Evaluation Electronics
For Metrology Applications
For many metrology applications, ranging from simple measuring stations to complex inspection systems with multiple measuring points, HEIDENHAIN supports you with compatible evaluation electronics.

Their functionality is always oriented toward the specific application. Whether for an SPC inspection station, profile projector, or measuring microscope, the HEIDENHAIN evaluation electronics for metrology applications are the right choice for your measurement tasks.

Digital readouts from HEIDENHAIN for manually operated machine tools optimally support the operator with practical cycles for milling, drilling, and turning. You can find these digital readouts on the Internet at www.heidenhain.de or in the Digital Readouts and Linear Encoders for Manually Operated Machine Tools brochure.

For further information, comprehensive descriptions of all available interfaces as well as general electrical information are included in the Interfaces of HEIDENHAIN Encoders brochure (ID 1078628-xx).

For the required cables, please refer to the Cables and Connectors brochure (ID 1206103-xx).

You can download the operating instructions in the desired language free of charge from the HEIDENHAIN homepage.

This brochure supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the brochure edition valid when the order is placed.

Standards (ISO, EN, etc.) apply only where explicitly stated in the brochure.

Contents

Overview
Selection guide for measurement and inspection tasks 4

Specifications
Measurement and inspection tasks
ND 280: evaluation unit for simple measuring and positioning tasks 6
ND 287: evaluation unit for measuring and inspection stations 8
GAGE-CHEK 2000: evaluation unit for demanding measured-value acquisition 10
EIB 700: signal converter for computeraided measured-value acquisition 14
IK 220: signal converter for computeraided measured-value acquisition 16

Mounting
Dimensions and installation
ND 200 18
EIB 700 19
GAGE-CHEK 2000 20
Accessory: adapter connectors 22
Accessory: external operating element 22

Electrical connection
Interfaces
Overview 23
Optional assemblies for the ND 287 24
Switching inputs/outputs on the ND 287 25
EIB 700 and IK 220 evaluation electronics 27
Encoder inputs 28
EIB application software for the EIB 700 31
## Selection guide
### Measurement and inspection tasks

<table>
<thead>
<tr>
<th>Screen</th>
<th>Axes</th>
<th>Functions</th>
<th>Options/Additional functions</th>
<th>Model</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND 200 Evaluation unit for Measurement equipment, Adjustment and inspection equipment, SPC inspection stations, Simple infeed and positioning tasks</td>
<td>Monochrome</td>
<td>1 (adjustable)</td>
<td>Metrological and statistical functions (sorting and tolerance checking, measurement series, SPC)</td>
<td>Second encoder for sum/difference display, temperature compensation</td>
<td>ND 280</td>
</tr>
<tr>
<td>ND 287 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAGE-CHEK 2000 Evaluation unit for Positioning equipment, Measuring fixtures, Adjustment and inspection equipment</td>
<td>Color touchscreen</td>
<td>Up to 3 (adjustable)</td>
<td>• Acquisition of precise measured values, and spot-on positioning in metrology applications • 100 presets • Dial gage: comparison of the displayed value with nominal value, warning threshold, and tolerance threshold • Measurement series with minimum and maximum value recording • Difference of minimum and maximum values (range) • Measurement of master parts (mastering) • Data transfer either manually, continuously, or triggered by touch probe or switching function • Diameter/radius display • Relative measurement • Profiling functions: edge, centerline, and circle • User administration • Configurability of each axis for length or angle display • Coupled axis for sum measurement or differential measurement</td>
<td></td>
<td>GC 2013</td>
</tr>
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<tr>
<td>EIB 700 Signal converter for computer-aided measured-value acquisition on Measuring machines, Inspection stations, Multi-gauging fixtures, Mobile data acquisition</td>
<td>PC screen</td>
<td>4 (adjustable)</td>
<td>• Precise position measurement; updating rate of up to 50 kHz • Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for typically 250,000 measured values per channel • Standard Ethernet interface connection to higher-level computer systems</td>
<td>Mounting bracket for 19-inch systems</td>
<td>EIB 741 EIB 742</td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>IK 220 Signal converter as a PCI slot card for computer-aided measured-value acquisition on measuring and inspection stations</td>
<td>PC screen</td>
<td>2 (adjustable)</td>
<td>• Programmable measured-value inputs • Internal and external measured-value triggers • Measured-value memory for 8192 measured values per channel</td>
<td>Assemblies for encoder outputs and external inputs/outputs</td>
<td>IK 220</td>
</tr>
</tbody>
</table>
The ND 280 evaluation unit for one axis is suitable for measuring and inspection stations, as well as simple positioning tasks. The universal encoder input permits the connection of all incremental encoders with 11 µAPP and 1 VPP signals, and absolute encoders with the EnDat 2.2 interface from HEIDENHAIN.

**Design**
The ND 200 series features a sturdy aluminum die-cast housing. Its splash-proof, full-travel keyboard is built to handle shopfloor conditions. For displaying the measured values, a graphics-capable screen shows the status display and soft keys.

**Functions**
The ND 280 digital readout provides all of the key functions for simple measuring and positioning tasks. Expanded functionality is offered by the ND 287 evaluation unit (e.g., for metrological acquisition and statistical analysis of measured values). Thanks to its switching inputs and outputs, the ND 287 can also be deployed in simple automated environments (see p. 8).

**Data interfaces**
The ND 280 is equipped with serial interfaces for the transmission of measured values to a PC or printer, for the input/output of parameter lists and compensation value lists, and for diagnostics: USB, RS-232-C/V24.

<table>
<thead>
<tr>
<th>ND 280</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axes</strong></td>
<td>One</td>
</tr>
<tr>
<td><strong>Encoder inputs</strong></td>
<td>1 VPP, 11 µAPP or EnDat1)</td>
</tr>
<tr>
<td><strong>Input frequency</strong></td>
<td>500 kHz, 100 kHz</td>
</tr>
<tr>
<td><strong>Subdivision factor</strong></td>
<td>4096-fold</td>
</tr>
<tr>
<td><strong>Display step</strong>2)</td>
<td>Adjustable, max. 9 digits</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>Monochrome TFT screen</td>
</tr>
<tr>
<td><strong>Status display</strong></td>
<td>Operating mode, REF, preset, scaling factor, compensation, stopwatch, unit of measure, soft-key level</td>
</tr>
<tr>
<td><strong>Functions</strong></td>
<td>REF reference-mark evaluation for distance-coded or single reference marks, Two presets, Distance-to-go mode, Integrated help and diagnostics, External operation via serial interface</td>
</tr>
<tr>
<td><strong>Axis-error compensation</strong></td>
<td>Linear axis: linear, and segmented linear via 200 compensation points, Angular axis: segmented linear with 180 compensation points (every 2°)</td>
</tr>
<tr>
<td><strong>Data interface</strong></td>
<td>RS-232-C/V24, USB (Type B)</td>
</tr>
<tr>
<td><strong>Power connection</strong></td>
<td>AC 100 V to 240 V (–15 % to +10 %), 48 Hz to 62 Hz; 30 W</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>0 °C to 50 °C (storage temperature: –40 °C to 85 °C)</td>
</tr>
<tr>
<td><strong>Protection</strong></td>
<td>EN 60529, IP40; front panel: IP54</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>Approx. 2.5 kg</td>
</tr>
</tbody>
</table>

1) Purely serial, with no evaluation of incremental signals
2) Depends on the signal period of the connected encoder (Display step = Signal period/4096)
Thanks to its extensive functionality, the ND 287 evaluation unit for one axis is well suited for measuring and inspection stations, and can also be used for simple positioning tasks. The universal encoder input permits the connection of all incremental encoders with 11 µAPP and 1 Vpp signals, and absolute encoders with the EnDat 2.2 interface from HEIDENHAIN.

### Design
The ND 287 features a sturdy aluminum die-cast housing. For displaying the measured values, a graphics-capable screen shows the status display and soft keys. Its splash-proof, full-travel keyboard is designed to handle the shop floor.

### Functions
The ND 287 provides numerous functions for the metrological acquisition of individual values, including functions such as sorting and tolerance check mode, minimum and maximum value recording, and measurement series storage. Based on these data, mean values and standard deviations can be calculated and displayed in histograms or control charts. Thanks to its modular design, the ND 287 permits the connection of a second encoder for sum/difference measurement, or the connection of an analog sensor (e.g., for temperature compensation).

### Data interfaces
The ND 287 is equipped with serial interfaces for the transmission of measured values to a PC or printer, for the input/output of parameter lists and compensation value lists, and for diagnostics:
- USB
- RS-232-C/V.24
- Ethernet 10BaseT (option)

The transmission of measured values can be initiated on the ND keyboard or via an external command. With RS-232-C/V.24, this is done using the software command CTRL+B or a configurable internal clock.

### Measured value acquisition
The ND 287 provides a measured-value memory for the storage of measurement series. Alternatively, during the measurement series, the minimum, maximum, or difference can be displayed. The displayed value can also be checked for tolerance conformity with the sorting function. The saved measured values are evaluated and displayed in the following ways:
- Statistical view (mean value x, standard deviation s, and range r)
- Diagram (graph of the measured values with minimum, maximum, and mean values, as well as tolerance limits)
- Measured value overview as a table

### Statistical Process Control (SPC)
For SPC, the ND 287 saves up to 1000 measured values in its nonvolatile FIFO memory. Evaluation is performed with the following functions:
- Statistical view of the measured values in the FIFO memory
- Measured value overview as a table
- Diagram of the last 30 measured values
- Histogram in ten classes with probability density function and process capability indexes Cp and Cpk.
- Control charts for mean value x, standard deviation s, and range r

### Sorting and tolerance checking
With the sorting and tolerance checking function of the ND 287, workpieces can be inspected for dimensional accuracy and sorted into classes. The result is shown through symbols in the color status display, with a corresponding signal applied at the switching outputs.

### Display freeze
For readability, even during rapidly changing measured values, the display can be frozen with an external signal. The internal counter keeps on running.

### Mathematical consideration of a second encoder
A second encoder or a sensor can be connected to the ND 287 through an optional encoder module or analog module input assembly. The data from the two encoders can be taken into account mathematically via operands. The result and the two measured values are saved. This opens up further areas of application, such as sum/ difference display of two encoders or temperature compensation by means of a temperature sensor.

### Recording and evaluating measurement series
The ND 287 provides a measured-value memory for the storage of measurement series. Alternatively, during the measurement series, the minimum, maximum, or difference can be displayed. The displayed value can also be checked for tolerance conformity with the sorting function. The saved measured values are evaluated and displayed in the following ways:
- Statistical view (mean value x, standard deviation s, and range r)
- Diagram (graph of the measured values with minimum, maximum, and mean values, as well as tolerance limits)
- Measured value overview as a table

Thanks to its extensive functionality, the ND 287 evaluation unit for one axis is well suited for measuring and inspection stations, and can also be used for simple positioning tasks. The universal encoder input permits the connection of all incremental encoders with 11 µAPP and 1 Vpp signals, and absolute encoders with the EnDat 2.2 interface from HEIDENHAIN.

### Axes
- One; option: second input through encoder module

### Encoder inputs
- Input frequency:
  - 1 Vpp:
  - 11 µAPP:
- Input frequency: 1 Vpp ≤ 500 kHz; 11 µAPP ≤ 100 kHz

### Subdivision factor
4096-fold

### Display step:
- Adjustable, max. 9 digits
- Linear axis: 0.5 µm to 0.002 mm; angular axis: 0.5° to 0.00001° (600° 00' 00.1"

### Analog input
- Option: ±10 V via analog module; resolution: 5 mV

### Display
- Screen for position values, dialog boxes, input fields, graphing functions, and soft keys

### Functions
- REF reference-mark evaluation for distance-coded or single reference marks
- Two presets and distance-to-go mode
- External operation via serial interface
- Sorting and tolerance checking
- Measurement series with minimum and maximum value recording
- Storage of measured values (up to 10 000)
- Functions for statistical process control (SPC)
- Graphical depiction of distribution/histogram
- Sum/difference display (with second encoder module)
- Thermal compensation (with analog module)

### Axis-error compensation
- Linear axis: linear, and segmented linear via 200 compensation points
- Angular axis: segmented linear with 180 compensation points (every 2°)

### Data interface
- RS-232-C/V.24; USB (Type B); option: Ethernet 100BaseT via Ethernet module

### Switching outputs for automation tasks
- Zero crossover; trigger points 1 and 2
- Sorting signals: “<” and “>”
- Errors

### Switching inputs for automation tasks
- Zero reset, set displayed value
- Move to reference point and ignore reference signals
- Measured value output or display freeze
- Start measurement series
- Minimum, maximum, and difference display
- Gating of the two encoder inputs
- Sum or difference display
- Display of measured value 1 or measured value 2

### Accessories
- Mounting adapter, encoder module, analog module, Ethernet module

### Power connection
- AC 100 V to 240 V (~15 % to +10 %), 48 Hz to 62 Hz; 30 W

### Operating temperature
- 0 °C to 50 °C (storage temperature: –40 °C to 85 °C)

### Protection
- EN 60529 IP40; front panel: IP54

### Mass
- Approx. 2.5 kg

1. Purely serial, with no evaluation of incremental signals
2. Depends on the signal period of the connected encoder (Display step = Signal period/4096)
GAGE-CHEK 2000
Evaluation unit for demanding measured-value acquisition

The GAGE-CHEK 2000 evaluation unit is particularly well suited for positioning tasks on positioning, measuring, adjustment, and inspection equipment, as well as for the retrofitting of measuring machines in order to collect and transmit data to a PC.

**Design**
Thanks to its rugged industrial design, the GAGE-CHEK 2000 is superbly suited for applications in measuring rooms and harsh production environments. Its slim aluminum housing, featuring an integrated power adapter and fanless passive cooling system, is exceptionally sturdy and resilient. The unit’s straightforward touchscreen, made of specially hardened glass, supports multi-touch gesture control and permits operation with gloves.

**Functions**
The logical arrangement of menus and function elements provides intuitive user guidance, which supports you while using the different functions. Along with the typical functionality of an evaluation unit, such as zero resetting and preset setting, the GAGE-CHEK 2000 also offers the following practical features:
- Dial gage for a graph of the measured value
- Measurement series with minimum and maximum value recording
- Measurement of master parts (mastering)
- Probing functions
- Manual, continuous, touch-probe-triggered, or switching-function triggered measured value output

Over the data interface, you can transfer the captured measured values to a PC.

**Configurable axis names**
The axis names shown in the display can be changed to meet the requirements of the given application. By means of an alias assignment, you can easily change the names of the X, Y, and Z axes. The axis names may contain any combination of up to two letters and/or numbers.

**Intuitive display**
All of the information you need is displayed in a clean and easy-to-read format on the unit’s high-resolution, 7-inch screen. Only those functions that are actually available within a given context and situation are shown. The self-explanatory operating elements provide intuitive user guidance.

**Configuration of axis names**
You can change the axis names on the unit’s high-resolution, 7-inch screen to meet the requirements of the given application. By means of alias assignment, you can easily change the names of the X, Y, and Z axes. The axis names may contain any combination of up to two letters and/or numbers.

**Management of parts**
The GAGE-CHEK 2000 allows you to configure functions for various objects of measurement and to store them in a structured manner in the function bar. The required measurement functions can thus be selected quickly and easily.

<table>
<thead>
<tr>
<th>GAGE-CHEK 2013</th>
<th>GAGE-CHEK 2023</th>
<th>GAGE-CHEK 2093</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Axes</strong></td>
<td>Up to three axes</td>
<td></td>
</tr>
<tr>
<td><strong>Encoder interface</strong></td>
<td>~ 1 Vpp ~ 11 µAPP</td>
<td>EnDat 2.2</td>
</tr>
<tr>
<td><strong>Input frequency</strong></td>
<td>~ 1 Vpp ≤ 400 kHz</td>
<td>~ 11 µAPP ≤ 150 kHz</td>
</tr>
<tr>
<td><strong>Subdivision factor</strong></td>
<td>4096-fold (only with 1 Vpp)</td>
<td></td>
</tr>
<tr>
<td><strong>Display step</strong></td>
<td>Configurable, up to eight digits</td>
<td></td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>7-inch screen (19:9) for multitouch operation; resolution: WVGA 800 x 480 pixels for dialog boxes, input fields, position values, and graphing functions</td>
<td></td>
</tr>
</tbody>
</table>
| **Functions** | • Acquisition of precise measured values, and spot-on positioning in metrology applications  
  • 100 presets  
  • Dial gage for a graph of the measured value  
  • Measurement series with minimum and maximum value recording  
  • Difference of minimum and maximum values (range)  
  • Measurement of master parts (mastering)  
  • Data transfer either manually, continuously, or triggered by touch probe or switching function  
  • Diameter/radius display  
  • Relative measurement  
  • Probing functions (edge, centerline, and circle)  
  • User administration  
  • Configurability of each axis for length or angle display  
  • Coupled axis for sum measurement or differential measurement |               |
| **Data interface** | 1x Ethernet 100 Mbit/1 Gbit (RJ45); 1x Hi-Speed USB 2.0 (Type A) |               |
| **Other connections** | Foot switch for two functions |               |
| **Accessories** | Multi-Pos, Duo-Pos, and Single-Pos stands, Multi-Pos holder, power cable, adapter connector, foot switch |               |
| **Power connection** | AC 100 V to 240 V (±10 %); 50 Hz to 60 Hz (±5 %); ≤ 38 W |               |
| **Operating temperature** | 0 °C to +45 °C (storage temperature: –20 °C to +70 °C) |               |
| **Protection** | EN 60529 | IP65; back panel: IP40 |               |
| **Mounting** | Multi-Pos, Duo-Pos, or Single-Pos stand; Multi-Pos holder; 50 mm x 50 mm mounting hole pattern |               |
| **Mass** | Device with Multi-Pos stand: approx. 2.0 kg; device with Duo-Pos stand: approx. 1.5 kg; device with Multi-Pos holder: approx. 1.7 kg; device alone: approx. 1.3 kg |               |

**Diameter/radius display**
The “D/R” (diameter/radius) function can be used for radial measurements on rotationally symmetrical parts; for example, in order to switch between the displayed radius and the equivalent diameter. The axes to be given this switching capability can be configured within the function, which can be used on linear axes or on angular axes displayed as linear axes.

**Sum/differential measurement**
With the coupled axis, two encoder inputs can be shown linked in the position display. For this purpose, the two encoder inputs are offset against each other as a sum or difference. The result is shown as coupled axis in the position display.

**Error compensation**
- Linear (LEC) and segmented linear (SLEC) using up to 200 compensation points
- Squareness calibration; matrix compensation (NLEC) using up to 99 x 99 points

**Additional features**
- Manual, continuous, touch-probe-triggered, or switching-function triggered measured value output
- Configurable axis names
- Intuitive display
- Measurement series with minimum and maximum value recording
- Measurement of master parts (mastering)
- Data transfer either manually, continuously, or triggered by touch probe or switching function
- Diameter/radius display
- Measurement of master parts (mastering)
- Data transfer either manually, continuously, or triggered by touch probe or switching function
- Diameter/radius display
- Relative measurement
- Probing functions (edge, centerline, and circle)
- User administration
- Configurability of each axis for length or angle display
- Coupled axis for sum measurement or differential measurement

**Environment**
- Operating temperature: 0 °C to +45 °C (storage temperature: –20 °C to +70 °C)
- Power connection: AC 100 V to 240 V (±10 %); 50 Hz to 60 Hz (±5 %); ≤ 38 W
- Operating temperature: 0 °C to +45 °C (storage temperature: –20 °C to +70 °C)
- Protection: EN 60529
- Mounting: Multi-Pos, Duo-Pos, or Single-Pos stand; Multi-Pos holder; 50 mm x 50 mm mounting hole pattern
- Mass: Device with Multi-Pos stand: approx. 2.0 kg; device with Duo-Pos stand: approx. 1.5 kg; device with Multi-Pos holder: approx. 1.7 kg; device alone: approx. 1.3 kg

**GAGE-CHEK 2000**
Thanks to its rugged industrial design, the GAGE-CHEK 2000 is superbly suited for applications in measuring rooms and harsh production environments. Its slim aluminum housing, featuring an integrated power adapter and fanless passive cooling system, is exceptionally sturdy and resilient. The unit’s straightforward touchscreen, made of specially hardened glass, supports multi-touch gesture control and permits operation with gloves.

**Design**
The logical arrangement of menus and function elements provides intuitive user guidance, which supports you while using the different functions. Along with the typical functionality of an evaluation unit, such as zero resetting and preset setting, the GAGE-CHEK 2000 also offers the following practical features:
- Dial gage for a graph of the measured value
- Measurement series with minimum and maximum value recording
- Measurement of master parts (mastering)
- Probing functions
- Manual, continuous, touch-probe-triggered, or switching-function triggered measured value output

Over the data interface, you can transfer the captured measured values to a PC.

**Functions**
The GAGE-CHEK 2000 allows you to configure functions for various objects of measurement and to store them in a structured manner in the function bar. The required measurement functions can thus be selected quickly and easily.

**Management of parts**
The GAGE-CHEK 2000 allows you to configure functions for various objects of measurement and to store them in a structured manner in the function bar. The required measurement functions can thus be selected quickly and easily.
Functions

Configurable function elements
The functionality of the GAGE-CHEK 2000 can be adapted to the given requirements through individually configurable function elements in the Inspector view. Along with function elements for the output of measured values, functions such as a preset table and the storage of minimum and maximum values are available as well.

Dial gage
The dial gage function lets you make a direct comparison between the acquired measured values and the nominal value, warning limits, and tolerance limits. The measured values are shown as a graph in the form of a dial gage. For evaluation, the GAGE-CHEK 2000 supports you with a color depiction of a dial gage.

Recording minimum and maximum values (MinMax)
The GAGE-CHEK 2000 is equipped with a function for recording minimum and maximum values. This function can be configured for the axes as desired. The highest and lowest measured values of a measurement series, including their difference, are recorded and can be output over the data interface. This function is particularly advantageous for radial run-out inspection.

Probing functions
The probing functions support you in determining positions and presets. For these purposes, the GAGE-CHEK 2000 provides edge, centerline, and circle-center probing functions.

Mastering
With the mastering function, you can reduce influences on the measurement results of a measurement series by using master parts. For this purpose, the master part is measured regularly with the known dimensions. The documented measured values of the master part are taken over either individually or entirely in the position display of the corresponding axes. Regular mastering helps you to improve the accuracy of your measurement series. In addition, you can reuse the measuring setup quickly and easily for new measured objects.

Configurable data formats for measured-value output
Along with providing a default format, the GAGE-CHEK 2000 also gives you the option of storing your own data formats for data transfer. Thanks to the configurability of its data formats, the GAGE-CHEK 2000 is particularly effective as a data logger on retrofitted, manually operated measuring machines. Within such applications, the GAGE-CHEK 2000 captures the measured values and relays them to a higher-level PC for processing.
**EIB 700**

Signal converter for computer-aided measured-value acquisition

For use as evaluation units, the EIB 700 signal converters feature connections for four encoders. These units are particularly well suited for the following applications:

- Precise position measurement, especially for inspection stations and multi-gauging fixtures
- Portable, on-site data acquisition (e.g., for machine calibration)
- Integration into customized applications (e.g., high-precision measuring machines)

The EIB 700 series is ideal for applications requiring high-resolution encoder signals and rapid measured-value acquisition. Its Ethernet transmission also enables the use of switches or hubs for connecting more than one EIB. Wireless LAN transmission, for example, can be used as well.

**Design**

The EIB 700 features a bench-top housing. With a mounting bracket accessory, it can also be easily installed into a 19-inch housing. The device is suitable for the following supply voltages:

- **EIB 741**: AC 100 V to 240 V
- **EIB 742**: DC 24 V

### Functions

**For measured-value generation**

- The EIB 700 series can typically see 250,000 measured values per axis. Based on the axis, these measured values can be saved by means of either an internal or external trigger.

**The interval counter**

- Permits position-dependent triggering in conjunction with an incremental encoder on Axis 1. For this purpose, the signals of Axis 1 are interpolated and forwarded to a position counter.

**Triggering pulses**

- Generated either at a certain position or equidistantly at configurable intervals. They are continuously generated once a configurable starting position is crossed in either counting direction.

**Trigger output**

- Can be used to trigger further internal axes of the EIB or can also be output over a trigger output.

### Data interface

**A standard Ethernet interface using TCP/IP or UDP communication is available for data output**, permitting direct connection to a PC, laptop, or industrial PC. The type of measured-value transmission can be selected through the operating mode (single values, as a block, or upon software request).

**For processing the measured values**

- On a PC, software drivers for Windows, Linux, and LabVIEW are included in delivery, as example programs and the EIB application software. The software driver makes it easy to program customized applications, and the example programs demonstrate the potential of the EIB 700 series. The EIB application software aids with setting up and demonstrating the capabilities of the EIB 700 series. This software is provided as source code and can serve as a platform for the development of one’s own applications.

### Operating modes

**Soft Real-Time**

- Immediate transmission of the measured value upon occurrence of the triggering event

**Recording**

- Storage of measured values in the EIB’s internal measured-value memory

**Streaming**

- Buffering and block transmission of measured values

**Polling**

- Software request originating from the customer’s application

### Selectable trigger sources

**All internal and external sources**

**Via software command**

### Trigger rate

- **≤ 10 kHz** (access time to position values ≤ 100 µs)
- **≤ 50 kHz** (up to 1 200 000 bytes/s)
- Depends on the application

### Typical applications

- **Closed Loop control**
- **Very high recording rate**
- **Offline data analysis**
- **High recording rate in combination with high recording depth**
- **Semi-static measured value recording**

### Measured-value memory

- Typically 250,000 position values per channel

### Measured-value trigger

- Storage of the measured values of the four axes through an external or internal trigger (selectable).

**External**:
- Signal via trigger input
- Software command over Ethernet

**Internal**:
- Timer and interval counter
- Reference pulse of the respective axis (from Axis 1 and other axes)

### Trigger input

- 9-pin D-sub connection (male); differential inputs as per RS-485 (terminating resistors can be activated)

### Trigger output

- 9-pin D-sub connection (female); four differential outputs as per RS-485

### Access to measured values

- Depends on the selected operating mode (see separate table)

### Software

- **Software drivers for Windows, Linux, and LabVIEW**
- **Example programs**
- **EIB application software**

### Data interface

- Ethernet as per IEEE 802.3 (10/100/1000 Mbit/s)

### Network address

- Automatic assignment through Dynamic Host Configuration Protocol (DHCP), or manual assignment

### Dimensions

- Approx. 213 mm x 152 mm x 42 mm

### Operating temperature

- 0 °C to 45 °C (storage temperature: 0 °C to +70 °C)

### Supply voltage

- **EIB 741**: AC 100 V to 240 V (±10 %), 50 Hz to 60 Hz (±2 %); max. power consumption: 30 W
- **EIB 742**: DC 24 V (±15 %/+20 %), max. 2 A

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1) The supply voltage range of the encoder must be maintained; specified cable length applies when HEIDENHAIN cables are used.
2) Various trigger sources can be assigned to the individual axes.
3) Can also be used as logical input or output
4) Maximum input frequency during triggering: 70 kHz
5) The quality of the data cable between the EIB and PC must be adapted to the transmission rate and cable length.
The IK 220 signal converter is an evaluation unit for two axes. As a PC counter card, the IK 220 can be inserted directly into a free PCI slot on the computer.

**Design**
Connectable to the IK 220 are two HEIDENHAIN encoders with sinusoidal current signals (~11 µAPP), sinusoidal voltage signals (~1 Vpp), or an EnDat 2.1 or SSI interface. External latch inputs/outputs and the output of encoder signals (~11 µAPP) can be implemented by means of additional slot covers (accessory).

**Functions**
The IK 220 subdivides the signal periods of the sinusoidal encoder signals up to 4096-fold. The signals are called and stored through either external latch inputs or software. The IK 220 features an integrated measured value memory. A total of up to 8192 measured values can be stored in the buffer memory and can be output as a single block.

Further processing of the measured values in the PC is performed by operator-created programs. To demonstrate the possibilities of the PC counter card, example programs and a software driver are included in delivery.

---

### IK 220

**Encoder inputs**
15-pin D-sub connections (male, X1 and X2), for two encoders

**Input signals (switchable)**

- ~1 Vpp
- ~11 µAPP
- EnDat 2.1
- SSI

**Input frequency**

- ≤ 500 kHz
- ≤ 33 kHz
- ~

**Cable length**

- ≤ 60 m
- ≤ 10 m

**Adjustment of encoder signals**
Adjustment of offset, phase, and amplitude by the software

**Signal subdivision**
4096-fold

**Data register for measured values**
48 bits; of which only 44 bits are used for the measured value

**Internal memory**
For 8192 position values

**Measured-value trigger**
Through the following (selectable):
- External latch signals (over separate IK assembly for external inputs/outputs)
- Software command
- Timers
- Traversing of reference marks

**Access time to measured values**

- Without adjustment, without compensation run:
  ≤ 100 µs

- With adjustment, without compensation run:
  ≤ 110 µs

- With adjustment, with compensation run:
  ≤ 160 µs

**Depends on the encoder**

**Interface**
PCI bus (plug and play) Local Bus Specification Rev. 2.1

**Software driver and demonstration program**
For Windows 7 (32-bit and 64-bit)
In VISUAL C++, VISUAL BASIC, and BORLAND DELPHI included in delivery
Via download: Windows 10 64-bit

**Outputs for encoder signals**

- ~11 µAPP
- Via PGB connector on the IK (10-pin, female)
- Fitting cable assembly with PC-slot cover optionally available

**Power consumption**
Approx. 4 W, without encoders

**Dimensions**
190 mm x 100 mm

**Operating temperature**
0 °C to 55 °C (storage temperature: −30 °C to 70 °C)

---

1) With HEIDENHAIN cable; longer cable lengths upon request
**Mounting**

**Mounting the ND 200**

**ND 200 series**
The ND 200 series digital readouts were designed as benchtop units and can be easily stacked. Recesses on the top prevent the stacked units from shifting out of place.

Through threaded holes at the bottom, the ND 28x can be fastened to a base plate with M4 screws.

Two side-by-side ND 28x readouts fit inside a 19-inch housing. For mounting inside a 19-inch housing, a mounting adapter is available as an accessory.

**Accessories**

- **Mounting adapter** for 19-inch housing
  - ID 654020-01

**Mounting the EIB 700**

The EIB 700 series was designed as a benchtop unit. It must be installed in a well-ventilated area and at a specified operating orientation.

Through threaded holes at the bottom, the EIB 700 can be fastened to a base plate with M3 screws. Two side-by-side EIB 700 units fit next to each other in a 19-inch housing, thus occupying one height unit. A mounting bracket is available as an accessory.

**Accessories**

- **Mounting bracket**
  - For installation of two EIB 74 units in a 19-inch housing.
  - ID 671144-01

*) Max. thread engagement: 4 mm
Mounting the GAGE-CHEK 2000

With the Multi-Pos or Duo-Pos stand, the GAGE-CHEK 2000 evaluation units can be set up at different angles of tilt. Mounting to the machine can be accomplished with the Multi-Pos holder or with other fastening systems featuring a 50 mm x 50 mm hole pattern.

**Multi-Pos stand**
For setup on and fastening to a horizontal surface (90° continuous tilt range).
ID 1089230-07

**Duo-Pos stand**
For setup on and fastening to a horizontal surface (20° or 40° tilt).
ID 1089230-08

**Single-Pos stand**
Included in delivery.
For setup on and fastening to a surface (20° tilt).
ID 1089230-05

**Multi-Pos holder**
For fastening to an arm (90° continuous tilt range).
ID 1089230-08

**Mounting arm, straight**
For fastening to a machine.
ID 1089207-01
Accessory: adapter connectors

**Adapter connectors for the GAGE-CHEK 2000**

For pin-layout conversion from HEIDENHAIN TTL to RSF TTL and Renishaw TTL.

- ID 1089210-01
  - HEIDENHAIN 11 µA+ to HEIDENHAIN
  - HEIDENHAIN 1 Vpp to HEIDENHAIN
  - HEIDENHAIN 1 Vpp to Mitutoyo 2 Vpp.

**Adapter cable for the GAGE-CHEK 2000**

For pin-layout conversion from the HEIDENHAIN touch-probe interface to the Renishaw touch-probe interface.

ID 1089216-01

Accessory: external operating element

Although the evaluation units are easy and intuitive to operate, external control capability may be useful in certain scenarios. The foot switch is available for externally controlled operation:

**Foot switch (accessory)**

- Cable length: 2.4 m

ID 681041-04

Interfaces

Evaluation units with an integrated display

The evaluation units are equipped with interfaces for encoders, communication, and external components.

<table>
<thead>
<tr>
<th>ND 280</th>
<th>ND 287</th>
<th>GAGE-CHEK 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Encoders</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Vpp/11 µA+</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>TTL</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>EnDat 2.2 11</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>Touch probe</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Sensor ±10 V</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>–</td>
<td>Option</td>
<td>–</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USB</td>
<td>Type B</td>
<td>Type B</td>
</tr>
<tr>
<td>RS-232-C/X24</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Ethernet</td>
<td>–</td>
<td>Option</td>
</tr>
<tr>
<td>Foot switch</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>Switching outputs</strong></td>
<td>–</td>
<td>6 TTL</td>
</tr>
<tr>
<td><strong>Switching inputs</strong></td>
<td>–</td>
<td>12 TTL</td>
</tr>
</tbody>
</table>

= Included  
= Not included
11 Purely serial, with no evaluation of incremental signals
1 HEIDENHAIN or Renishaw touch probe
2 Possible with RS-232 adapter connection via USB port
Various input and output assemblies are available for the evaluation unit.

**Second encoder input (option)**
The ND 287 evaluation unit can be equipped with an optional second encoder input.

**Encoder module**
Input assembly for second encoder with a 1 Vpp, 11 µAPP, or EnDat 2.2 interface. ID 654017-01

**Analog input (option)**
Through an optional input assembly, the ND 287 evaluation unit can be equipped with an additional analog input for connecting a sensor. The input voltage range is interpolated 4096-fold; for a sensor with ±10 V, the resolution is therefore 5 mV. The analog module provides DC 5 V, DC 12 V, and DC 24 V as supply voltage for the sensor.

The DC 5 V (B) and DC 12/24 V (A) supply voltages are galvanically isolated and must not be used at the same time. A 9-pin D-sub connector is required as a mating connector.

**Analog module**
Input assembly for the ±10 V analog sensor. ID 654018-01

**Ethernet (option)**
The ND 287 evaluation unit can be provided with an optional Ethernet module.

**Ethernet module**
ID 654019-01
This module features an Ethernet 100BaseT interface with an RJ45 connector (8-pin, female), allowing the ND 287 to be connected directly to an internal network or, with a crossover cable, to a PC.

**Housing**
External shield

---

**Pin Assignment**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+12 V (A)85 mA</td>
</tr>
<tr>
<td>2</td>
<td>0 V (A)</td>
</tr>
<tr>
<td>3</td>
<td>0 V (A)</td>
</tr>
<tr>
<td>4</td>
<td>+12 V (A)85 mA</td>
</tr>
<tr>
<td>5</td>
<td>Shield</td>
</tr>
<tr>
<td>6</td>
<td>0 V (B)</td>
</tr>
<tr>
<td>7</td>
<td>0 V (B)</td>
</tr>
<tr>
<td>8</td>
<td>Sensor (B) max. ±10 V</td>
</tr>
<tr>
<td>9</td>
<td>+5 V (B)400 mA</td>
</tr>
</tbody>
</table>

**Pin Assignment**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
</tr>
<tr>
<td>2</td>
<td>TX-</td>
</tr>
<tr>
<td>3</td>
<td>REC+</td>
</tr>
<tr>
<td>4</td>
<td>Do not assign</td>
</tr>
<tr>
<td>5</td>
<td>Do not assign</td>
</tr>
<tr>
<td>6</td>
<td>REC-</td>
</tr>
<tr>
<td>7</td>
<td>Do not assign</td>
</tr>
<tr>
<td>8</td>
<td>Do not assign</td>
</tr>
<tr>
<td>9</td>
<td>Housing External shield</td>
</tr>
</tbody>
</table>

---

**Switching inputs**
The ND 287 evaluation unit features numerous inputs for external operation and outputs for switching functions. The inputs can be addressed with a pulse or a closed contact. **Exception:** the switching inputs for transmitting measured values over the data interface are separate for contact and pulse.

The switching input E is active when a LOW signal $U_{IL}$ is applied (contact or pulse to 0 V).

**Signal level**

- $-0.5 \text{ V} \leq U_{IL} \leq 0.9 \text{ V}$ with $I_L \leq 6 \text{ mA}$
- $3.9 \text{ V} \leq U_{IH} \leq 15.0 \text{ V}$
- $t_{\text{min}} \geq 30 \text{ ms}$

**Zero reset / set value**
Via an external signal, each axis can be set to the display value zero or to a value stored in a parameter (SET).

**External control of measurement series**
Switching the display to MIN, MAX, and DIFF

- Continuously applying a LOW signal at the corresponding switching input activates the external operation of measurement series.
- The start of a new measurement series and the switch to the MIN/MAX/DIFF display are then externally controlled through further switching inputs.

**Ignoring reference mark signals**
(Reference pulse lock)
When this input is active, the readout ignores all of the reference mark signals.

**Activating or deactivating REF mode**
After switch-on or a power interruption, the digital readout can be externally switched to REF mode. The next signal then deactivates REF mode (switching function).

**Display with axis coupling**
The ND 287 can have two optional encoder inputs. Using switching inputs, you can switch the display to individual measured values, a sum, a difference, or any logical operation.

---

**Switching inputs**

<table>
<thead>
<tr>
<th>Twelve switching inputs</th>
<th>ND 287</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero reset, clear error message</td>
<td>Set a preset</td>
</tr>
<tr>
<td>Ext. control of measurement series</td>
<td>or display $X_1$</td>
</tr>
<tr>
<td>Start measurement series</td>
<td>or display $f(X_1, X_2)$</td>
</tr>
<tr>
<td>Display minimum MIN</td>
<td>or display $X_2$</td>
</tr>
<tr>
<td>Display maximum MAX</td>
<td>or display $X_1 + X_2$</td>
</tr>
<tr>
<td>Display difference DIFF</td>
<td>or display $X_1 - X_2$</td>
</tr>
<tr>
<td>Measured value output (pulse)</td>
<td></td>
</tr>
<tr>
<td>Measured value output (contact)</td>
<td></td>
</tr>
<tr>
<td>Ignore reference mark signals (input X1)</td>
<td></td>
</tr>
<tr>
<td>Ignore reference mark signals (input X2)</td>
<td></td>
</tr>
<tr>
<td>Activate or deactivate REF mode</td>
<td></td>
</tr>
</tbody>
</table>

**Six switching outputs**

<table>
<thead>
<tr>
<th>Display value is “0”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured value ≥ Switching limit A1</td>
</tr>
<tr>
<td>Measured value ≤ Switching limit A2</td>
</tr>
<tr>
<td>Measured value &gt; Upper sorting limit</td>
</tr>
<tr>
<td>Measured value &lt; Lower sorting limit</td>
</tr>
<tr>
<td>Error</td>
</tr>
</tbody>
</table>

(1) Also selectable by parameter

---

**Contact**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E</td>
</tr>
<tr>
<td>2</td>
<td>0 V</td>
</tr>
</tbody>
</table>

**Pulse**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E</td>
</tr>
<tr>
<td>2</td>
<td>0 V</td>
</tr>
</tbody>
</table>
Switching outputs
The ND 287 features open-collector outputs that switch to 0 V (= Active LOW).

Delay until signal output:
\[ t_v \leq 20 \text{ ms} \]

Signal level
\[ U_h \leq 0.4 \text{ V at } I_h \leq 100 \text{ mA} \]
\[ U_l \leq 32 \text{ V at } I_l \leq 10 \mu A \]

Trigger points (in actual value mode)
When the measured value reaches trigger points defined via parameters, the corresponding output becomes active. Up to two trigger points can be defined.

Switch-off ranges (distance-to-go mode)
In distance-to-go mode, the trigger points function as switch-off ranges, appearing equidistantly from the display value “0”.

Sorting limits
When the tolerance sorting limits as defined via parameters are exceeded, the corresponding outputs become active.

Triggering signal for an error
The ND 200 readouts constantly monitor the measuring signals, input frequency, data output, etc., displaying error messages as they arise. If errors occur that have a significant effect on a measurement or data output, the readout sets a switching output to active. This enables monitoring for automated processes.

Zero crossover
At the display value “0”, the corresponding output becomes active. The minimum signal duration is 180 ms.

The EIB 700 and IK 220 units feature D-sub connectors for external operation and the connection of encoders.

With the IK 220, the encoder signals can be routed out over an additional slot cover and are available as 11 µA current signals for further processing in evaluation electronics or EXE pulse-shaping electronics. An additional slot cover holds the connections for the external inputs/outputs (e.g., for storing the measured values).
The evaluation electronics are equipped with interfaces for connecting HEIDENHAIN encoders. Other interfaces are available upon request.

**Pin layout for 1 Vpp**

*15-pin D-sub flange socket (female)*

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>5/6/8/13/15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 Vpp* = Power supply voltage

**Pin layout for TTL**

*9-pin D-sub flange socket (female)*

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

*TTL* = Power supply voltage

Cable shield connected to housing; UP = 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.

**Pin layout of the ND 200 and GAGE-CHEK series with 1 Vpp/11 µApp/EnDat**

*15-pin D-sub flange socket (female)*

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Serial data transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>8</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

*1 Vpp* = 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!

**Pin layout of the EIB 700 series with 1 Vpp**

*15-pin D-sub flange socket (female)*

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>6/13/15</td>
</tr>
</tbody>
</table>

*1 Vpp* = 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!

**Pin layout for TTL**

*9-pin D-sub flange socket (female)*

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

*TTL* = Power supply voltage

Cable shield connected to housing; UP = Power supply voltage

Vacant pins or wires must not be used!

1) Pins for homing or limit signals if supported by the encoder.
Pin layout of the EIB 700 series with EnDat

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Serial data transfer</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>EnDat</td>
<td>UP</td>
<td>Sensor 0V</td>
<td>Sensor 0V</td>
</tr>
<tr>
<td>U+</td>
<td>A+</td>
<td>B+</td>
<td>DATA</td>
</tr>
<tr>
<td>U_</td>
<td>A_</td>
<td>B_</td>
<td>DATA</td>
</tr>
<tr>
<td>Internal shield</td>
<td></td>
<td></td>
<td>CLOCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CLOCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>/</td>
</tr>
</tbody>
</table>

Shield on housing; \( U_+ \) = Power supply voltage.

Sensor: The sense line is connected in the encoder with the corresponding power line.

1) For encoders with ordering designations EnDat01 and EnDat02.

Pin layout of the IK 220

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Incremental signals</th>
<th>Serial data transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>( \mu \text{A}_{\text{pp}} )</td>
<td>( U_+ ) 6V</td>
<td>Sensor 0V</td>
</tr>
<tr>
<td>( U_- )</td>
<td>( I_+ )</td>
<td>( I_- )</td>
</tr>
<tr>
<td>( 1 \text{ V}_{\text{pp}} )</td>
<td>( \text{A+} )</td>
<td>( \text{A}_- )</td>
</tr>
<tr>
<td>EnDat SSI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Shield on connector housing.

Vacant pins or wires must not be used.

EIB application software for the EIB 700

The EIB application software covers two applications:

**Configuring and demonstrating the EIB 700**
- Easy configuration of settings required for operating the EIB 700 (e.g., input interface, data packets, operating mode, trigger settings)
- Management of one or more EIB 700 units
- Simple depiction of the positions transmitted by the EIB 700
- Saving of settings for management of different application projects

For more information, please refer to the User’s Guide.

**Platform for customized applications**

The EIB application software is provided as source code, thereby allowing customers to rapidly implement their own applications. The application software was programmed using C++/CLI and Windows Forms in Visual Studio 2008. This programming environment is widely used in technical application programming but does not necessarily provide state-of-the-art user interfaces such as those in Windows 10. However, adaptation to other graphical interfaces can be performed by the customer.