Product Information

EIB 5000
Sensor Boxes for Temperature Measurement of Direct Drive Motors
HEIDENHAIN EIB 5000 sensor boxes
Sensor boxes for temperature measurement of direct drive motors

- Reduced cabling
- Overload protection of the direct drive motor through monitoring of all three windings
- Faster response behavior to overheating through compensation of the transmission timing behavior of the temperature measurement (for direct drive motors from ETEL)
- More economical use of the direct drive motor through operation up to its thermal load limit
- Suitability for various encoder interfaces and control platforms

Application
The HEIDENHAIN sensor boxes of the EIB 5000 series enable measurement of the temperature of direct drive motors. To achieve this functionality, the EIB 5000 boxes process values from up to three temperature sensors and compensate the transmission timing behavior of the temperature measurement (for direct drive motors from ETEL). The maximum determined temperature is relayed to the upstream control. When the sensor box is used with a HEIDENHAIN encoder, the processed temperature values can be transmitted to the upstream control along with the position data. The control can use the temperature values to optimize the regulation of the direct drive motor, thus ensuring a rapid shutoff in case of an overload.

Close-to-application measurement of a direct drive motor

Mounting in an electrical cabinet

The EIB 5181 is optimized for use in an electrical cabinet in combination with controls from HEIDENHAIN. The placement in an electrical cabinet makes it possible to use DIP switches in order to configure the necessary parameters. Also, the EIB 5181 offers a universal interface solution for encoders with 1 Vpp EnDat 2.1, and EnDat 2.2 interfaces. The encoders must be connected to the encoder input using a 25-pin D-sub connector, since the EIB 5181 transmits the temperature value to the control as an analog value.

The EIB 5281 is primarily designed for encoders with the EnDat 2.1 interface in conjunction with HEIDENHAIN controls. The EIB transmits the temperature to the control as an analog value (PT 1000 emulation) along with the information about the interface, which is determined by the encoder itself. Thanks to the 1 Vpp rating, the EIB 5281 can be placed in direct proximity to the direct drive motor. This makes it possible to keep the length of the connecting cables for the temperature sensors very short. A special variant of the EIB 5281 may be necessary, depending on the design of the direct drive motor (see variants of the EIB 5200). The EIB 5281 is optionally available with an additional switching output (see Switching outputs). Please contact HEIDENHAIN for more information.

The EIB 5211 is primarily designed for encoders with the EnDat 2.2 interface. The temperature value is transmitted to the control digitally in the protocol (if the interface supports that). The EIB 5211 itself does not influence the encoder interface. Not only does the EIB 5211 have a high 1 Vpp rating, but its purely digital data transmission offers numerous important advantages as well. The transmission technology is particularly immune to noise and achieves an increased accuracy of the temperature evaluation (also see Emulation of PT 1000 behavior). A special variant of the EIB 5211 may be necessary, depending on the design of the direct drive motor (see variants of the EIB 5200). The EIB 5211 is optionally available with an additional switching output (see Switching outputs). Please contact HEIDENHAIN for more information.

The EIB 5282 is the primary interface for the EnDat 2.2 interface. The EIB 5282 has additional switching outputs. For more information, please contact HEIDENHAIN.

The digitized temperature value is transmitted from the EIB 5211 to the encoder, and then from the encoder over the interface to the control. The encoder must have been appropriately designed for this type of operation. Suitable at present are the RCN 2001, RCN 5001, and RCN 8001 series. Please contact HEIDENHAIN for information about the availability of other encoders.

The EIB 5291 S combines the functionality of the EIB 5211 with the possibility of connecting directly to subsequent electronics equipped with a DRIVE-CLiQ interface. For this purpose the EIB 5291 S has an integrated function for converting from EnDat 2.2 to DRIVE-CLiQ. Accordingly, an encoder with the ordering designation EnDat 22 must be used. Regarding the temperature evaluation and possibilities for connection, it is the same as the EIB 5211.

Switching outputs
The EIB 5322 and EIB 5212 have additional switching outputs. This makes it possible, for example, to switch off the direct drive motor through the PLC if the temperature signal cannot be processed directly by the subsequent electronics. Two switching outputs are supported:
- Error (temperature > 130 °C*)
- Warning (temperature > 100 °C*)

Supply voltage (PELV): 0 V to 36 V
Switching capacity: max. 32 mW
4-pin M12 flange socket (male)
Cable length: max. 30 m

For more information, please contact HEIDENHAIN.

Drive-CLiQ is a registered trademark of Siemens AG.

*Default setting. Please contact HEIDENHAIN regarding the availability of other switch-off thresholds.

EIB 5211  EIB 5212  EIB 5291 S

EnDat 2.2  EnDat 2.1

1 Vpp

Temperature sensors

Direct drive motors

Control

EIB 5181

EIB 5282
EIB 5281

Heidenhain

EIB 5291 S
Compensation of the transmission timing behavior of the temperature measurement for direct drive motors from ETEL.

Where a direct drive motor is required to hold a position at standstill, an asymmetric current distribution may arise. This can cause a winding to overload and lead to a rapid spike in temperature. The simplest way of detecting such an overload is through the use of three switching elements (usually PTC thermostors). However, because the measurement location and the affected components are thermally decoupled from each other, the winding may become overheated before the switching elements react. When sensors are used instead of switching elements, and when the thermal coupling is known (thermal model), the sudden spike in temperature can be emulated through mathematical compensation of the transmission timing behavior of the temperature measurement. Switch-off occurs much earlier, thereby contributing significantly to protection of the direct drive motor. The transmission timing behavior of the temperature measurement is largely determined by the thermal coupling between the sensor and the motor winding, and by the design of the direct drive motor. Different types of direct drive motors exhibit different time constants. For ETEL direct drive motors, the exact time constants are known. On the EIB 5181 the time constant can be set using the DIP switches. For the EIB 5200 the time constant must be indicated when ordering.

Emulation of PT 1000 behavior

At the control input, the EIB 5181 and EIB 521x emulate the resistance value of a PT 1000 sensor. In determining the temperature value, the control must provide a constant level of current to ensure correct emulation and proper functioning of the control algorithms. The temperature value is determined via the voltage drop. If a pulse current is provided, then proper functioning cannot be guaranteed (e.g., if SMx sensor modules from Siemens are used). The accuracy of the temperature evaluation is also affected by the cable length. The EIB 5181 also emulates the behavior of a PT 1000, but additionally the DIP switches can be used to reconfigure it to emulate a KTY84-130.

Electrical safety

The EIB 5000 features increased insulation separating the motor sensor inputs from the encoder and control connections. The EIB 5000 temperature sensor inputs exhibit safe electrical separation from dangerous electric circuits in accordance with DIN EN 61010-1 and DIN EN 61800-5-1.

The subsequent electronics are thus well protected.

Cascading

In certain applications (e.g., gantry motors), two direct drive motors may be controlled by means of a single encoder. To enable temperature monitoring in both direct drive motors, two EIB sensor boxes can be used in combination. These two sensor boxes must be properly configured (please contact HEIDENHAIN). The EIB 5181 is configured using DIP switches. Cascading is not possible with the EIB 521x and EIB 5291 S.

Monitoring functions

The EIB 5000 uses its analog temperature connection and/or the digital temperature value to output not only the temperature but fault conditions as well:

- Sensor short
- Sensor wire breakage
- Invalid configuration
- Other errors

Power-on behavior

During the initialization phase, the maximum value is output for the temperature. The temperature value then levels out at the actual measured value.

Power supply

The power supplied by the subsequent electronics is passed along to the connected encoder by the EIB. The power required for evaluation of the temperature sensors is diverted from the incoming supply voltage by means of galvanic isolation.

EIB 5291 S: As opposed to other EIB 5000 units, here the supply voltage for the encoder and also for the EIB 5291 S is generated from the 24 V-This necessitates the considerably higher power consumption.

Functional safety

In principle, the EIB can be used in safety-related applications only if functional safety is supported by the connected encoder. The characteristics with regard to functional safety are substantially determined by the connected encoder and the subsequent electronics (if required, contact the manufacturer; the EIB basically conveys the characteristics of the encoder). The safe position is also substantially determined by the connected encoder and the subsequent electronics.

Functional safety (EIB 5291 S)

Additionally true for the EIB 5291 S: The EIB itself does not influence the safe position. The “safe position” and “safety-related measured step (SMx)” of the connected EnDat encoder are required to calculate the safe position. Please contact the manufacturer of the subsequent electronics for further information. The

Note:

The software of the DRIVE-CLQ subsequent electronics must be designed for operation of the EIB 5291 S in safety-related applications. For more information on availability, please refer to the manufacturer.

EIB 5291 S

Depending on the connected encoder and subsequent electronics, suited for applications with up to:

- SIL 2 as per EN 61508 (further basis for testing: EN 61800-5-2)
- Category 3, PL d as per EN ISO 13849-1:2016-06

PPH value of the total system (EIB 5291 S + encoder) is the sum of the PPH values of the EIB 5291 S and the connected encoder.

For information on the measuring instrument, please refer to the documentation of the encoder (Product Information document, brochure, and mounting instructions). The EIB 5291 S is designed for a service life of 20 years (in accordance with ISO 13849).

Please contact the manufacturer of the subsequent electronics for more information on the application of the EIB and encoder in safety-related applications.

Note:

PFH 26 · 10⁻⁹ (with respect to an operating elevation of 5000 m above sea level)
Specifications EIB 5281 / EIB 5282

Encoder input

- Interface: Depends on the encoder
- Ordering designation: Depends on the encoder
- Electrical connection: 17-pin M23 flange socket (female) with coupling ring
- Power supply of encoder: The EIB passes the supply voltage from the subsequent electronics to the connected encoder
- Cable length: < 6 m

Temperature sensor input

- Quantity: 3
- Connectable sensors: KTY84-130, PT 1000, PTC, PTC tripel
- Evaluation accuracy tolerance: Typically: ±1 K; maximum: ±2 K
- Time constant for temperature measurement: Please indicate when ordering
- Electrical connection: 7-pin M17 flange socket (female), 6-pin header (male)
- Cable length: < 6 m

Control output

- Interface: Depends on the encoder
- Ordering designation: Depends on the encoder
- Electrical connection: 17-pin M23 flange socket (male), 25-pin D-sub connector (female)
- Cable length: < 6 m

Electrical connection

- 17-pin M23 flange socket (female) with coupling ring
- 25-pin D-sub connector (male).

Power supply of encoder

- The EIB passes the supply voltage from the subsequent electronics to the connected encoder
- Cable length: < 6 m

Electrical connection

- 7-pin M17 flange socket (female), 6-pin header (male)
- 17-pin M23 flange socket (male), 25-pin D-sub connector (female)

Supply voltage

- Typically: 200 mW; max. 300 mW
- Typically: 250 mW; max. 350 mW

Temperature output

- Emulation of PT 1000 behavior
- Emulation accuracy tolerance: Typically: ±3 K; maximum: ±4 K

Operating temperature

- 0 °C to 70 °C

Storage temperature

- –30 °C to 70 °C

Vibration

- 55 Hz to 2000 Hz

Shock

- 11 ms

Protection

- EN 60529 IP65 (when engaged)
- IP20

Elevation

- < 2000 m above sea level

Mass

- 0.5 kg

Notes:
1) The EIB 5282 features additional switching outputs (see Switching outputs on page 3)
2) Optimized for EnDat 2.1, determined by the encoder and relayed by the EIB (see also Using with other controls on page 3)
3) Applies only to HEIDENHAIN cables; be sure to consider the voltage drop
4) For further information, please refer to Temperature evaluation and Monitoring functions
5) Please select when ordering: EIB 5181 is configured using DIP switches
6) Observe the information from the motor manufacturer
7) Take the supply voltage range of the encoder into account
8) Without power or current consumption of the encoder; version with switching output: additional power consumption of 50 mW
9) See Emulation of PT 1000 behavior
10) Applies to cable lengths < 1 m
**Specifications**

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<td>12-pin M12 flange socket (female)</td>
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<tr>
<td>Power supply of encoder</td>
<td>See Power supply on page 5 DC 8.0 V ± 0.4 V (max. 1800 mW)</td>
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<tr>
<td>Cable length&lt;sup&gt;4&lt;/sup&gt;</td>
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<td>Quantity</td>
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<td>KTY 84-130, PT 1000, PTC, PTC triplet&lt;sup&gt;6&lt;/sup&gt;</td>
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<tr>
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<td>&lt; 50 m</td>
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<td>Supply voltage&lt;sup&gt;8&lt;/sup&gt;</td>
<td>3.6 V to 14 V DC 24 V (16.0 V to 28.8 V); up to DC 36.0 V possible without compromising functional safety</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Typically: 160 mW; max. 210 mW&lt;sup&gt;27&lt;/sup&gt; Maximum: At 16.0 V: ± 3300 mW At 28.8 V: ± 3400 mW Typically At 24.0 V: ± 1100 mW ± 1.15 · PMtyp (PMtyp = Typical power consumption of encoder)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 °C to 70 °C</td>
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<td>Storage temperature</td>
<td>-30 °C to 70 °C</td>
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<td>Vibration</td>
<td>55 Hz to 2000 Hz 100 m/s&lt;sup&gt;2&lt;/sup&gt; (EN 60068-2-6) 300 m/s&lt;sup&gt;2&lt;/sup&gt; (EN 60068-2-27)</td>
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<tr>
<td>Shock</td>
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<td>EN 60529 IP65 (when engaged)</td>
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<tr>
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<td>&lt; 2000 m above sea level &lt; 1000 m above sea level</td>
</tr>
<tr>
<td>Mass</td>
<td>&lt; 0.5 kg</td>
</tr>
</tbody>
</table>

<sup>1</sup> The EIB 5212 features additional switching outputs (see Switching outputs on page 3).

<sup>2</sup> Optimized for EnDat 2.2, determined by the encoder and relayed by the EIB (see also Using with other controls on page 3).

<sup>3</sup> The encoder must be designed for connection to an EIB 521x or EIB 5291S.

<sup>4</sup> Applies only to HEIDENHAIN cables; be sure to consider the voltage drop.

<sup>5</sup> For further information, please refer to Temperature evaluation and Monitoring functions.

<sup>6</sup> Please select when ordering.

<sup>7</sup> Observe the information from the motor manufacturer.

<sup>8</sup> Take the supply voltage range of the encoder into account.

<sup>9</sup> Without power or current consumption of the encoder; version with switching output: additional power consumption of 50 mW.

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**Further information:**
For detailed descriptions of cables, please refer to the Cables and Connectors brochure.
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:

To ensure proper and intended use, comply with the specifications in the following documents:

- Brochure, Product Information, and Mounting Instructions of the connected encoder
- Operating instructions: EiB 5000 1302631-xx