s}^2$ | |
| Vibration 55 Hz to 2000 Hz ³⁾ Shock 6 ms | <i>AE scanning unit:</i> $\leq 400 \text{ m/s}^2$; <i>rotors:</i> $\leq 600 \text{ m/s}^2$ (EN 60068-2-6) $\leq 2000 \text{ m/s}^2$ (EN 60068-2-27) | |
| Operating temperature | -40 °C to 115 °C | |
| Trigger threshold for exceeded temperature error message | 127 °C (measuring accuracy of the internal temperature sensor: $\pm 1 \text{ K}$) | |
| Relative humidity | $\leq 93 \%$ (40 °C/21 d as per EN 60068-2-78), condensation excluded | |
| Protection rating EN 60529 | IP00 (read about insulation under <i>Electrical safety</i> in the <i>Interfaces of HEIDENHAIN Encoders</i> brochure) | |
| Mass | $\approx 0.065 \text{ kg}$ (scanning unit and rotors) | |
| ID number | <i>Individual packaging:</i> ID 1348258-01 (AE scanning unit) ID 1348267-01 (TKN: Encoder A, $\varnothing 20 \text{ mm}$) ID 1348267-02 (TKN: Encoder A, $\varnothing 16 \text{ mm}$) ID 1348268-01 (TKN: Encoder B, $\varnothing 25 \text{ mm}$) ID 1348268-02 (TKN: Encoder B, $\varnothing 20 \text{ mm}$) | <i>Collective package:</i> ID 1348258-51 (AE scanning unit) ID 1348267-51 (TKN: Encoder A, $\varnothing 20 \text{ mm}$) ID 1348267-52 (TKN: Encoder A, $\varnothing 16 \text{ mm}$) ID 1348268-51 (TKN: Encoder B, $\varnothing 25 \text{ mm}$) ID 1348268-52 (TKN: Encoder B, $\varnothing 20 \text{ mm}$) |

¹⁾ See pin layout for encoder

²⁾ See *General electrical information* in the *Interfaces of HEIDENHAIN Encoders* brochure, or visit www.heidenhain.com

³⁾ *Scanning unit:* 10 Hz to 55 Hz, 6.5 mm constant peak to peak
Rotors: 10 Hz to 55 Hz, 10 mm constant peak to peak

Position measurement

| Specifications | KCI 120Dplus singletum Output side (Encoder A) | KCI 120Dplus singletum Motor side (Encoder B) |
|--------------------------------|---|--|
| Shaft | Hubs with an inside diameter of 20 mm and 16 mm | Hubs with an inside diameter of 25 mm and 20 mm |
| Shaft speed | $\leq 6000 \text{ rpm}$ | $\leq 15000 \text{ rpm}$ |
| Moment of inertia of rotor | $5.5 \cdot 10^{-6} \text{ kg} \cdot \text{m}^2$ (without supporting ball bearing) | $5.0 \cdot 10^{-6} \text{ kg} \cdot \text{m}^2$ |
| Axial motion ¹⁾ | $\pm 0.3 \text{ mm}$ | $\pm 0.5 \text{ mm}$ |
| Position values per revolution | 1 048 576 (20 bits) | 524 288 (19 bits) |
| System accuracy | $\pm 40''$ | $\pm 120''$ |
| Online compensation | No | Yes |

¹⁾ Including thermal linear expansion and mounting tolerance

Mounting

Mounting and protection rating

Mounting and protection rating

The KCI 120Dplus is mounted by press-fitting the two disk/hub assemblies and attaching the scanning unit. The circular scales are press-fit onto the respective shaft, and the scanning unit is mounted to the mating surface with the help of the centering pins. The press-fitting process may be performed only once for each disk/hub assembly. For the press-fit, comply with the material properties and conditions for the mating surfaces stated in the documents relevant for proper use. These requirements must be followed, even when new disk/hub assemblies are press-fitted onto a customer shaft that has already been used.

Once the lower limit of the press-fit force has been exceeded, the press-fit force being applied must remain within the specified range for the rest of the procedure until the final position is reached.

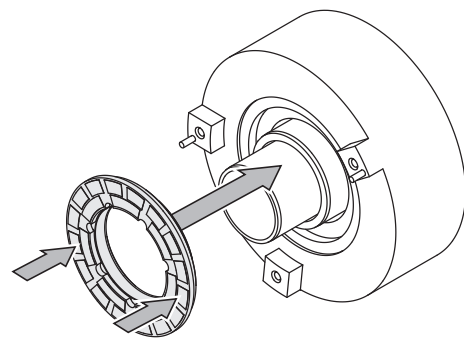
When the disk/hub assembly is press fitted, force may be applied only to the intended surfaces by means of pressing stamps (see mounting instructions).

When using a supporting bearing in conjunction with the hub of Encoder A, the stated forces and the torque must not be exceeded:

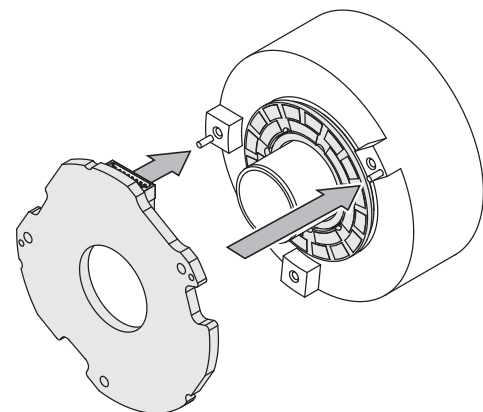
Axial force ≤ 60 N
 Radial force ≤ 60 N
 Torque ≤ 0.5 Nm

More information:

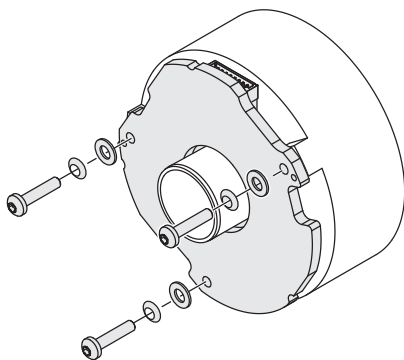
To ensure proper operation, comply with the measures in the *General electrical information* under *Electromagnetic compatibility* in the *Interfaces of HEIDENHAIN Encoders* brochure.



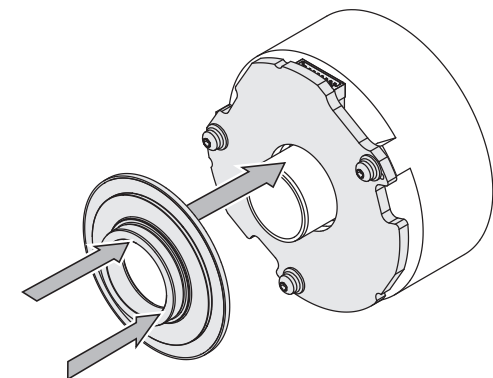
Disk/hub assembly (Encoder B)



Scanning unit



Scanning unit (mounted)



Disk/hub assembly (Encoder A)

For the design of the fault exclusion, the following material properties and conditions for the mating surfaces are assumed.

| | Customer motor shaft | Customer output shaft | Customer stator |
|--|--|-----------------------|---|
| Material | S45C steel as per DIN 1.1191 | | Aluminum |
| Tensile strength R_m | ≥ 700 N/mm ² | | ≥ 220 N/mm ² |
| Yield strength $R_{p0.2}$ or yield point R_e | ≥ 490 N/mm ² | | Not applicable |
| Shear strength τ_a | ≥ 390 N/mm ² | | ≥ 130 N/mm ² |
| Interface pressure p_G | ≥ 660 N/mm ² | | ≥ 250 N/mm ² |
| Modulus of elasticity E (at 20 °C) | 210 kN/mm ² | | 70 kN/mm ² to 75 kN/mm ² |
| Coefficient of thermal expansion α_{therm} (at 20 °C) | $10 \cdot 10^{-6} \text{ K}^{-1}$ to $12 \cdot 10^{-6} \text{ K}^{-1}$ | | $\leq 25 \cdot 10^{-6} \text{ K}^{-1}$ |
| Surface roughness R_z | $\leq 6.3 \dots 16 \mu\text{m}$ | | |
| Friction values | Lubrication at the joint surfaces is recommended. | | Mounting surfaces must be clean and free of grease. Use screws and washers in their condition as delivered. |
| Tightening procedure | | | Use a signal-emitting torque wrench as per DIN EN ISO 6789; accuracy: $\pm 6\%$ |
| Mounting temperature | 15 °C to 35 °C | | |

Mounting tool

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

ID 1075573-01



Mounting accessories

Screws: M2.5 x 12 ISO 4762 or ISO 14583 - 8.8 - MKL and spring washers: DIN 6796 - 2.5 - FSt.

Washer: ID 1334909-01

Instructions for use: use screws with material bonding anti-rotation lock as per DIN 26727 (see the *General mechanical information* in the *Rotary Encoders* brochure). Fastening screws and spring washers must be ordered separately.

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

Integrated temperature evaluation

Each axis of these rotary encoders features an internal temperature sensor integrated into the encoder electronics. The digitized temperature value is transmitted purely serially via the EnDat protocol.

Regarding the internal temperature sensor, the rotary encoder supports the two-stage cascaded signaling of a temperature exceedance. This consists of an EnDat warning and an EnDat error message.

In accordance with the EnDat specification, an EnDat warning (EnDat memory area "Operating status," word 1 "Warnings," bit 2¹ "Temperature exceeded") is output when the warning threshold for the temperature exceedance of the internal temperature sensor is reached. 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" of each axis, and can be individually adjusted.

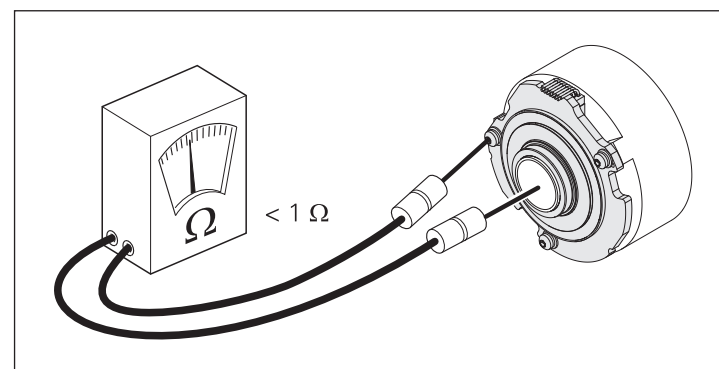
A device-specific default value is saved here before the encoder is shipped. The temperature measured by the internal temperature sensor is higher by a device-specific and application-specific amount than the temperature at the measuring point, as shown in the dimension drawing.

Each axis of the rotary encoders features a further, albeit non-adjustable trigger threshold for the "Temperature exceeded" EnDat error message of the internal temperature sensor. When this is reached, an EnDat error message is output (EnDat memory area "Operating status," word 0 "Error messages," bit 2² "Position" and in additional data 2 "Operating status error sources," bit 2⁶ "Temperature exceeded"). This trigger threshold may vary depending on the encoder 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. Compliance with the temperature at the measuring point is required for adherence to the encoder's intended and proper use.

Electrical resistance

Check the electrical resistance between the customer-side stator and both customer-side shafts. Nominal value: < 1 ohm



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 diagnostics interface**). The following information is available:

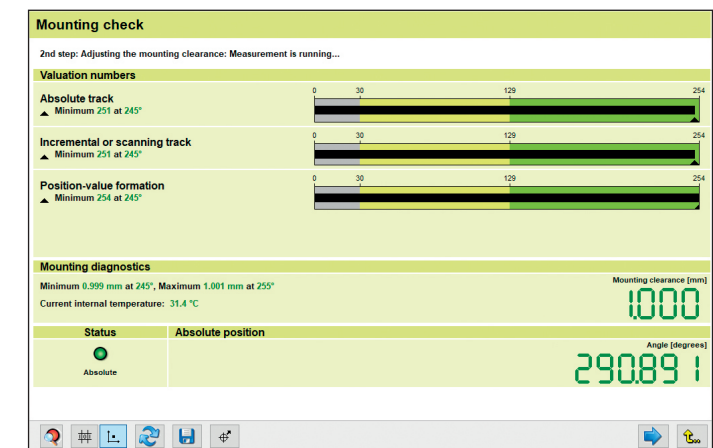
- Error message: position value is not reliable
- Warning: an internal functional limit of the encoder has been reached
- Valuation numbers:
 - Detailed information about the encoder's function reserve
 - Identical scaling for all HEIDENHAIN encoders
 - Cyclic reading capability

The downstream electronics are able to evaluate the current status of the encoder with low resource expenditure, including in closed-loop operation.

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 inspection or testing 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 | <ul style="list-style-type: none"> • EnDat 2.1, EnDat 2.2, or EnDat 3 (absolute value with or without incremental signals) • DRIVE-CLiQ • Fancu 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.

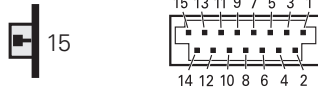

Electrical connection

For connection to the PMW 21 diagnostic and testing device, Encoder A (output side) and Encoder B (motor side) each require a different special testing cable.

HEIDENHAIN offers two testing cables for this purpose. As a result, either a testing cable for the output-side encoder or a testing cable for the motor-side encoder can be connected to the PWM 21 as needed.

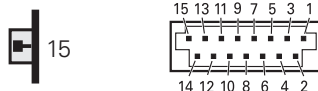

Pin layout of the testing cables

Testing cable for connection to Encoder A: 1311046-xx

| 15-pin PCB connector | | | | | Power supply | | | | Serial data transmission (Encoder A) | | | |
|---|--|--|--|--|--------------|--------------|----------------|--------------------------|--------------------------------------|-----------|------------|------------|
|  | | | | | 14 | 12 | 13 | 11 | 7 | 8 | 9 | 10 |
|  | | | | | 0V | Sensor 0V | U _P | Sensor U _P | DATA A | DATA A | CLOCK A | CLOCK A |
| | | | | | White/Green | White | Brown/Green | Blue | Gray | Pink | Violet | Yellow |

U_P = Power supply
Vacant pins or wires must not be used!

Testing cable for connection to Encoder B: 1311047-xx

| 15-pin PCB connector | | | | | Power supply | | | | Serial data transmission (Encoder B) | | | |
|--|--|--|--|--|--------------|--------------|----------------|--------------------------|--------------------------------------|-----------|------------|------------|
|  | | | | | 14 | 12 | 13 | 11 | 1 | 2 | 3 | 4 |
|  | | | | | 0V | Sensor 0V | U _P | Sensor U _P | DATA B | DATA B | CLOCK B | CLOCK B |
| | | | | | White/Green | White | Brown/Green | Blue | Gray | Pink | Violet | Yellow |

U_P = Power supply
Vacant pins or wires must not be used!

Pin layout for the rotary encoder

| 15-pin PCB connector | | | | | | | | | | | |
|----------------------|--------------|----------------|--------------------------|--------------------------------------|-----------|------------|------------|--------------------------------------|-----------|------------|------------|
| Power supply | | | | Serial data transmission (Encoder A) | | | | Serial data transmission (Encoder B) | | | |
| 14 | 12 | 13 | 11 | 7 | 8 | 9 | 10 | 1 | 2 | 3 | 4 |
| 0V | Sensor 0V | U _P | Sensor U _P | DATA A | DATA A | CLOCK A | CLOCK A | DATA B | DATA B | CLOCK B | CLOCK B |

U_P = Power supply
Vacant pins or wires must not be used!
The subsequent electronics must have a common ground reference!

Cable length > 0.5 m:
To prevent crosstalk, the two EnDat interfaces must be separately shielded from each other. The cable sold by the meter with ID 1347450-xx (PUR, Ø 3.7 mm) can be used for this. Two cables must be attached to the PCB connector in order to transmit the EnDat signals separately. Only one cable is used for the power supply.

When using the cable sold by the meter with ID 1347450-xx, comply with the *General information* in the *Cables and Connectors* brochure; use of the cables at temperatures of up to 100 °C is possible, provided that the exposure to hydrolysis and harmful media is low.

Cable length ≤ 0.5 m:
When single wires with up to a maximum length of 0.5 m are used, each data and clock wire combination must be implemented as a twisted wire pair in order to avoid coupled interference. As an alternative, the cable with ID 605090-51 (EPG, Ø 4.5 mm) and a length of 0.3 m can be used. The *General information* in the *Cables and Connectors* brochure must be noted.

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: *Encoders for Servo Drives* 208922-xx
 - Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx
 - Brochure: *Cables and Connectors* 1206103-xx
 - Mounting Instructions: KCI 120 Dplus 1363648-xx
 - Product Notes for JAE connecting element 576762-xx (sheet 1) 1082415-xx
 - Setup instructions