Product Information

**KCI 120 Dplus**
Absolute Inductive Rotary Encoder with Additional Functionality:

Position measurement at the output side
**KCI 120 Dplus**

**Absolute inductive rotary encoder with additional functionality**

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

---

**M1** = Measuring point for operating temperature; ensure electrical isolation for the mounted temperature sensor

**M2** = Measuring point for vibration

---

1 = 15-pin PCB connector

2 = Cylinder head screw

DIN EN ISO 4762 – M2.5 x 12 – 8.8 – MKL or 
DIN EN ISO 14583 – M2.5 x 12 – 8.8 – MKL (ID 202264-61); 
tightening torque: 0.7 Nm ± 0.05 Nm, with spring washer: DIN 6796 – 2.5 – FSt, and washer: ID 1334909-01

Pay attention to the mounting position of the spring washer!

---

3 = Ensure installation space for cable

4 = Direction of shaft rotation for ascending position values

5 = TKN for Rotor A, separate; for mounting, see the respective mating dimensions

6 = TKN for Rotor B, separate; for mounting, see the respective mating dimensions

7 = Holes as an option for aligning the scanning unit by means of a device; centered position relative to reference Ø after mounting

8 = Room for supporting flange for Rotor A; avoid collision with the scanning unit

9 = Ensure > 1 mm gap for air and creepage distances

---

*Instructions for use: screw with material bonding anti-rotation lock as per DIN 267-27; see General mechanical information in the Rotary Encoders brochure (screw not included in delivery)!*

---

**Notes:**

- = Bearing of mating shaft

1 = Scanning unit (AE), separate; for mounting, see the respective mating dimensions.

2 = Rotor B mating dimension; tolerance includes compensation for the mounting tolerances and thermal expansion; dynamic motion permitted over entire range.

3 = On the fine track (Ø 42 mm to Ø 48 mm), after press-fitting.

4 = Rounded transition to the fit surface.

5 = Required fit length on the mating shaft.

6 = Bearing surface of scanning unit (AE).

7 = Rotor A mating dimension; tolerance includes compensation for the mounting tolerances and thermal expansion; dynamic motion permitted over entire range.

8 = Axial runout after press-fitting.

9 = A suitable support bearing is permissible but optional; permissible forces and torques during operation:
  - Axial force: 40 N
  - Radial force: 40 N
  - Torque: 0.5 Nm

---

**Product Information KCI 120 Dplus**

01/2023

---

**Product Information KCI 120 Dplus**

01/2023
General information

Specifications | KCI 120 Dplus
---|---

**Interface**
EnDat 2.2

**Ordering designation**
EnDat 22

**Calculation time**
\( t_{\text{cal}} \leq 5 \mu s 

**Clock frequency**
\( \leq 16 \text{ MHz} \)

**Electrical connection**
15-pin PCB connector (radial); cable length \( \leq 10 \text{ m} \)

**Supply voltage**
DC 3.6 V to 14 V (for both axes together)

**Power consumption (max.)**
- At 3.6 V: \( \leq 1.2 \text{ W} \)
- At 14 V: \( \leq 1.4 \text{ W} \)

**Current consumption (typical)**
- At 5 V: 180 mA (without load)

**Angular acceleration of rotors**
\( \leq 1 \cdot 10^5 \text{ rad/s}^2 \)

**Vibration**
55 Hz to 2000 Hz
- AE scanning unit: \( \leq 400 \text{ m/s}^2 \)
- Rotors: \( \leq 600 \text{ m/s}^2 \) (EN 60068-2-27)

**Shock**
6 ms
- AE scanning unit: \( \leq 400 \text{ m/s}^2 \)
- Rotors: \( \leq 600 \text{ m/s}^2 \) (EN 60068-2-6)
- Rotors: \( \leq 2000 \text{ m/s}^2 \) (EN 60068-2-27)

**Operating temperature**
\(-40 ^\circ \text{ C to } 115 ^\circ \text{ C} \)

**Trigger threshold**

**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 Electrical safety in the Interfaces of HEIDENHAIN Encoders brochure)

**Mass**
\( \leq 0.1 \text{ kg (scanning unit and rotors)} \)

**ID number**

<table>
<thead>
<tr>
<th>Individual packaging:</th>
<th>Collective package:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID 1362008-01 (AE scanning unit)</td>
<td>ID 1362008-51 (AE scanning unit)</td>
</tr>
<tr>
<td>ID 1362008-01 (disk/hub assembly: Encoder A)</td>
<td>ID 1362008-51 (disk/hub assembly: Encoder A)</td>
</tr>
<tr>
<td>ID 1362007-01 (disk/hub assembly: Encoder B)</td>
<td>ID 1362007-51 (disk/hub assembly: Encoder B)</td>
</tr>
</tbody>
</table>

---

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

---

= Bearing of mating shaft
= Mating dimensions on the customer side; mounting with centering collar
= Mating dimension on the customer side; mounting with cylindrical pins (not available as an accessory)
= Customer-side mating dimensions; mounting with mounting device (not available as an accessory)
= Flange surface: ensure full-surface, burr-free contact!
= Chamfer at start of thread is obligatory for material bonding anti-rotation lock
= For thread dimensions, see \( \Phi \)
### Position measurement

<table>
<thead>
<tr>
<th>Specifications</th>
<th>KCI 120 D plus singleturn Output side (Encoder A)</th>
<th>KCI 120 D plus singleturn Motor side (Encoder B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft</td>
<td>Hub with an inside diameter of 29 mm</td>
<td>Hub with an inside diameter of 34 mm</td>
</tr>
<tr>
<td>Shaft speed</td>
<td>≤ 6000 rpm</td>
<td>≤ 15 000 rpm</td>
</tr>
<tr>
<td>Moment of inertia of rotor</td>
<td>17 · 10⁻⁷ kgm²</td>
<td>15 · 10⁻⁶ kgm²</td>
</tr>
<tr>
<td>Axial motion¹</td>
<td>±0.3 mm</td>
<td>±0.5 mm</td>
</tr>
<tr>
<td>Position values per revolution</td>
<td>1 048 576 (20 bits)</td>
<td>524 288 (19 bits)</td>
</tr>
<tr>
<td>System accuracy</td>
<td>±40”</td>
<td>±120”</td>
</tr>
</tbody>
</table>

¹ Including thermal linear expansion and mounting tolerance

### Mounting

#### Mounting and protection rating

Mounting the KCI 120 D plus consists of the following: alignment and mounting of the scanning unit, and press-fitting the two disk/hub assemblies. The disk/hub assemblies are press-fitted onto the respective shaft, and the scanning unit is mounted to the mating surface via the four holes. Alignment can optionally be performed with a centering collar, with cylindrical pins or with a mounting device. The press-fitting process may be performed only once for each disk/hub assembly. For press-fitting, adhere to the material properties and the conditions for the mating surfaces stated in the relevant documents for use. These requirements must be followed, even when new disk/hub assemblies are press-fitted onto a mating 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, including until the final position is reached.

### Mounting diagram

- Mounting the disk/hub assembly (Encoder B)
- Alignment with centering collar
- Alignment with cylindrical pins
- Alignment with mounting device
- Mounting of scanning unit
- Mounting of disk/hub assembly (Encoder A)

For more information:
Follow the measures for electromagnetic compatibility described in the General electrical information in the Interfaces of HEIDENHAIN Encoders brochure to ensure disturbance-free operation.
For the design of the fault exclusion, the following material properties and conditions for the mating surfaces are assumed.

<table>
<thead>
<tr>
<th>Material</th>
<th>Customer motor shaft</th>
<th>Customer output shaft</th>
<th>Customer stator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unalloyed hardened steel</td>
<td></td>
<td></td>
<td>Hardened wrought aluminum alloy</td>
</tr>
<tr>
<td>Tensile strength $R_{m}$</td>
<td>$\geq 600 \text{N/mm}^2$</td>
<td>$\geq 220 \text{N/mm}^2$</td>
<td></td>
</tr>
<tr>
<td>YIELD strength $R_{p2}$ or yield point $R_y$</td>
<td>$\geq 400 \text{N/mm}^2$</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Shear strength $\tau$</td>
<td>$\geq 390 \text{N/mm}^2$</td>
<td>$\geq 130 \text{N/mm}^2$</td>
<td></td>
</tr>
<tr>
<td>Interface pressure $p_i$</td>
<td>$\geq 660 \text{N/mm}^2$</td>
<td>$\geq 250 \text{N/mm}^2$</td>
<td></td>
</tr>
<tr>
<td>Modulus of elasticity $E$</td>
<td>200 kN/mm² to 215 kN/mm²</td>
<td>70 kN/mm² to 75 kN/mm²</td>
<td></td>
</tr>
<tr>
<td>Coefficient of thermal expansion $\alpha_{th}$</td>
<td>$10 \cdot 10^{-6} \text{K}^{-1}$ to $12 \cdot 10^{-6} \text{K}^{-1}$</td>
<td>$\leq 25 \cdot 10^{-6} \text{K}^{-1}$</td>
<td></td>
</tr>
<tr>
<td>Surfact roughness $R_z$</td>
<td>$\leq 16 \mu m$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friction values</td>
<td></td>
<td>Lubrication at the joint surfaces is recommended.</td>
<td>Mounting surfaces must be clean and free of grease. Use screws and washers in their condition as delivered.</td>
</tr>
<tr>
<td>Tightening procedure</td>
<td>Use a signal-emitting torque wrench as per DIN EN ISO 6789, with an accuracy of ±6 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounting temperature</td>
<td>15 °C to 35 °C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 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. Please bear in mind that this measurement and transmission of the temperature is not safe in terms of functional safety.

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.

Each axis of the rotary encoder 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 21 “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

Instructions for use: use screws with material bonding anti-rotation lock as per DIN 267 27 (see 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 tested with the PWMM 21 and the ATS software (see document ID 1082418).
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 quantification 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 a 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.

### 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 Vpp/TTL/11 µAPP
- HTL (via signal adapter)

### Interface

USB 2.0

### Supply voltage

AC 100 V to 240 V or DC 24 V

### Dimensions

258 mm x 154 mm x 55 mm

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.

When a special testing cable is connected to the PWM 21 diagnostic and testing device, Encoder A (output side) is connected. In order to connect Encoder B (motor side), a different special testing cable must be used.

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.

#### Electrical connection

**Pin layout of the testing cables**

**Testing cable for connection to Encoder A: 131046-xx**

<table>
<thead>
<tr>
<th>15-pin PCB connector</th>
<th>Power supply</th>
<th>Serial data transmission (Encoder A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14, 12, 13, 11, 7, 8, 9, 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 V</td>
<td>Sensor</td>
<td>Sensor</td>
</tr>
<tr>
<td>Sensor</td>
<td>DATA A</td>
<td>DATA A</td>
</tr>
<tr>
<td>DATA A</td>
<td>CLOCK A</td>
<td>CLOCK A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Green</td>
<td>White</td>
<td>Brown/Green</td>
</tr>
<tr>
<td>White</td>
<td>Brown/Green</td>
<td>Blue</td>
</tr>
<tr>
<td>Yellow</td>
<td>Gray</td>
<td>Pink</td>
</tr>
<tr>
<td>Violet</td>
<td>Yellow</td>
<td></td>
</tr>
</tbody>
</table>

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

**Testing cable for connection to Encoder B: 131047-xx**

<table>
<thead>
<tr>
<th>15-pin PCB connector</th>
<th>Power supply</th>
<th>Serial data transmission (Encoder B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14, 12, 13, 11, 1, 2, 3, 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 V</td>
<td>Sensor</td>
<td>Sensor</td>
</tr>
<tr>
<td>Sensor</td>
<td>DATA B</td>
<td>DATA B</td>
</tr>
<tr>
<td>DATA B</td>
<td>CLOCK B</td>
<td>CLOCK B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White/Green</td>
<td>White</td>
<td>Brown/Green</td>
</tr>
<tr>
<td>White</td>
<td>Brown/Green</td>
<td>Blue</td>
</tr>
<tr>
<td>Yellow</td>
<td>Gray</td>
<td>Pink</td>
</tr>
<tr>
<td>Violet</td>
<td>Yellow</td>
<td></td>
</tr>
</tbody>
</table>

Up = Power supply
Vacant pins or wires must not be used!
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 interferences. 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.

Pin layout for the rotary encoder

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Serial data transmission (Encoder A)</th>
<th>Serial data transmission (Encoder B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 12 13 11</td>
<td>7 8 9 10 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>0 V Sensor</td>
<td>DATA A DATA A CLOCK A CLOCK A</td>
<td>DATA B DATA B CLOCK B CLOCK B</td>
</tr>
<tr>
<td>Vp Sensor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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