Barcode positioning system BE 901 EPN (D) (H)

_Safety instructions
_Function description
_Mounting and installation
_Commissioning, Configuration
_Diagnostics and troubleshooting
_Technical data
_Ordering information and accessories

User Manual

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Preferred heights for barcode tape removed	05/30/2017	01
General update	02/01/2021	02
Chapter 12 Table 12.6: Product Reliability added	03/12/2024	03

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1 About this document

1.1 Used symbols and signal words

Table 1.1: Warning symbols and signal words

⚠ WARNING	Signal word for serious injury Indicates hazards that could result in serious or fatal injury if you do not follow the measures for danger avoidance.
⚠ CAUTION	Signal word for light injuries Indicates dangers that can cause slight injuries if the measures for danger avoidance are not followed.
NOTICE	Signal word for property damage Indicates dangers that can cause damage to property if you do not follow the measures for avoiding danger.
	Symbol for dangers from harmful laser radiation

Table 1.2: Other symbols

	Symbol for tips Texts with this symbol provide you with further information.
	Symbol for action steps Texts with this symbol instruct you to perform actions.
	Symbol for action results Texts with this symbol describe the result of the previous action.

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Table 1.3: Terms and abbreviations

BCB	Barcode tape
BE 901	Barcode positioning system - Series 901
CFR	Code of Federal Regulations
DAP	Device Access Point
DCP	Discovery and Configuration Protocol
EMC	Electromagnetic compatibility
EN	European standard
EPN	Ethernet PROFINET
FE	Functional earth
GSD	General Station Description
GSDML	Generic Station Description Markup Language
GUI	Graphical User Interface
IO or I/O	Input/Output
I&M	Identification & Maintenance
IP	Internet Protocol
LED	Light Emitting Diode
MAC	Media Access Control
MVS	Type of control barcode
MV0	Type of control barcode
NEC	National Electric Code
OSI	Open Systems Interconnection model
PELV	Protective Extra-Low Voltage
PNO	PROFIBUS Nutzerorganisation e.V. (PROFIBUS User Organization)
PROFIBUS	Manufacturer independent, open field bus standard
PROFINET	PROFINET is the open Industrial Ethernet Standard of the PROFIBUS User Organization for the automation.
RT	Real Time
SNMP	Simple Network Management Protocol
PLC	Programmable Logic Control
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
USB	Universal Serial Bus
UL	Underwriters Laboratories
UV	Ultraviolet
XML	Extensible Markup Language

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2 Safety

This sensor was developed, manufactured and tested in line with the applicable safety standards. It corresponds to the state of the art.

2.1 Intended use

The device is an optical measuring system which uses visible red laser light to determine its position relative to a permanently mounted barcode tape.
All accuracy details for the BE 901 EPN measurement system refer to the position relative to the permanently mounted barcode tape.

⚠ CAUTION

Only use approved barcode tapes!

The barcode tapes approved and offered by TR-Electronic GmbH are an essential part of the measuring system. Barcode tapes from external sources are not allowed and the intended use is not given for this case.

Areas of application:

The BE 901 EPN is designed for positioning in the following areas of application:

- Telpher line
- Travel and lifting axes of high-bay storage devices
- Repositioning units
- Gantry crane bridges and their trolleys
- Elevators

⚠ CAUTION

Observe intended use!

The protection of operating personnel and the device is not guaranteed if the device is not used in accordance with its intended use.

- *Only operate the device in accordance with its intended use.*
- *TR-Electronic GmbH is not liable for damages resulting from improper use.*
- *Please read this operating manual before using the device. Knowledge of the operating instructions is part of the intended use.*

NOTICE

Comply with conditions and regulations!

- *Observe the locally applicable statutory provisions and the regulations of the employers' liability insurance associations.*

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2.2 Foreseeable misuse

Any use other than that defined under “Intended use” or which goes beyond that use is considered improper use.

In particular, use of the device is not permitted in the following cases:

- in rooms with explosive atmospheres
- for medicinal purposes
- as own safety component in accordance with the machinery directive*

Use as a security-related component within a security function is possible with a corresponding conception of the combination of component parts by the machinery manufacturer.

NOTICE

No intervention or changes to the device!

- *Do not make any interventions or changes to the device. Interventions and changes to the device are not permitted.*
- *The use of a barcode tape not approved by TR-Electronic GmbH is to be equated with an intervention or a change to the device / measuring system.*
- *The device must not be opened. It does not contain any parts to be adjusted or maintained by the user.*
- *A repair may only be carried out by TR-Electronic GmbH.*

2.3 Competent persons

Connection, mounting, commissioning and adjustment of the device must only be carried out by competent persons.

Prerequisites for competent persons:

- They have a suitable technical education.
- They are familiar with the rules and regulations for occupational safety and safety at work.
- They are familiar with the original operating instructions of the device.
- They have been instructed by the responsible person on the mounting and operation of the device.

Certified electricians:

Electrical work must be carried out by a certified electrician.
Due to their technical training, knowledge and experience as well as their familiarity with relevant standards and regulations, certified electricians are able to perform work on electrical systems and independently detect possible dangers.

In Germany, certified electricians must fulfill the requirements of accident-prevention regulations BGV A3 (e.g. electrician foreman). In other countries, there are respective regulations that must be observed.

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2.4 Exemption of liability

TR-Electronic GmbH is not liable in the following cases:

- The device is not being used properly.
- Reasonably foreseeable misuse is not taken into account.
- Mounting and electrical connection are not properly performed.
- Changes (e.g., constructional) are made to the device.

2.5 Laser warning notices

NOTICE

LASER RADIATION - LASER CLASS 1

The device meets the requirements of IEC/EN 60825-1:2014 for a Class 1 laser product and the requirements of U.S. 21 CFR 1040.10 with the deviations as per Laser Notice No. 56 dated May 8, 2019.

- *Observe the applicable legal and local laser safety regulations.*
- *Access and modifications to the device are not permitted. The device contains no parts that need to be adjusted or maintained by the user. Repairs may only be carried out by TR-Electronic GmbH.*

⚠ CAUTION

Do not open the device!

- *Opening the device can lead to radiation exposure.*

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3 Device description

3.1 Device overview

3.1.1 General information

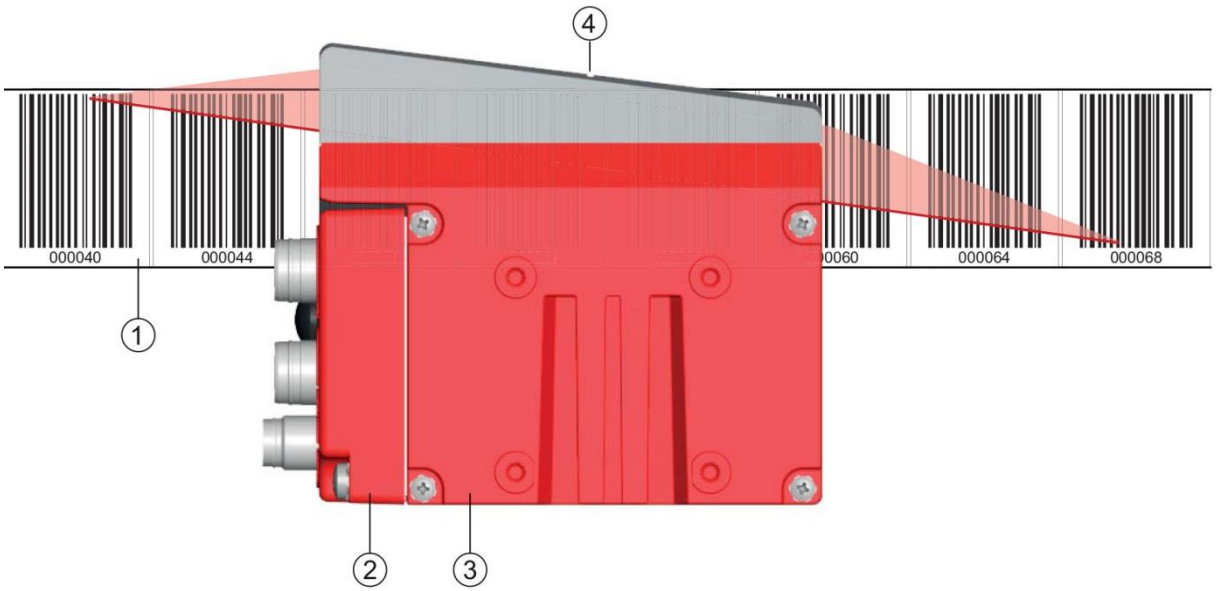
The BE 901 EPN barcode positioning system uses visible red laser light to determine its position and its speed value relative to a barcode tape that is affixed along the travel path. This takes place in the following steps:

- Read a code on the barcode tape (see Figure 3.1)
- Determine the position of the read code in the scanning beam
- Calculate the position to within less than a millimeter using the code information and the code position relative to the device's center.

The position and speed values are then output to the controller via the host interface.
The BE 901 EPN consists of device housing and interface connection hood for the connection to the control. The BE 901 EPN can optionally be delivered with display and optics heating.

The following connection hoods are available for the connection of the PROFINET interface:

- BE 901 MS EPN connection hood with M12 connectors
- BE 901 MK EPN connection hood with spring-cage terminals



1: Barcode tape
2: Connection hood
3: Device housing
4: Middle of the scanning beam (device middle, output position value)

Figure 3.1: Device construction, device arrangement and beam exit

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3.1.2 Performance characteristics

The most important performance characteristics of the barcode positioning system:

- Positioning with submillimeter accuracy from 0 to 10,000 m
- For the control at high traverse rates of up to 10 m/s
- Simultaneous position and speed measurement
- Working range: 50 to 170 mm; enables flexible mounting positions
- Interfaces: PROFINET fieldbus, PROFIBUS fieldbus, SSI
- Binary inputs and outputs for control and process monitoring
- Configuration via webConfig tool or fieldbus
- Diagnostics via webConfig tool or optional display
- Optional model with display
- Optional model with heating for use to -35 °C

3.1.3 Accessories

Special accessories are available for the barcode positioning system. The accessories are optimally matched to the BE 901 EPN:

- Highly flexible, scratch-, smudge- and UV-resistant barcode tape
- Mounting devices for precise mounting with one screw
- Modular connection technology via connection hoods with M12 connectors or spring-cage terminals

3.1.4 Device model with heating

The barcode positioning system is optionally available as a model with integrated heating. In this case, heating is permanently installed ex works.

NOTICE

No self-installation of the heating!

↳ *Self-installation of the heating on-site by the user is not possible.*

The heating consists of two parts:

- Front cover heater
- Housing heater

Features of the integrated heating:

- Extends the application range of the BE 901 EPN to -35 °C
- Supply voltage 18 … 30 VDC
- BE 901 EPN enabling through an internal temperature switch (startup delay of about 30 min for 24 VDC and minimum ambient temperature of -35 °C)
- Required conductor cross-section for the power supply: At least 0.75 mm^2

NOTICE

Do not use ready-made cables!

↳ *It is not possible to use ready-made cables. The current consumption of the BE 901 EPN is too high for the ready-made cables.*

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Function:

When the supply voltage is applied to the BE 901 EPN, a temperature switch initially only supplies the heating with current (front cover heater and housing heater). During the heating phase (around 30 min), when the inside temperature rises above 15 °C, the temperature switch connects the BE 901 EPN to the supply voltage. This is followed by the self-test and the changeover to read operation. The PWR LED lights up, showing overall readiness for operation.
When the inside temperature reaches approx. 18 °C, another temperature switch turns the housing heater off and, if necessary, back on again (if the inside temperature drops below 15 °C). This does not interrupt the read operation.
The front cover heater remains activated until an inside temperature of 25 °C is reached. At temperatures above this, the front cover heater switches off and, with a switching hysteresis of 3 °C, back on again at an inside temperature below 22 °C.

3.2 Connection technology

For the electrical connection of the BE 901 EPN, the following connection variants are available:

- BE 901 MS EPN connection hood with M12 connectors
- BE 901 MK EPN connection hood with spring-cage terminals

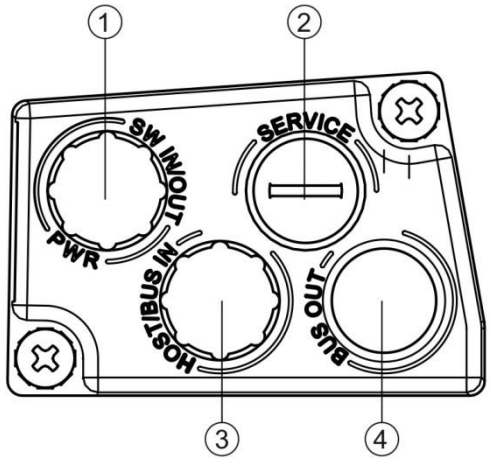
The voltage supply (18 … 30 VDC) is connected acc. to the connection type selected. Two freely programmable switching inputs/switching outputs for individual adaptation to the respective application are also available here.

3.2.1 BE 901 MS EPN connection hood with M12 connectors

The BE 901 MS EPN connection hood features three M12 connector plugs and a Mini-B type USB socket as a service interface for configuration and diagnostics of the BE 901 EPN.

The BE 901 MS EPN contains the integrated parameter memory for easy replacement of the BE 901 EPN.

In the integrated parameter memory, both the settings and the PROFINET name are stored and automatically transferred to the new BE 901 EPN when the device is replaced.



1: PWR / SW IN/OUT: M12 plug (A-coded)
2: SERVICE: Mini-B USB socket (behind protective cap)
3: HOST / BUS IN: M12 plug (D-coded), Ethernet 0
4: BUS OUT: M12 socket (D-coded), Ethernet 1

Figure 3.2: BE 901 MS EPN connection hood, connections

NOTICE

Shielding connection

↳ *The shielding connection is done via the M12 connector housing.*

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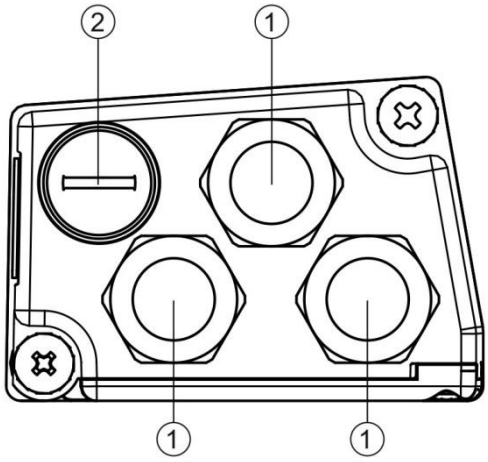
3.2.2 BE 901 MK EPN connection hood with spring-cage terminals

The BE 901 MK EPN connection hood makes it possible to connect the BE 901 EPN directly and without additional connectors.

- The BE 901 MK EPN features three cable bushings in which the shielding connection for the interface cable is also located.
- A Mini-B type USB socket is used for service purposes and for configuration and diagnostic of the BE 901 EPN.

The BE 901 MK EPN contains the integrated parameter memory for easy replacement of the BE 901 EPN.

In the integrated parameter memory, both the settings and the PROFINET name are stored and automatically transferred to the new BE 901 EPN when the device is replaced.



1: 3x cable bushing, M16 x 1.5
2: SERVICE: Mini-B USB socket (behind protective cap)

Figure 3.3: BE 901 MK EPN connection hood, connections

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Cable fabrication and shielding connection:

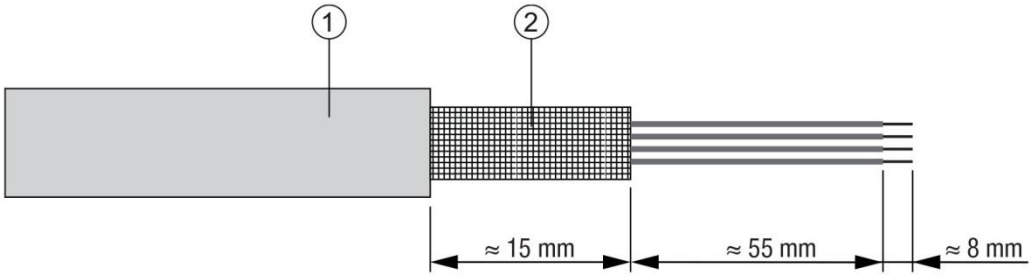
- Remove approx. 78 mm of the connection cable sheathing.
  15 mm of sheath of the shielded line must be freely accessible.
- Lead the individual wires into the terminals according to the diagram.

NOTICE

Do not use wire-end sleeves!

- *When fabricating cables, we recommend against using wire-end sleeves.*

The shield is automatically contacted when the cable is lead into the metal screw fitting and fastened when the cord grip is closed.



1: Diameter of contact area, cable: 6 … 9.5 mm
2: Diameter of contact area, shield: 5 … 9.5 mm

Figure 3.4: Cable fabrication for connection hoods with spring-cage terminals

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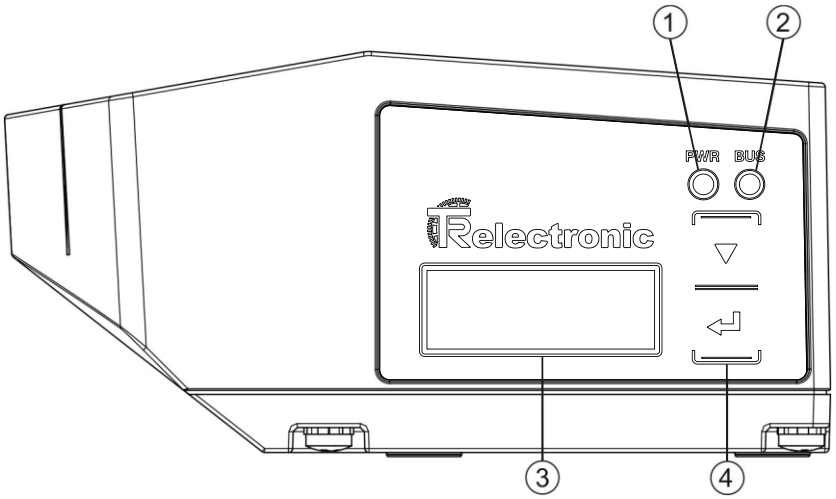
3.3 Display elements

The BE 901 EPN is available optionally with display, two control buttons and LEDs or with only two LEDs as indicators on the device housing.
Located in the connection hood (BE 901 MS EPN or BE 901 MK EPN) are two, split, two-colored LEDs as status display for PROFINET connections HOST / BUS IN and BUS OUT.

3.3.1 LED indicators

The device housing features the following multicolor LED indicators as primary display element:

- PWR
- BUS



1: PWR LED
2: BUS LED
3: Display
4: Control buttons

Figure 3.5: Indicators on the device housing

Table 3.1: Meaning of the LED indicators on the device housing

LED 1	Color, state	Description
PWR	Off	Device is switched off - No supply voltage
	Green, flashing	Device is being initialized - Supply voltage connected - Initialization running - No measurement value output
	Green, continuous light	Device in operation - Initialization finished - Measurement value output
	Red, flashing	Warning set - No measurement (e.g. no barcode tape)
	Red, continuous light	Device error - Device function is limited - Details via event log (see chapter 10.1.2 "Diagnostics with webConfig tool")
	Orange, flashing	PROFINET wave function activated
	Orange, continuous light	Service active - No data on the host interface - Configuration via USB service interface

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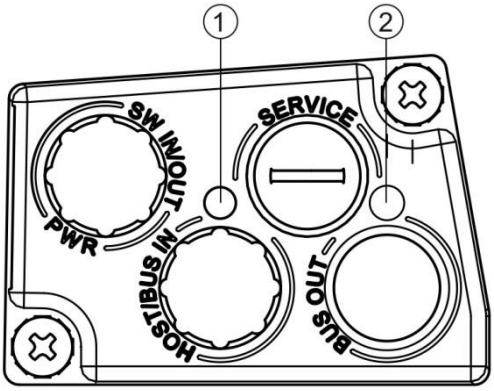
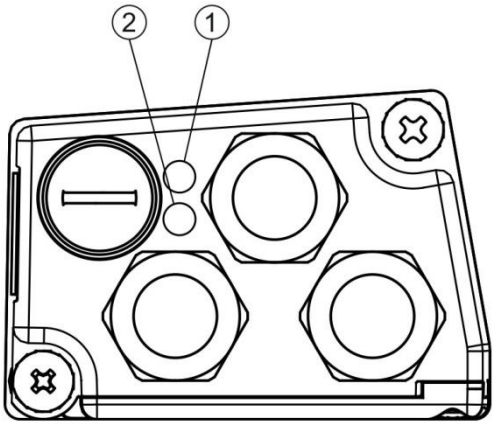
LED 2	Color, state	Description
BUS	Off	No supply voltage
	Green, flashing	- Device waiting for communication to be re-established - No data exchange
	Green, continuous light	- Communication with IO-Controller established - Data exchange active
	Orange, flashing	PROFINET wave function activated
	Red, flashing	- Parameterization or configuration failed - No data exchange

LED indicators on the connection hood (BE 901 MS EPN or BE 901 MK EPN):



1: LED 0, ACT0/LINK0
2: LED 1, ACT1/LINK1

Figure 3.6: BE 901 MS EPN, LED indicators



1: LED 0, ACT0/LINK0
2: LED 1, ACT1/LINK1

Figure 3.7: BE 901 MK EPN, LED indicators

Table 3.2: Meaning of the LED indicators on the connection hood

LED	Color, state	Description
ACT0/LINK0	Green, continuous light	Ethernet connected (LINK)
	Yellow flickering light	Data communication (ACT)
ACT1/LINK1	Green, continuous light	Ethernet connected (LINK)
	Yellow flickering light	Data communication (ACT)

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3.3.2 Display indicators

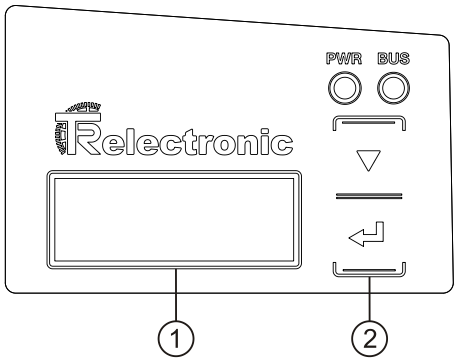
The optional display of the BE 901 EPN is only used as a display element. The display has the following features:

- Monochromatic with white background lighting
- Double line, 128 x 32 pixels
- Display language: English

Two control buttons can be used to control which values appear in the display.
The background lighting is activated by pressing any control button and is automatically deactivated after ten minutes have passed.

The display shows the content on two lines:

- The upper display line shows the selected function as an English term.
- The lower display line shows the data of the selected function.



1: Display
2: Control buttons

Figure 3.8: Display on the device housing

Display functions:

The following functions can be displayed and activated in the display:

- Position value
  - *Position Value*
  - Position value in mm displayed with "." as decimal separator character (e.g., + *34598.7 mm*)
- Read quality
  - *Quality*
  - 0 … 100 %
- Device status
  - *BE901 Info*
  - *System OK / Warning / Error*
- I/O status
  (Status of the inputs/outputs)
  - *I/O status*
  - *IO1 In: 0 / IO2 Out: 0*
  - In/Out depending on configuration, 0/1 for state of the I/O
- Device address for host communication
  - *BE901 Address*
  - Device name in PROFINET-IO, e.g. *Probe 2*
    Ticker text with up to 240 characters
- Version information
  Software and hardware version of the device
  - *Version*
  - *SW: V1.3.0 HW:1*

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NOTICE

Laser activation by selecting Quality!

↳ *If position measurement is stopped, the laser is activated by selecting Quality.*

The display is controlled via the control buttons:

- ↵ – **Enter:** activate or deactivate the display shift function
- ▼ – **Down:** scroll through functions (downwards)

Example: Representation of the I/O status on the display

1. Press button ↵: display flashes
2. Press button ▼: Display changes from position value (*Position Value*) to read quality (*Quality*)
3. Press button ▼: Display changes from read quality (*Quality*) to device status (*BE901 Info*)
4. Press button ▼: Display changes from device status (*BE901 Info*) to I/O status
5. Press button ↵: I/O status displayed, display stops flashing

Display during device startup:

During device startup, a startup display first appears which is briefly followed by the display with the version information.
The standard display after starting up the BE 901 EPN is Position Value.

3.4 Barcode tape

3.4.1 General information

The barcode tape (BCB) is available in different variants:

- Barcode tape BCB G40 with 40 mm grid
  Code128 with character set C, increasing in increments of 4 (e.g., 000004, 000008, …)
- Barcode tape BCB G30 with 30 mm grid
  Code128 with character set C, increasing in increments of 3 (e.g. 000003, 000006, …)

A barcode tape consists of a sequence of individual position labels in one of the two grids. Defined cut marks are provided for cutting the BCB.

The barcode tape is delivered on a roll. A roll contains up to 300 m of BCB, with the wrapping direction from the outside to the inside (smallest number on the outside). If more than 300 m of BCB is ordered, the total length is divided into rolls of 300 m.

Barcode standard tapes in fixed length gradations as well as special tapes with individual tape start value, tape end value, individual length and height can be ordered from TR-Electronic GmbH (see chapter 13.5 "Barcode tapes").

NOTICE

Only one BCB type per system!

↳ *Use either only BCB G30 with 30 mm grid or only BCB G40 with 40 mm grid in a system.*

If different grids are used in a system, the BE 901 EPN cannot ensure accurate positioning.

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NOTICE

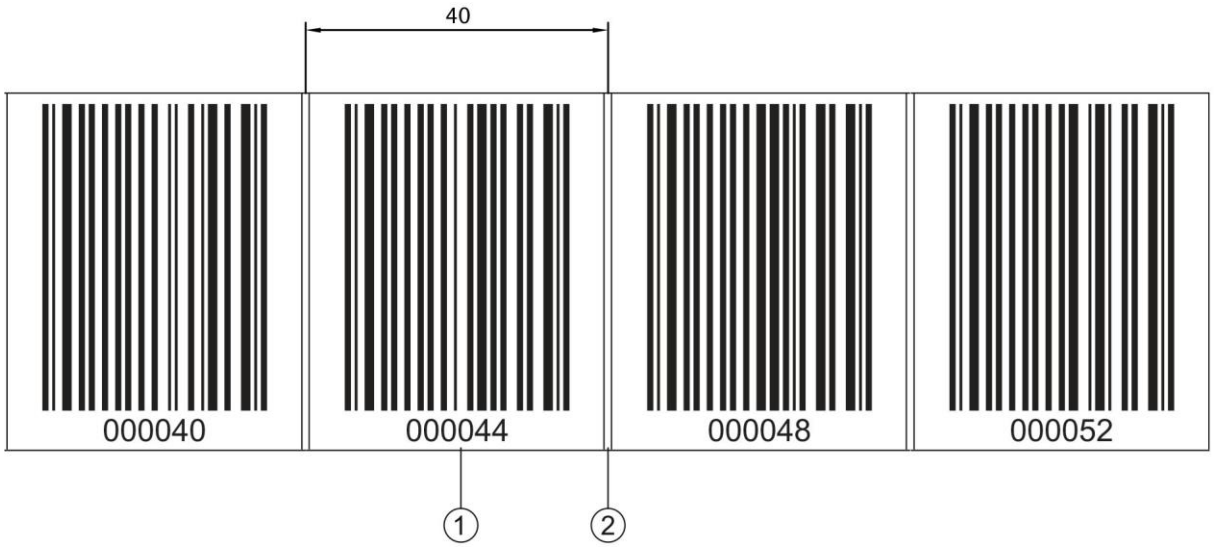
Configure the BE 901 EPN for the used BCB type!

- *The used BCB type must be set in the BE901 configuration with the Tape selection parameter; see chapter 8.4.2 "DAP module – Permanently defined parameters".*
- *On delivery, the BE 901 EPN is set for BCB G40 with a 40 mm grid.*

  If the BCB G30 with a 30 mm grid is used, the Tape selection must be adjusted in the BE901 configuration.
- *If the used BCB type does not correspond to the Tape selection configured in the BE 901 EPN, exact position determination cannot be performed by the BE 901 EPN.*

*Standard barcode tapes are available in different length gradations in the heights **47 mm** and **25 mm**.*

Barcode tape BCB G40 with 40 mm grid:



1: Position label with position value
2: Cut mark

Figure 3.9: Barcode tape BCB G40 with 40 mm grid

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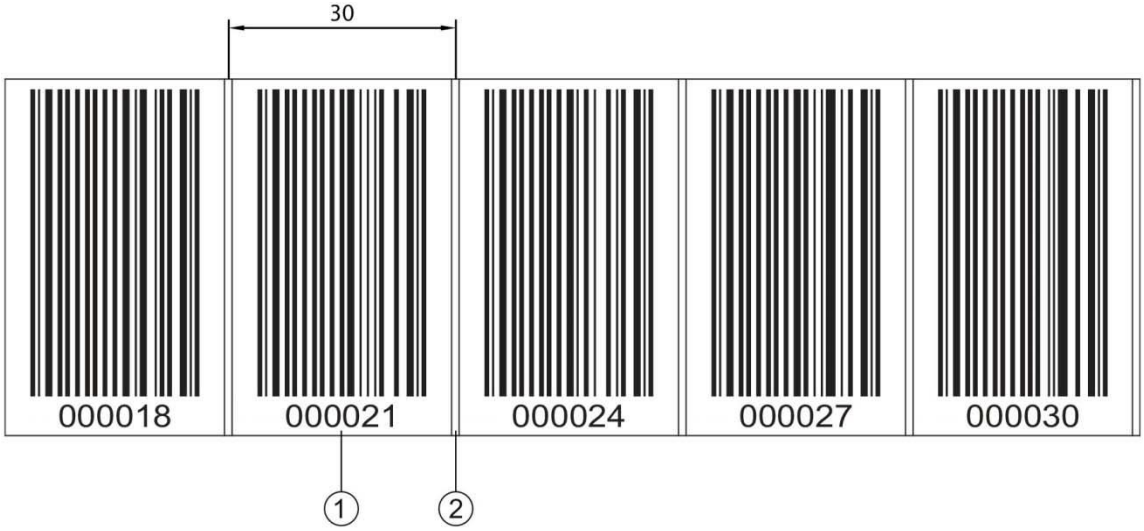
Barcode tape BCB G30 with 30 mm grid



1: Position label with position value
2: Cut mark

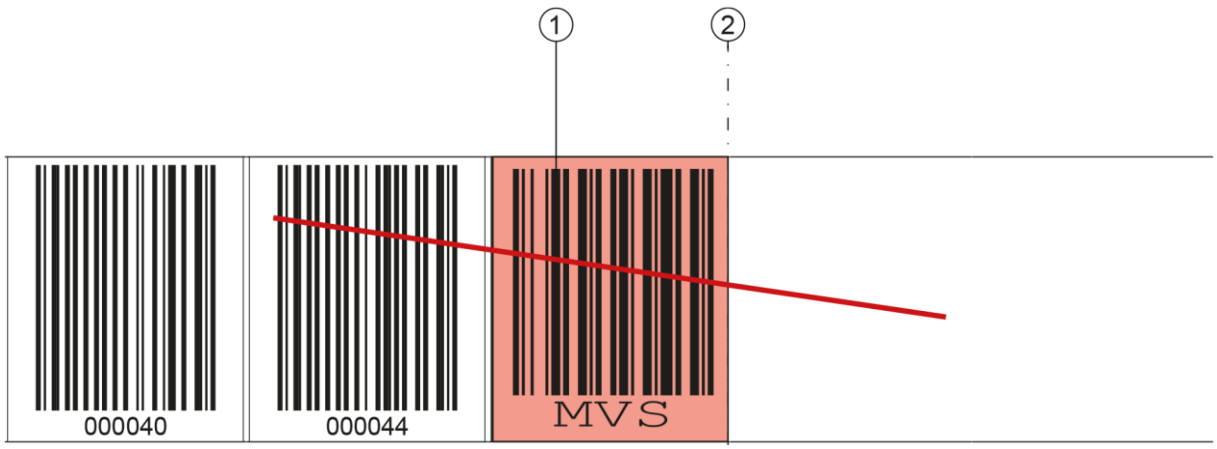
Figure 3.10: Barcode tape BCB G30 with 30 mm grid

3.4.2 Control barcodes

With the help of control barcodes that are affixed on top of the barcode tape at appropriate positions, functions in the BE 901 EPN can be activated or deactivated, e.g., for changing various position values at switches. Code type Code128 with character set B is used for the control barcode.

MVS label

The *MVS* label is a control bar code for the direction-independent switching of the position values from one bar code tape to another in the middle of the control bar code label.
If, upon reaching the changeover position in the middle of the *MVS* label, the BE 901 EPN does not detect the new BE 901 EPN section in the scanning beam, the position value of the first BCB section is still output after the middle of the *MVS* label for half of the label width.



1: Control barcode
2: Deactivation of the position detection at the end of the control barcode

Figure 3.11: Arrangement of the MVS control barcode

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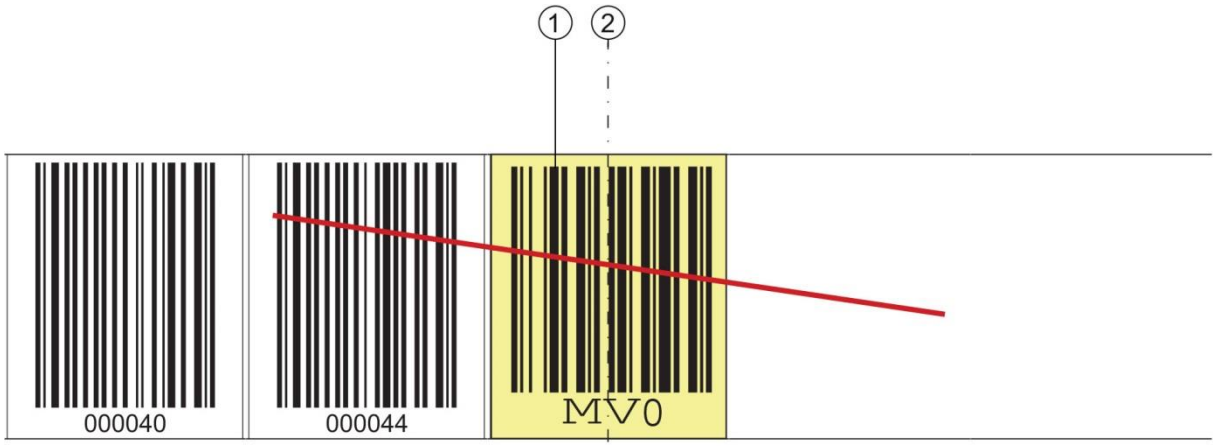
MV0 label

The *MV0* label is a control bar code for the direction-independent switching of the position values from one bar code tape to another in the middle of the control bar code label.
If, upon reaching the changeover position in the middle of the *MV0* label, the BE 901 EPN does not detect the new BE 901 EPN section in the scanning beam, no position is output from the middle of the *MV0* label.



1: Control barcode
2: Deactivation of the position detection from the middle of the control barcode

Figure 3.12: Arrangement of the MV0 control barcode

Arrangement of the control barcodes:

The control barcode is arranged to replace a position barcode or to connect two barcode tapes with different value ranges.

The control barcode MVS or MV0 need not be immediately followed by a position label. For an uninterrupted determination of measured values, there may be a gap between the control barcode and the following position label of less than or equal to a label width (40 mm).

NOTICE

Distance between two control barcodes!

↳ *Make certain that there is only one control barcode (or marker label) in the scanning beam at a time.*

The minimum distance between two control barcodes is determined by the distance between the BE 901 EPN and barcode tape and the resulting length of the scanning beam.

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The control barcodes are simply affixed over the existing barcode tape.

A control barcode should cover an entire position barcode and must have the correct grid dimension:

- 30 mm with BCB G30 barcode tapes
- 40 mm with BCB G40 barcode tapes

Keep the gap between the BCBs that are switched between as small as possible.

1: Control barcode perfectly affixed on the barcode tape
2: Control barcode at small gap between two barcode tapes

Figure 3.13: Correct positioning of the control barcode

NOTICE

Gaps in barcode tape!

- *Avoid polished and high-gloss surfaces.*
- *Keep the gaps between the two barcode tapes and the control barcode as small as possible.*

Measurement value switching between two barcode tapes with different value ranges:

The *MVS* or *MV0* control barcode is used to switch between two barcode tapes.

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NOTICE

1 m difference of the barcode position values for correct measured value switching!

↳ *If the BCB value ranges are different, make sure that the position value has a value distance of at least 1 m between the leading position barcode (before the control barcode) and the following position barcode (after the control barcode).*

If the minimum distance between the barcode values is not maintained, the position determination may be disturbed.

➢ *Example (BCB in 40 mm grid): If the last position barcode on the BCB is 75120 before the control barcode, the subsequent position barcode on the BCB after the control barcode must be at least 75220.*

- The end of the preceding barcode tape and the start of the subsequent barcode tape can end and begin, respectively, with completely different position barcodes.
- BCB changeover by means of a control barcode always occurs at the same position, i.e., it serves to change from the preceding tape to the subsequent tape and vice versa.
- If the center of the BE 901 EPN reaches the transition point of the control barcode, the device switches to the second BCB, provided the next position label is in the BE 901 EPN's scanning beam (see Figure 3.14). The output position value is thereby always uniquely assigned to one BCB.

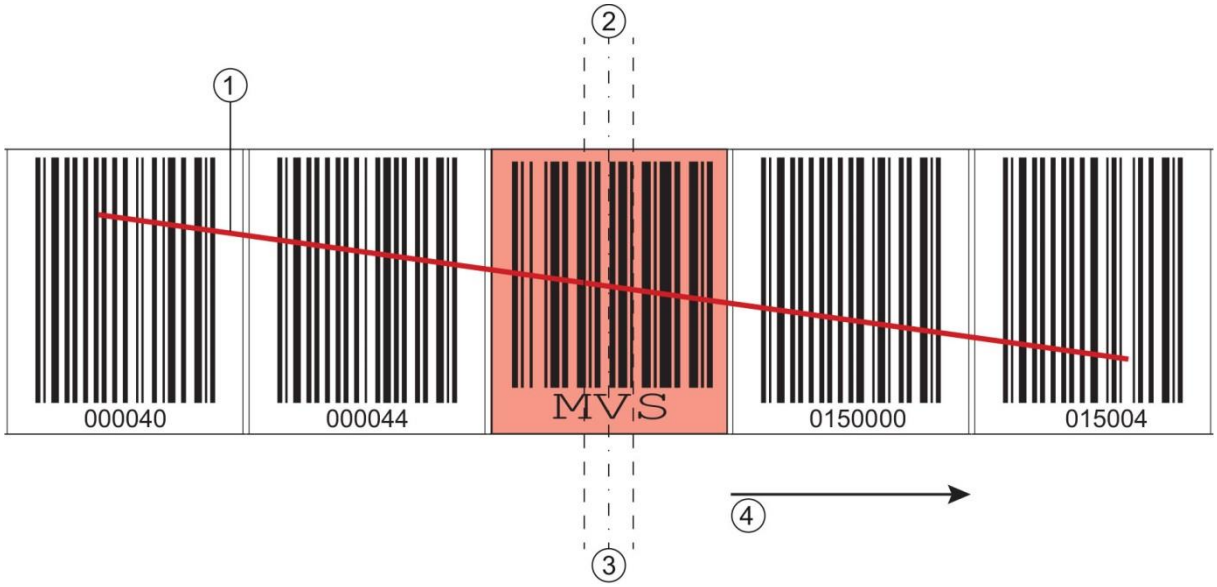
  This means that the output position value is always clearly assigned to a BCB.

If the BE 901 EPN does not detect the new BCB section upon reaching the changeover position, the position value output is dependent on the used control barcode.

MVS control barcode: The position value of the first BCB is output beyond the middle of the MVS label for half of the label width.

MV0 control barcode: No position values are output after the middle of the MV0 label.

- When the control label is passed, the new BCB value is output relative to the middle of the device or label.



1: Scanning beam
2: Middle of the control barcode
3: Middle of the BE 901 EPN
4: Direction of movement

Figure 3.14: Changeover position with MVS control barcode for BCB changeover

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3.4.3 Marker labels

Marker labels, which are affixed at the appropriate locations on top of the barcode tape, can be used to trigger various functions in the superior control. The BE 901 EPN detects the defined marker labels in the scanning beam, decodes them, and makes them available to the control.

NOTICE

Distance between two marker labels!

↳ *Make certain that there is only one marker label (or control barcode) in the scanning beam at a time.*

The minimum distance between two marker labels is determined by the distance between the BE 901 EPN and barcode tape and the resulting length of the scanning beam.

Definition of the marker label:

The following combinations of letters and numbers may be used as marker labels:

- AA1
- BB1
- CC1
- DD1
- EE1
- FF1
- GG1

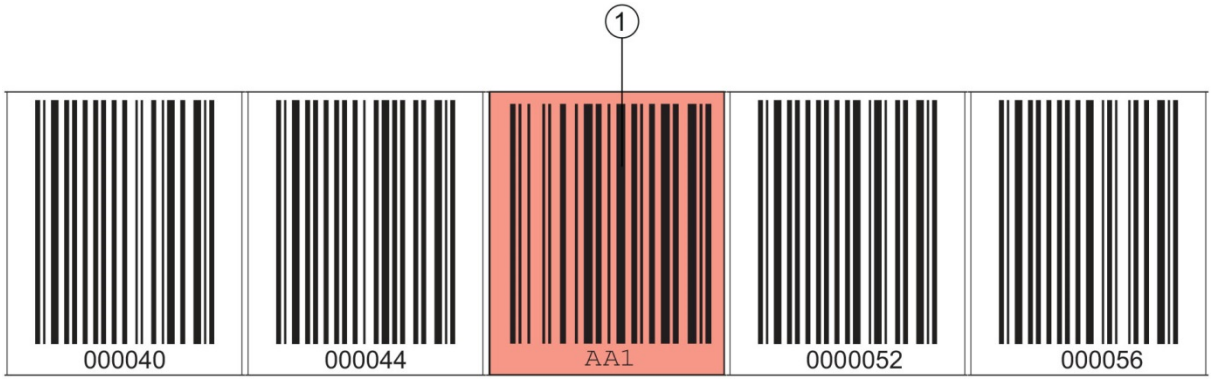
Marker labels are designed as follows:

- Color red
- height 47 mm
- with grid dimension 40 mm (BCB G40)
- with grid dimension 30 mm (BCB G30)
- Code 128 B

Marker labels are single labels and are delivered in a packaging unit of 10 pieces.

Arrangement when using the marker label with positioning:

The marker label must be attached to the barcode tape aligned with the grid of the actual coding. A position code should be visible before and after the marker label.



1: Marker label

Figure 3.15: System arrangement of marker labels

Arrangement when using the marker label without positioning:

The marker label must be positioned within the BE 901 EPN's detection range.

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3.4.4 Twin tapes

Twin tapes are jointly manufactured barcode tapes with the same value range.

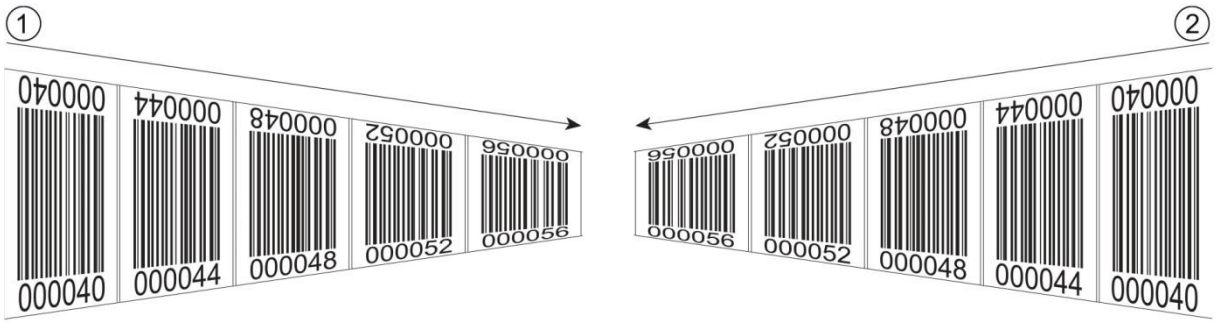
NOTICE

A twin tape always consists of two barcode tapes!

↳ *When ordering a twin tape, two barcode tapes are always included with an order.*

Twin tapes are used if positioning with two barcode tapes is necessary, e.g., with crane systems or elevators.

Because they are manufactured jointly, both tapes have the same length tolerance. As a result, differences in length and code position are minimal. By having the same code position on both tapes, improved synchronization can be achieved during positioning compared to barcode tapes that are manufactured separately.



1: Twin barcode tape 1
2: Twin barcode tape 2

Figure 3.16: Twin tape with double numbering

Twin tapes are always delivered in pairs on two rolls.
If twin tapes are replaced, both tapes are to be replaced.

4 Functions

This chapter describes the functions of the BE 901 EPN and the parameters for adaptation to the respective application conditions and requirements.

Main functions:

- Position measurement
- Speed measurement

The following parameters are relevant for the timing of the position and speed measurement:

- Measurement value preparation
  Configurable response time
- Measurement error tolerance
  Configurable time-based error suppression

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4.1 Position measurement

The output value of the position measurement is calculated from the measurement and the settings for resolution, preset, offset, etc.
The most important individual parameters for the position measurement are:

Parameter	Description	Range/Values
Position resolution	The parameter specifies the resolution of the position value. It acts only on the host interface. The resolution has no effect on the set parameter values such as offset or preset.	0.001 mm 0.01 mm 0.1 mm 1 mm 10 mm or free resolution
Unit	The parameter specifies the measurement unit of the measured position and speed. The selection of the measurement unit affects all parameters with measurement units.	Metric (mm) or inch (1/100 in)
Offset	The offset is used to correct the position value by a fixed amount. If the offset is activated, the offset is added to the position value. This yields a new output value: Output value = position value + offset	1 mm or inch/100
Preset	Like the offset, the preset is used to correct the position value. With preset, a preset value is specified. The value is accepted during a corresponding event (switching input or fieldbus). If the preset is activated, this has priority over the offset.	1 mm or inch/100

4.2 Speed measurement

The current speed is ascertained and output on the basis of the respective position values. The most important individual parameters for the speed measurement are:

Parameters	Description	Range/Values
Speed resolution	The parameter defines the resolution of the speed value. It affects only the fieldbus output.	1 mm/s 10 mm/s 100 mm/s 1000 mm/s or free resolution
Averaging	The parameter specifies the averaging time of the calculated speed values in steps.	Schritte: 2, 4, 8, 16, 32 ms

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4.3 Timing

The BE 901 EPN operates with a scanning rate of 1000 scans per second. A measurement value is ascertained every 1 ms.
The following parameters are relevant for the timing of the position and speed measurement:

Parameters	Description	Range/Values
Integration depth	The integration depth affects the measurement of position and speed. The *integration depth* parameter specifies the number of sequential measurements that the BE 901 EPN uses for position determination. The integration results in smoothing of the output measurement value. An *integration depth* of 8 (position determination with 8 measurement values) results in a response time of 8 ms.	Factory setting: 8
Error delay time	Errors that occur are suppressed for the configured time. If no valid position or speed value can be ascertained in the configured *error delay time*, the last valid value is always output. If the error persists after the *error delay time* elapses, the value of the *Position / Speed value in case of error* parameter is then output (standard).	Factory setting: 50 ms

4.4 TR webConfig tool

The webConfig configuration tool offers a graphical user interface for the display of process data, configuration and diagnostics of the BE 901 EPN via a PC; see chapter 9 "Commissioning – webConfig tool".

4.5 Evaluation of the read quality

Output of the reading quality

The BE 901 EPN can diagnose the reading quality in the arrangement of the BE 901 EPN to the barcode tape.

- *The reading quality is displayed in % values.*
- *Despite optimum operating conditions, the reading quality may be slightly below 100%. This does not constitute a defect of the BE 901 EPN or the barcode tape.*

The factory preset warning threshold at a read quality < 60%, as well as a shutdown threshold at a read quality < 30%, corresponds to the experience of TR-Electronic GmbH in a typical application.

For applications that result in a deliberate interruption of the barcode tape (switches, expansion joints, vertical slopes/gradients), the preset thresholds can be adapted to the respective application.

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The reading quality depends on several factors:

- Operation of the BE 901 EPN at the specified depth of field
- Number of barcodes in the transmission beam
- Number of barcodes in reading range
- contamination of the barcodes
- Travel speed of the BE 901 EPN (number of barcode symbols within the time window)
- Incidence of ambient light on the barcode and on the optics (glass exit window) of the BE 901 EPN

In particular, the reading quality is influenced in the following cases:

- Switches, expansion joints and other transition points where the barcode tape is not glued without interruption
- Vertical travel if at least three barcode symbols are not completely within the reading range of the sensor at any time.
- Vertical travel when the barcode tape has been cut at the marked cutting edges to adapt to the curve.

If the reading quality is influenced by the factors listed above, the reading quality may drop to 0%.

- ↳ *This does not mean that the BE 901 EPN is defective, but that the read quality characteristics are reduced to 0% in the respective arrangement.*
- ↳ *If a position value is output at a read quality of 0%, it is correct and valid.*

The parameters for evaluating the reading quality are set in the interface-specific configuration; see chapter 8.4.23 “Module 24 – Read quality”.

The read quality values are indicated via the optional display (Quality), the serial communication protocol and via the webConfig tool; see chapter 9.3.3 "ALIGNMENT function".

The evaluation of the reading quality provides the following information, for example:

- The reading quality is constantly poor: contamination of the optics of the BE 901 EPN
- The reading quality is always poor at certain position values: contamination of the BCB

4.6 Status query of position / speed measurement

Module 6 – Status and control (see chapter 8.4.8) and Module 16 – Speed status (see chapter 8.4.18) in the PROFINET configuration signal status information of the position/velocity measurement.

The following status information can be transmitted to the PROFINET master:

- Status information for position measurement: Input data 0.0 … 1.7;
  see chapter 8.4.8 "Module 6 – Status and control"
- Status information for speed measurement: Input data 0.0 … 1.5;
  see chapter 8.4.18 "Module 16 – Speed status"

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4.7 Distance measurement to the barcode tape

Within the reading field, the BE 901 EPN can output the current distance from the read head to the BCB. The distance from the position label closest to the reference point is output (see chapter 8.4.20 "Module 21 – distance to the barcode tape (BCB)").

The distance measurement value is output via:

- the *ALIGNMENT* function (*Quality* menu) in the webConfig tool (see chapter 9.3.3); this function is only available in the Service operating mode
- the host interface (input data)

5 Applications

Wherever systems are moved automatically, it is necessary to uniquely determine their respective positions. In addition to mechanical measuring sensors, optical methods are particularly well suited for position determination as they can be used to determine position without mechanical wear and slippage.
Compared to common optical measurement techniques, the barcode positioning system (BE 901 EPN) is able to measure a position with absolute sub-millimeter accuracy, i.e. independent of reference points. As a result, it is able to provide a unique position value at any time. With the highly flexible and hard-wearing Bar Code Tape (BCB), the system can even be used without problem in systems with curves or guide tolerances. And this at lengths of up to 10,000 meters.

The product family of TR-Electronic GmbH barcode positioning systems convinces with a variety of advantages:

- The laser simultaneously scans three barcodes and, as a result, is able to determine the position with sub-millimeter accuracy. The wide reading field makes accurate position determination possible even in the event of minor damage to the tape.
- With the systems' flexible depth of field, it is also possible to bridge over mechanical deviations.
- Due to the large reading distance combined with the great depth of field, a large opening angle and a very compact construction, the device is ideally suited for the conveyor and storage technology market.
- The BE 901 EPN devices are capable of simultaneously measuring position and speed and are thus also suitable for control tasks in your automation applications.
- Using a mounting device, the BE 901 EPN can be mounted with millimeter accuracy with just one screw. If mounted using a mounting device, a new device is automatically aligned correctly should it be necessary to exchange a device.
- Due to the unique coding of the position value on the barcode tape, the system can continue to operate without any problems even after a short-term voltage drop without having to resort to a reference point, for example.
- The barcode tape is very robust, highly flexible and, thanks to the self-adhesive back, can be easily integrated into your overall mechanical system. It can be fit optimally to both vertical as well as horizontal curved paths and thereby reliably facilitates trouble-free and reproducible measurement at any point in your system with sub-millimeter accuracy.

Typical applications for the BE 901 EPN include:

- High-bay storage device (see chapter 5.1)
- Telpher line (see chapter 5.2)
- Gantry cranes (see chapter 5.3)

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5.1 High-bay storage device

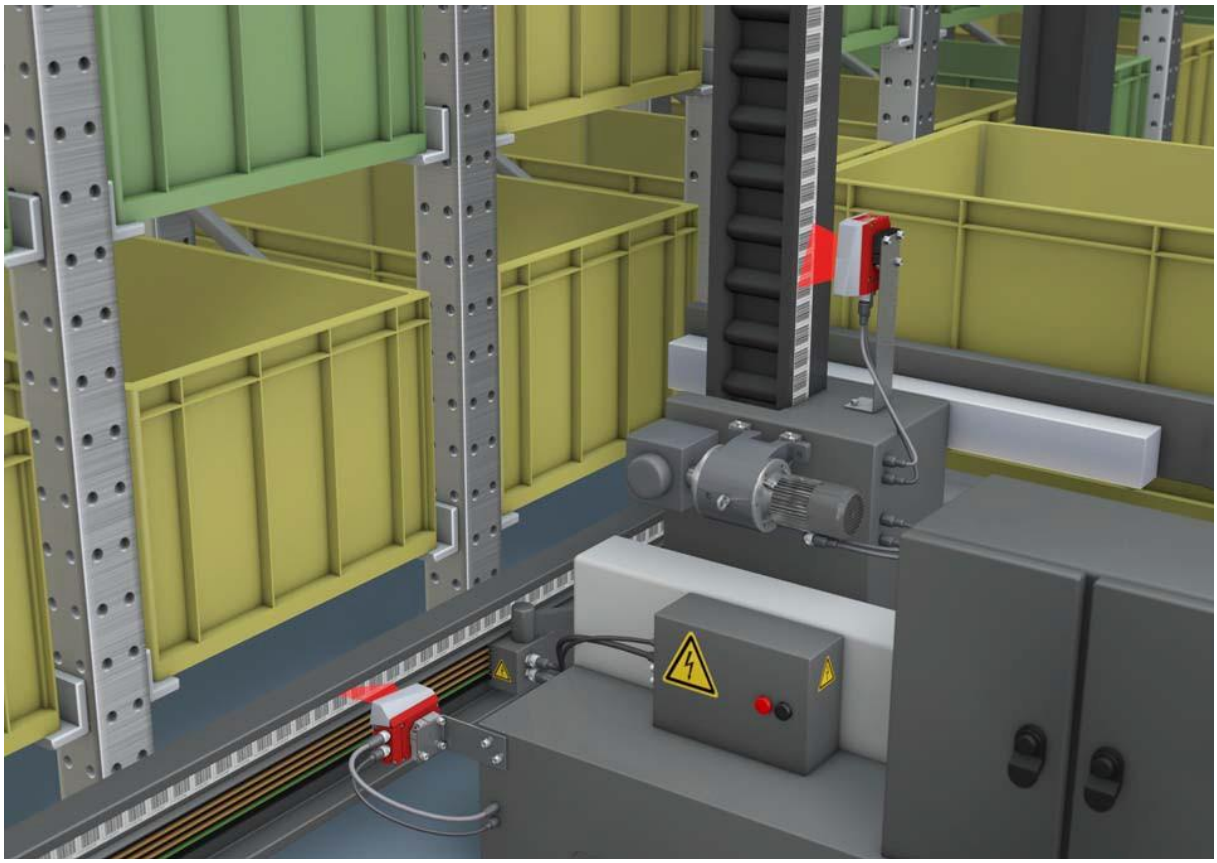

Figure 5.1: High-bay storage device

- Simultaneous position and speed measurement for regulation tasks
- Precise positioning with a reproducibility of ± 0.15 mm
- Control at high traverse rates of up to 10 m/s

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5.2 Telpher line

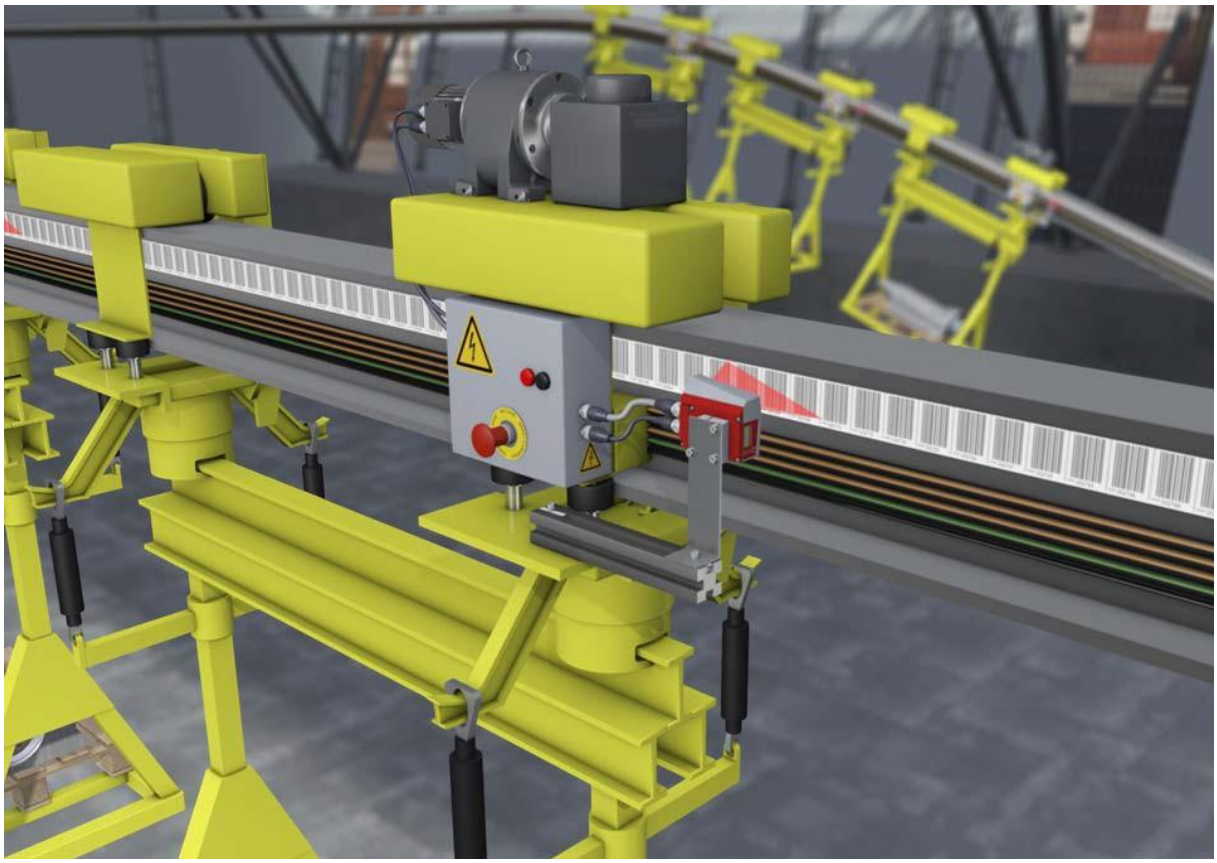

Figure 5.2: Telpher line

- Positioning from 0 to 10,000 meters
- The working range from 50 - 170 mm allows for flexible mounting positions and reliable position detection at varying distances
- Control codes for changing to different position values at switches

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5.3 Gantry cranes

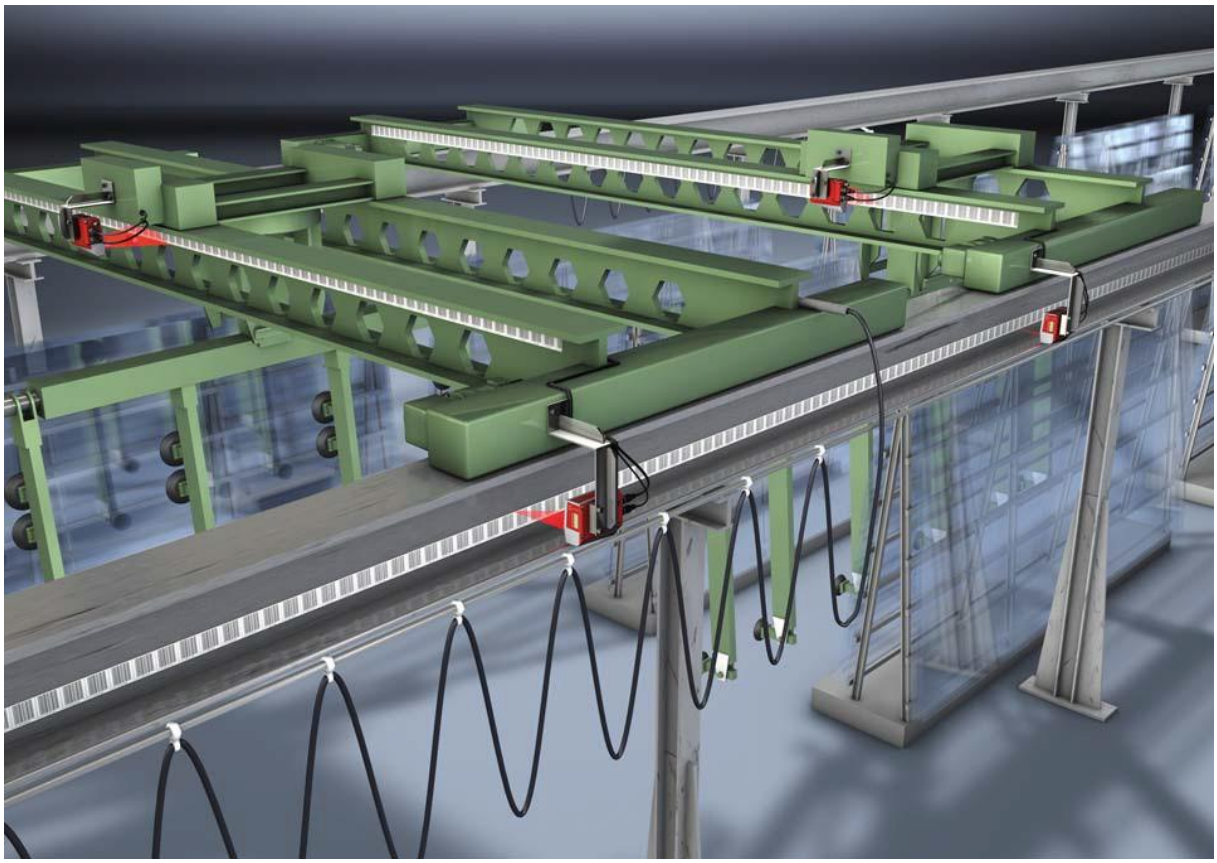

Figure 5.3: Gantry cranes

- Scratch- and smudge-proof, UV-resistant barcode tapes
- Synchronous positioning with twin tapes on both rails
- Mounting device for fast, precise mounting with one screw

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6 Mounting and installation

6.1 Mounting barcode tape

6.1.1 Installation and application remarks

NOTICE

BCB mounting

- *When processing BCBs, observe the specified processing temperatures.*

  When processing BCBs in cold storage facilities, the BCB must be affixed before cooling the storage facility.

  However, if it should be necessary to affix the BCB at temperatures outside of the specified processing temperature, assure that the bonding surface as well as the BCB is at the processing temperature.
- *Avoid dirt deposits on the BCB.*

  If possible, affix the BCB vertically.

  If possible, affix the BCB below an overhead covering.

  The BCB must never be continuously cleaned by on-board cleaning devices such as brushes or sponges. Permanent on-board cleaning devices polish the BCB and give it a glossy finish. The reading quality deteriorates as a result.
- *After affixing the BCBs, make certain that there are no polished, high-gloss surfaces in the scanning beam (e.g., glossy metal at gaps between the individual BCBs), as the measurement quality of the BE 901 EPN may be impaired.*

  Affix the BCBs to a diffusely reflective support, e.g., a painted surface.
- *Avoid sources of extraneous light and reflections on the BCB.*

  Ensure that neither strong sources of extraneous light nor reflections of the support on which the BCB is affixed occur in the vicinity of the BE 901 EPN scanning beam.
- *Affix the BCB over expansion joints up to a width of several millimeters.*

  The BCB must not be interrupted at this location.
- *Cover protruding screw heads with the BCB.*
- *Ensure that the BCB is affixed without tension.*

  The BCB is a plastic tape that can be stretched by strong mechanical tension. Excessive mechanical stretching results in lengthening of the tape and distortion of the position values.

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NOTICE

BCB application

- *Make certain that the BCB is located in the scanning beam of the BE 901 EPN over the entire traversing path. The BE 901 EPN can determine the position on BCBs with arbitrary orientation.*
- *Barcode tapes with different value ranges may not directly follow one another.*

  For different value ranges, a gap of at least 1 m between the position value of the last position barcode of the leading BCB and the position value of the first position barcode of the trailing BCB must be maintained (see chapter 3.4.2 “Control barcodes”).
- *For MVS/MV0 control barcodes (see chapter 3.4.2), the minimum distance of 1 m between the last position barcode before the control barcode and the first position barcode after the control barcode must be maintained.*
- *For barcode tapes with different value ranges, both BCBs must correspond to the BCB type configured in the BE 901 EPN (see chapter 3.4.1).*
- *Avoid position barcode labels with the value 00000.*

  Measurements to the left of the center of a 00000 label produce negative position values that may not be displayed correctly.

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6.1.2 Cutting barcode tapes

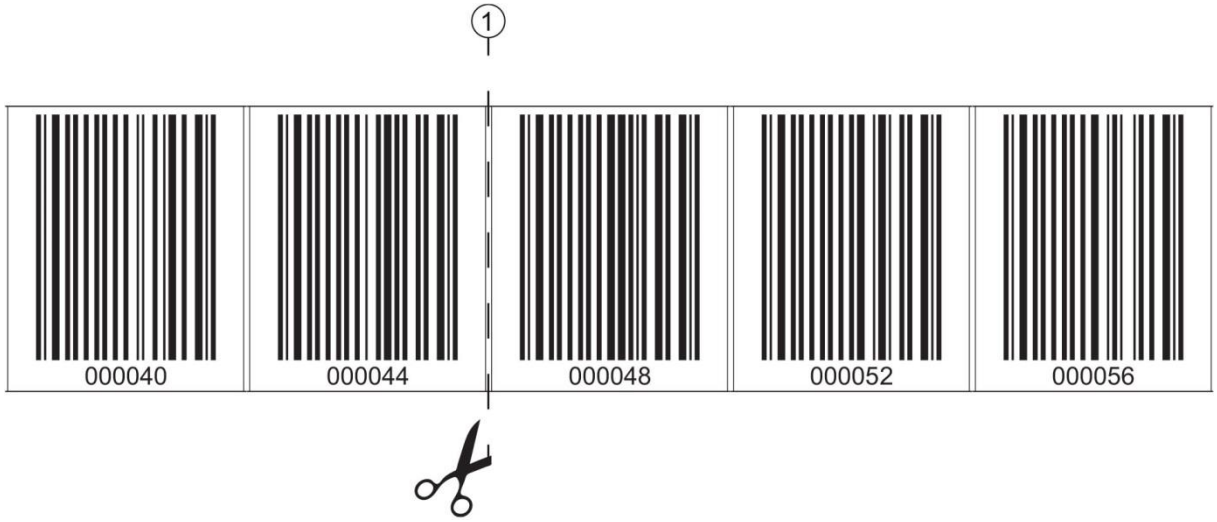
NOTICE

Avoid cutting BCB!

- *If possible, avoid cutting barcode tapes.*

  Optimum position value determination by the BE 901 EPN is achieved with continuously affixed BCB.
- *If there are mechanical gaps, first affix the BCB continuously. Then cut the BCB.*

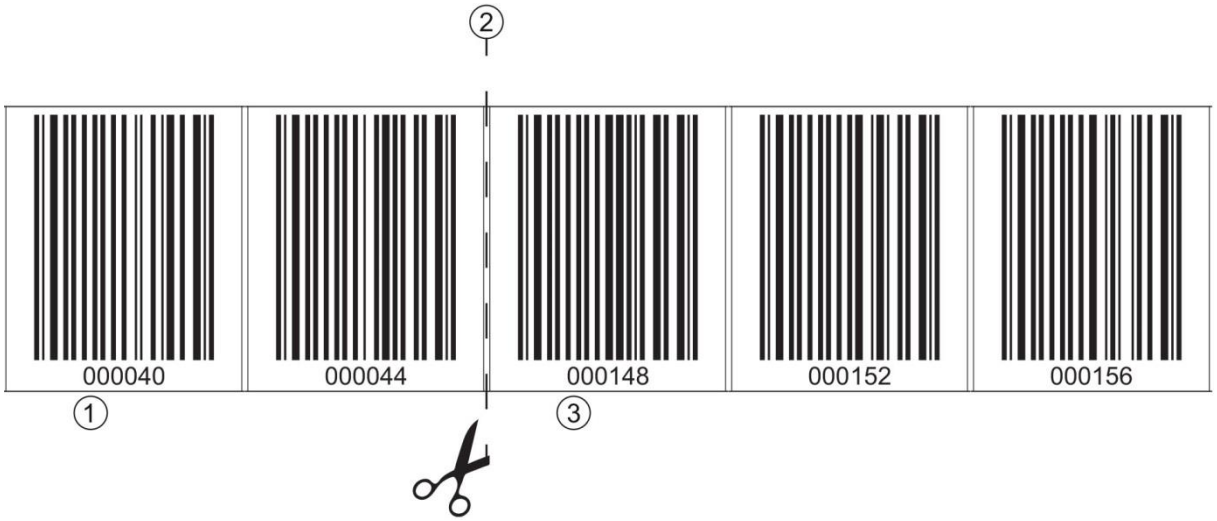
The BCB is cut at the indicated cut marks.



1: Cut mark

Figure 6.1: Cut mark on the barcode tape

If another BCB is to be affixed directly after the preceding BCB, the subsequent barcode value must differ from the preceding BCB by at least 1 m; see Figure 6.2.



1: Preceding barcode tape
2: Cut mark
3: Subsequent barcode tape, value range + 1 m

Figure 6.2: Cut barcode tape

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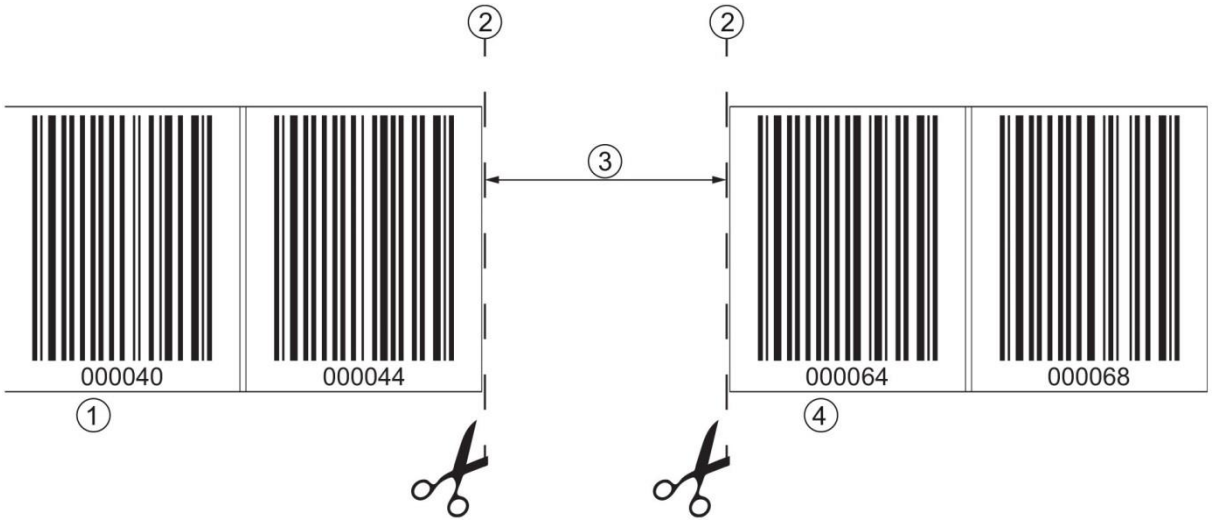
If there is a gap without tape after the preceding BCB, it must be at least 300 mm wide before the subsequent BCB is affixed; see Figure 6.3. The first barcode value of the subsequent BCB must differ by at least 20 (200 mm) from the last barcode value of the preceding BCB.



1: Preceding barcode tape
2: Cut mark
3: Gap, at least 300 mm
4: Following barcode tape

Figure 6.3: Gap in cut barcode tape to avoid double positions

NOTICE

No glossy gaps in the cut barcode tape!

↳ *Ensure that there are matt, bright surfaces behind the gaps in the BCB.*

Polished, reflective, and high-gloss surfaces in the scanning beam may impair the measurement quality of the BE 901 EPN

6.1.3 Mounting of the BCB

Mount the BCB as follows:

↳ Examine the mounting surface.

It must be flat, free of grease and dust, and be dry.

↳ Define a reference edge (e.g., metal edge of the bus bar).

↳ Remove the backing and affix the BCB along the reference edge tension free.

↳ Secure the BCB to the mounting surface by pressing down with the palm of your hand.

When affixing, make certain that the BCB is free of folds and creases and that no air pockets form.

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NOTICE

When mounting, do not pull on the BCB!

The BCB is a plastic tape that can be stretched by strong mechanical tension.

The stretching results in lengthening of the tape and distortion of the position values on the BCB.

While the BE 901 EPN can still perform the position calculation in the event of distortions, the absolute measurement accuracy is no longer ensured in this case. If the values are taught using a teach-in process, stretching of the BCB is irrelevant.

If a barcode tape was damaged, e.g., by falling parts, you can download a repair kit for the BCB (see chapter 11.2.2 "BCB repair with repair kit").

↳ *Use the barcode tape created with the repair kit only temporarily as an emergency solution.*

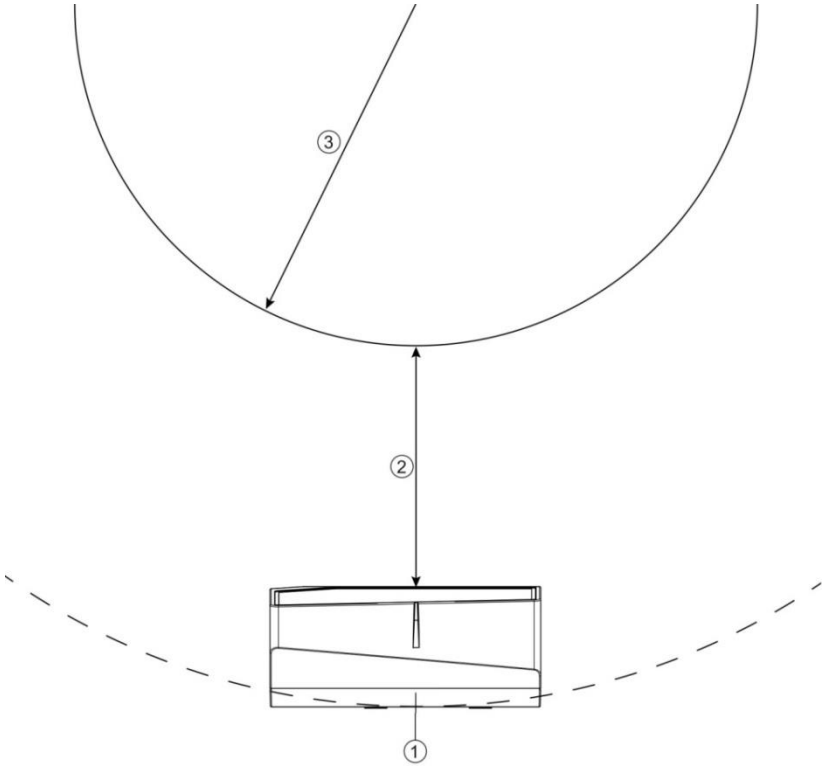
BCB mounting in horizontal curves:

NOTICE

Limited absolute measurement accuracy and reproducibility!

BCB mounting in curves impairs the absolute accuracy of the BE 901 EPN, since optical distortions mean that the distance between two barcodes is no longer exactly 40 mm or 30 mm.

↳ For horizontal curves, maintain a minimum bending radius of 300 mm (see Figure 6.4).



1: BE 901 EPN
2: Reading distance
3: Radius barcode tape, R_{min} = 300 mm

Figure 6.4: Mounting the barcode tape for use in horizontal curves

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BCB mounting in vertical curves:

NOTICE

Limited absolute measurement accuracy and reproducibility!

- *BCB mounting in curves decreases the absolute measurement accuracy of the BE 901 EPN, since the distance between two barcodes is no longer exactly 40 mm or 30 mm.*
- *In areas where the BCB is fanned out around curves, limitations of the reproducibility must be expected.*

- Only partially cut the BCB at the cut mark.
- Affix the BCB along the curve like a fan (see Figure 6.5).
- Ensure that the BCB is affixed without mechanical tension.

NOTICE

No glossy gaps in the barcode tape!

- *Ensure that there are matt, bright surfaces behind the gaps in the BCB.*

  Polished, reflective, and high-gloss surfaces in the scanning beam may impair the measurement quality of the BE 901 EPN

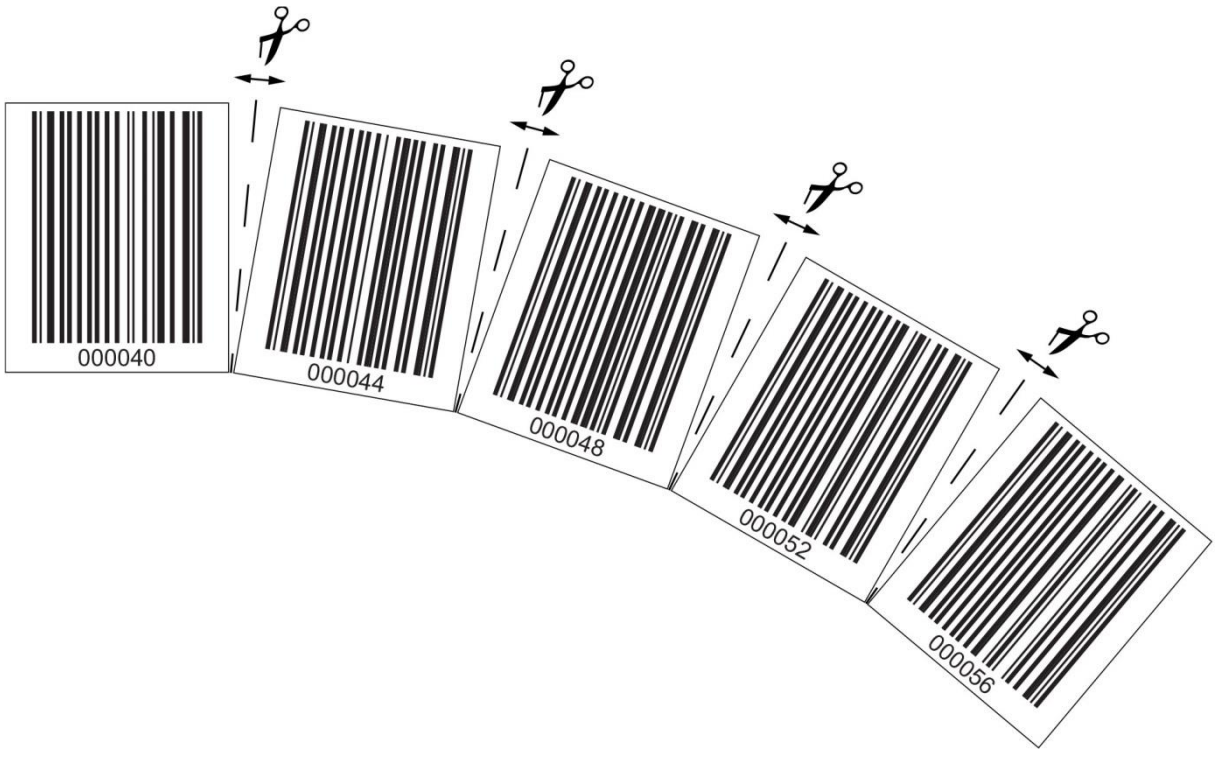

Figure 6.5: Preparing the barcode tape for use in vertical curves

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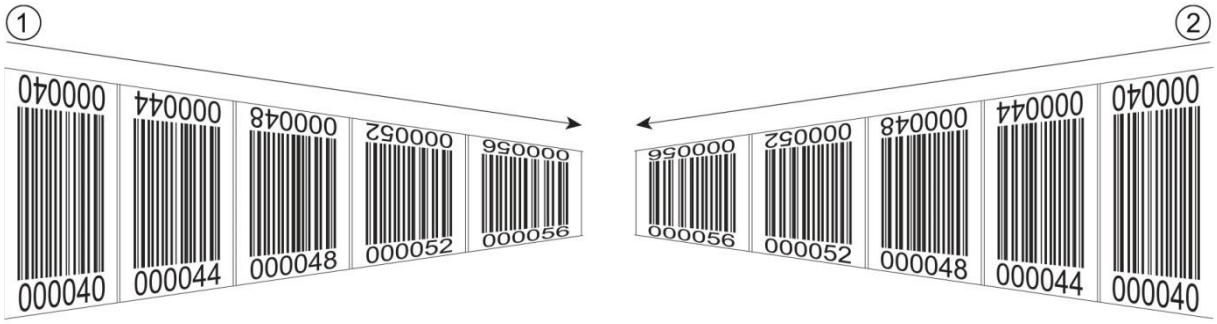
Mounting twin tapes:

If two barcode tapes with the same value range are used for positioning, e.g., for crane systems or elevators, the use of twin tapes is recommended (see chapter 3.4.4 "Twin tapes").

Twin tapes are provided with duplicate numbering. As a result, it is not necessary to affix the BCBs “upside down” in order to have the same values at the same position (see Figure 6.6).



1: Twin barcode tape 1
2: Twin barcode tape 2

Figure 6.6: Mounting twin tapes

NOTICE

A twin tape always consists of two barcode tapes

- *When ordering twin tapes, two barcode tapes are always delivered with one order.*
- *The two TWIN barcode tapes have exactly the same length tolerances to each other.*
- *Make sure that the BCB is attached without tension.*

  The BCB is a plastic tape that can be stretched by strong mechanical tension. Excessive mechanical stretching will lengthen the tape and distort the position values.

Mounting two barcode tapes with the same value range:

For crane systems or elevators, two barcode tapes with the same value range are used for positioning.

If two barcode tapes with the same value range and the same length tolerances are required, the use of twin tapes is recommended (see chapter 3.4.4 "Twin tapes").

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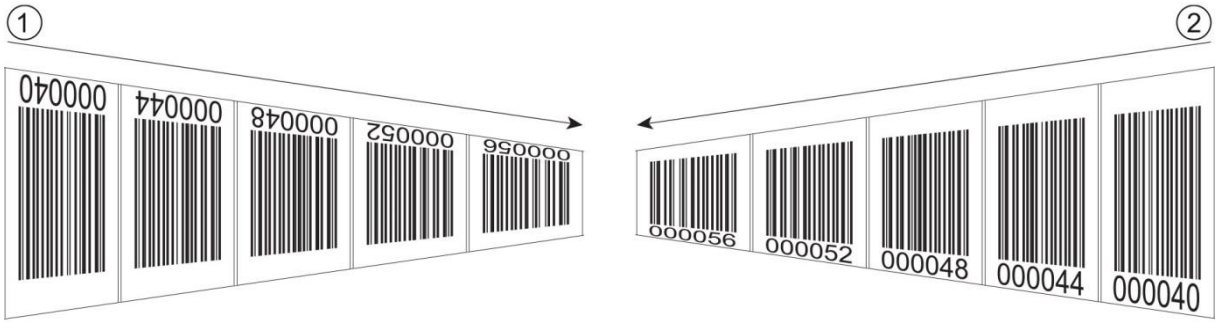
If a twin tape is not used: To have the same values at the same position, one barcode tape must be affixed with numbers upside down while the other is affixed normally (see Figure 6.7).

If no TWIN barcode tapes are used, the two barcode tapes can deviate +/- 1 mm per meter from each other.



1: BCB affixed upside down
2: BCB affixed normally

Figure 6.7: Affixing two barcode tapes with the same value range

6.2 Mounting barcode positioning system

The BE 901 EPN can be mounted in the following ways:

- Mounting using a mounting device on the fastening grooves
  - BE 901 FA-001 (BE901 Befestigung): (Wall mounting
  - BE 90 FA-001: Mounting on a rod
- Mounting using a mounting device on the M4 mounting threads on the rear of the device
  - BE 901 FA-002 (BE901 Befestigungswinkel): Mounting on a mounting bracket
  - BE 901 FA-003 (BE901 Befestigung kompl.): Mounting on a rod
- Mounting using four M4 mounting threads on the rear of the device

If the BE 901 FA-001 mounting device is used to mount the device, the new device is automatically aligned correctly should it be necessary to exchange a device.

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6.2.1 Mounting instructions

NOTICE

Select the mounting location

- *Make certain that the required environmental conditions (humidity, temperature) are maintained.*
- *Make certain that the distance between BE 901 EPN and barcode tape is sufficiently large. The scanning beam of the BE 901 EPN should cover three or more barcodes. The distance between BE 901 EPN and barcode tape must be in the working range of the reading field curve.*
- *Make certain that the exit window does not become soiled, e.g., by leaking liquids, abrasion from cardboard packaging or residues from packaging material.*
- *Mounting the BE 901 EPN outdoors or with BE 901 EPN with integrated heating:*

  Mount the BE 901 EPN in a way which provides maximum thermal isolation, e.g., using rubber bonded metal.

  Mount the BE 901 EPN so that it is protected from airflow, e.g., in a protective housing.
- *Mounting the BE 901 EPN in a protective housing:*

  When installing the BE 901 EPN in a protective housing, ensure that the scanning beam can exit the protective housing without obstruction.
- *Make certain that the scanning range determined from the scanning curve is adhered to at all locations where a position determination is to be made.*
- *Ensure that the scanning beam is always incident on the BCB when the system is moving. For the position calculation, the scanning beam of the BE 901 EPN must be incident on the BCB without interruption.*

  For the best functionality, the BE 901 EPN must be guided parallel to the BCB. It is not permitted to move outside of the approved working range of the BE 901 EPN (50 … 170 mm) while the system is in motion.
- *Make certain that there is only one control barcode (or marker label) in the scanning beam at a time. The minimum distance between two control barcodes is determined by the distance between the BE 901 EPN and barcode tape and the resulting length of the scanning beam.*

NOTICE

For parallel mounting, maintain the minimum distance!

- *Maintain the minimum distance of 300 mm if you mount two BE 901 EPN next to or above one another.*

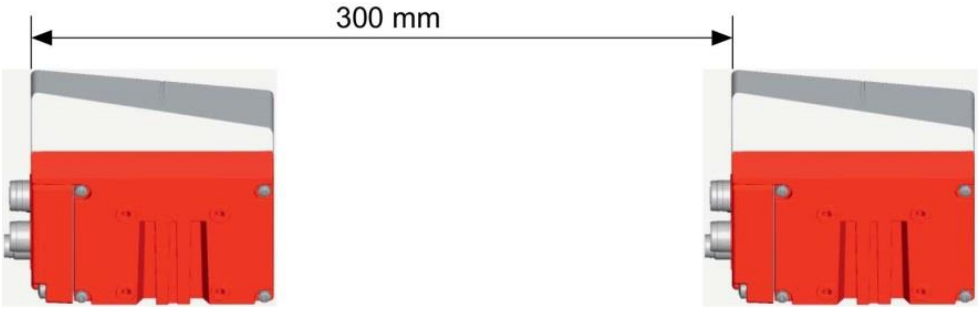

Figure 6.8: Minimum distance for parallel mounting

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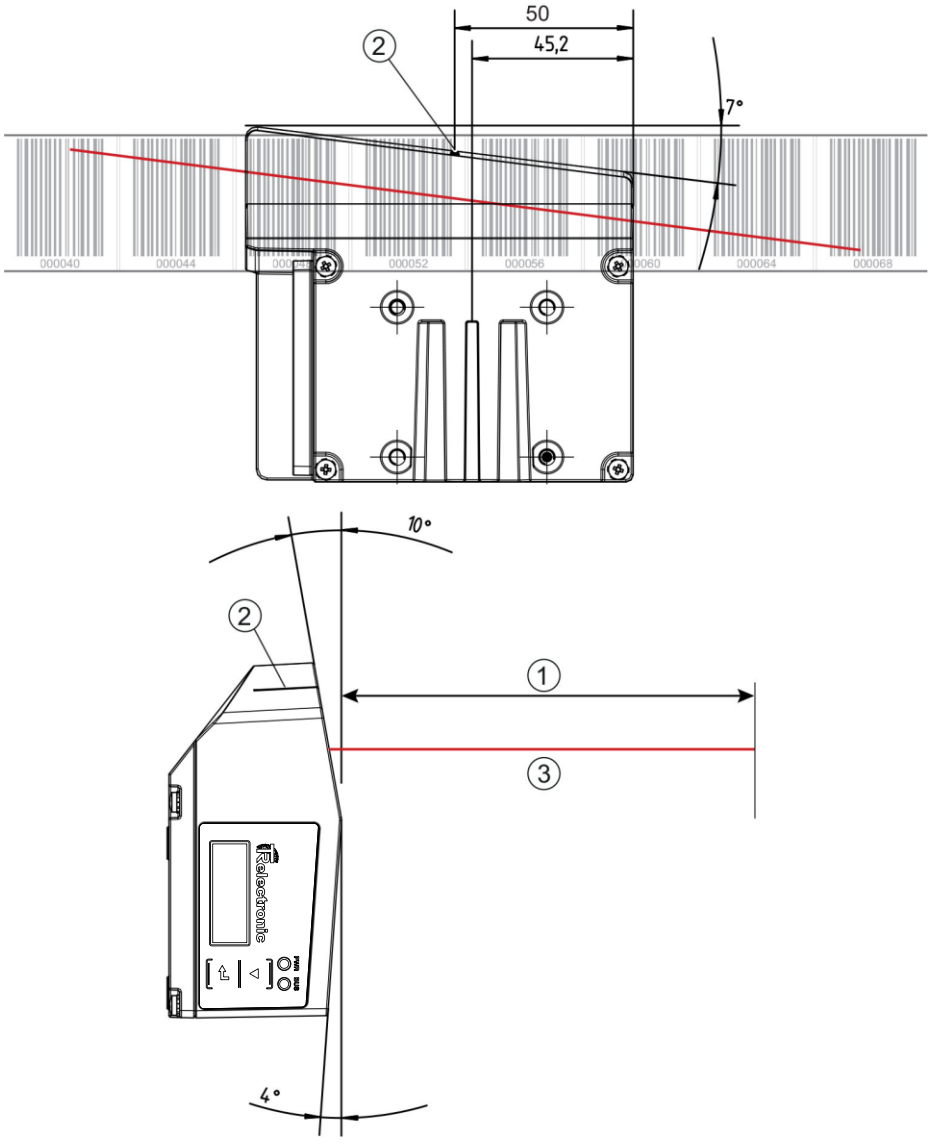
NOTICE

Install the connection hood before mounting the BE 901 EPN!

- *Screw the BE 901 MS EPN or BE 901 MK EPN connection hood to the device housing with two M4 screws.*
- *Tighten the screws on the connection hood with a tightening torque of 1.4 Nm.*

6.2.2 Orientation of the BE 901 EPN to the barcode tape

The beam of the BE 901 EPN must be oriented at an incline of 7° to the barcode tape (see Figure 6.9). When positioning, make certain that the angle of radiation to the rear side of the housing is 90° and the reading distance to the barcode tape is maintained.



1: Reading distance
2: Reference point for the barcode position
3: Scanning beam

Figure 6.9: Beam exit

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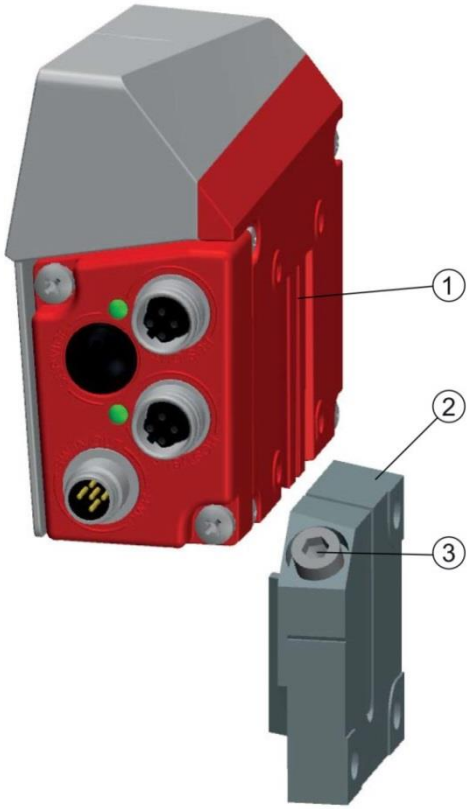
6.2.3 Mounting with the “BE 901 FA-001” mounting device

Mounting the BE 901 EPN with a “BE 901 FA-001” mounting device is intended for wall mounting. For ordering information see chapter 13.4; for dimensioned drawing see Figure 12.7.



1: Clamp profile
2: Clamping jaws
3: Screw terminal

Figure 6.10: Mounting the BE 901 EPN with the “BE 901 FA-001” mounting device

- Mount the “BE 901 FA-001” on the system side with M6 fastening screws (not included in delivery contents).
- Mount the BE 901 EPN with the dovetail fastening grooves on the clamping jaws of the “BE 901 FA-001” with limit stop at end.
- Secure the BE 901 EPN with the M6 screw terminal.

  Maximum tightening torque for the M6 screw terminal: 8 Nm

6.2.4 Mounting with “BE 90 FA-001” mounting device

Mounting of the BE 901 EPN with a ”BE 90 FA-001” mounting device is intended for rod mounting. For ordering information see chapter 13.4; for dimensioned drawing see Figure 12.9.

- Mount the ”BE 90 FA-001” on the rod with the clamp profile (system-side).
- Mount the BE 901 EPN with its fastening grooves on the clamping jaws of the ”BE 90 FA-001” with limit stop at end.
- Secure the BE 901 EPN with the M6 screw terminal.

  Maximum tightening torque for the M6 screw terminal: 8 Nm

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6.2.5 Mounting with the “BE 901 FA-002” mounting bracket

Mounting of the BE 901 EPN with a “BE 901 FA-002” mounting bracket is intended for wall mounting. For ordering information see chapter 13.4; for dimensioned drawing see Figure 12.8.

- Mount the “BE 901 FA-002” mounting bracket on the system side with M6 fastening screws (included in delivery contents).
- Mount the BE 901 EPN on the mounting bracket with M4 fastening screws (included in delivery contents).

  Max. tightening torque of the M4 fastening screws: 2 Nm

6.2.6 Mounting with “BE 901 FA-003” mounting device

Mounting of the BE 901 EPN with a “BE 901 FA-003” mounting device is intended for rod mounting. For ordering information see chapter 13.4; for dimensioned drawing see Figure 12.10.

- Mount the “BE 901 FA-003” mounting device with the clamp profile on the rod (system-side).
- Mount the BE 901 EPN on the mounting bracket of the “BE 901 FA-003” with M4 fastening screws (included in delivery contents).

  Max. tightening torque of the M4 fastening screws: 2 Nm

6.2.7 Mounting with M4 fastening screws

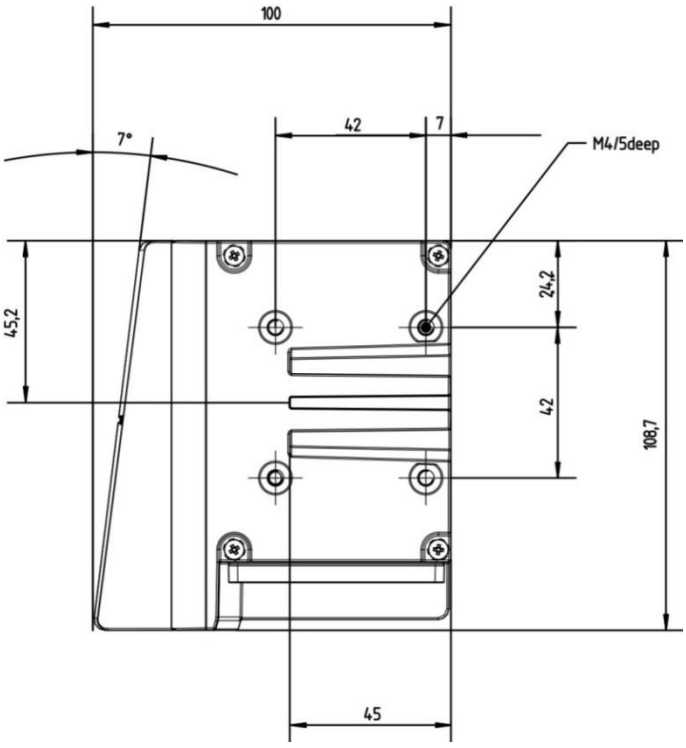

Figure 6.11: Dimensioned drawing of rear of BE 901 EPN

- Mount the BE 901 EPN on the system with M4 fastening screws (not included in delivery contents).

  Max. tightening torque of the fastening screws: 2 Nm

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7 Electrical connection

⚠ CAUTION

- *Before connecting the device, be sure that the supply voltage agrees with the value printed on the name plate.*
- *Only allow competent persons to perform the electrical connection.*
- *Ensure that the functional earth (FE) is connected correctly.*

  Fault-free operation is only guaranteed if the functional earth is connected properly.
- *If faults cannot be rectified, take the device out of operation. Protect the device from accidentally being started.*

⚠ CAUTION

UL applications!

For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

NOTICE

Protective Extra Low Voltage (PELV)

- *The BE 901 EPN is designed in accordance with pro tection class III for supply with PELV (protective extra-low voltage).*

NOTICE

Connection hood and degree of protection IP 65

- *Before connecting, mount the connection hood on the BE 901 EPN device housing.*
- *To ensure degree of protection IP 65 is fulfilled, the screws of the connection hood are tightened with a tightening torque of 1.4 Nm for connecting to the BE 901 EPN.*
- *Degree of protection IP 65 is not fulfilled until connectors or cable bushings are screwed on and caps are installed.*

7.1 External parameter memory in the connection hood

The parameter memory in the BE 901 MS EPN or BE 901 MK EPN connection hood stores the device name and holds a copy of the current BE 901 EPN parameter set.

- If a BE 901 EPN device exchange is performed on-site, the device name for the new BE 901 EPN is taken over automatically. Manual configuration of the exchanged device and “re-naming” of the device name are not necessary.
- The control can immediately access the exchanged BE 901 EPN.

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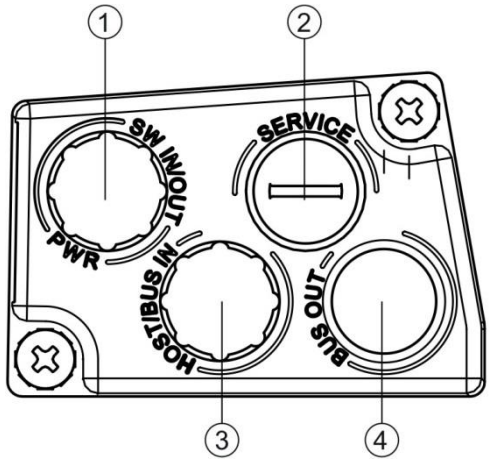
7.2 BE 901 MS EPN connection hood with connectors

The BE 901 MS EPN connection hood features three M12 connector plugs and a Mini-B type USB socket as a service interface.



1: PWR / SW IN/OUT: M12 plug (A-coded)
2: SERVICE: Mini-B USB socket (behind protective cap)
3: HOST / BUS IN: M12 plug (D-coded), Ethernet 0
4: BUS OUT: M12 socket (D-coded), Ethernet 1

Figure 7.1: BE 901 MS EPN connection hood, connections

NOTICE

Shielding connection and functional earth connection!

- *The shielding connection is done via the M12 connector housing.*
- *Ensure that the functional earth (FE) is connected correctly. Unimpaired operation is only guaranteed when the functional earth is connected properly.*

  All electrical disturbances (EMC couplings) are discharged via the functional earth connection.

NOTICE

Network interruption with BE 901 EPN in PROFINET linear topology!

- *In the event of a device exchange, the PROFINET network is interrupted at this location.*
- *The PROFINET network is interrupted if the BE 901 EPN is unplugged from the connection hood.*
- *If there is no voltage supply for the BE 901 EPN, the PROFINET network is interrupted.*

- Connect connection PWR / SW IN/OUT to the supply voltage or the switching inputs/outputs connection cable.
- PROFINET - star topology:

  Connect the HOST / BUS IN connection to a switch with the interconnection cable.
- PROFINET - linear topology:

  Connect the HOST / BUS IN connection to the BUS OUT connection of the upstream BE 901 EPN with the interconnection cable.

  Connect the BUS OUT connection to the HOST / BUS IN connection of the downstream BE 901 EPN with the interconnection cable.

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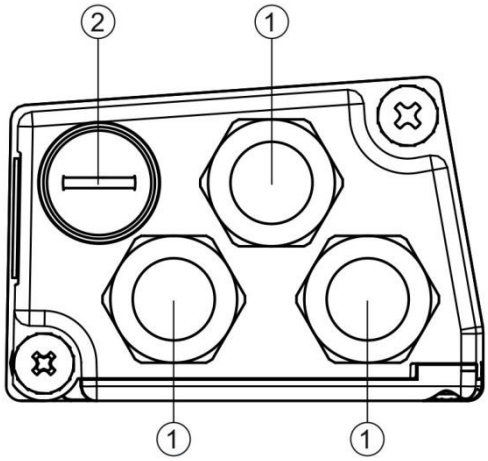
7.3 BE 901 MK EPN connection hood with spring-cage terminals

With the BE 901 MK EPN connection hood, the BE 901 EPN is connected directly and with no additional plug. The BE 901 MK EPN features three cable bushings in which the shielding connection for the interface cable is also located. A Mini-B type USB socket is used for service purposes.



1: 3x cable bushing, M16 x 1.5
2: SERVICE: Mini-B USB socket (behind protective cap)

Figure 7.2: BE 901 MK EPN connection hood, connections

NOTICE

Cable fabrication!

↳ *It is recommended not to use wire-end sleeves.*

NOTICE

Functional earth connection!

↳ *Ensure that the functional earth (FE) is connected correctly. Unimpaired operation is only guaranteed when the functional earth is connected properly. All electrical disturbances (EMC couplings) are discharged via the functional earth connection.*

↳ Connect connection PWR / SW IN/OUT to the supply voltage or the switching inputs/outputs connection cable.

↳ PROFINET - star topology:

Connect the HOST / BUS IN connection to a switch with the interconnection cable.

↳ PROFINET - linear topology:

Connect the HOST / BUS IN connection to the BUS OUT connection of the upstream BE 901 EPN with the interconnection cable.

Connect the BUS OUT connection to the HOST / BUS IN connection of the downstream BE 901 EPN with the interconnection cable.

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7.4 Pin assignment

7.4.1 PWR / SW IN/OUT (Power and switching input/output)

5-pin, M12 plug (A-coded) or terminal block for connecting to PWR / SW IN/OUT.

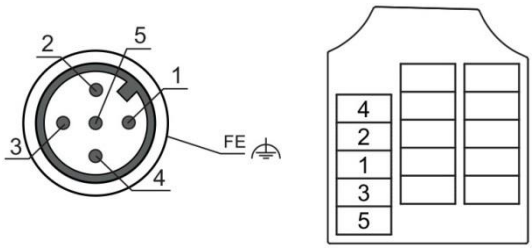

Figure 7.3: PWR / SW IN/OUT connection

Table 7.1: PWR / SW IN/OUT pin assignment

Pin/terminal	Designation	Assignment
1	VIN	+18 … +30 VDC supply voltage
2	SWIO1	Sw. input/output 1 (configurable)
3	GNDIN	Negative supply voltage (0 VDC)
4	SWIO2	Sw. input/output 2 (configurable)
5	FE	Functional earth
Thread (M12 plug) Cable gland	Functional earth	Connection cable shield. The shield of the connection cable is on the thread of the M12 plug or on the screw fitting of the cable bushing. The thread or the screw fitting is part of the metallic housing. The housing is at the potential of the functional earth via pin 5.

⚠ CAUTION

UL applications!

For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

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Switching input/output:

The BE 901 EPN is equipped with two, freely programmable, optically decoupled switching inputs/outputs, SWIO1 and SWIO2.

- The switching inputs can be used to activate various internal functions of the BE 901 EPN (e.g., Measurement Stop/Start, Teach Preset and Reset Preset).
- The switching outputs can be used to signal the state of the BE 901 EPN and to implement external functions independent of the superior control (e.g. position value/speed value invalid, position and speed limit value exceeded, device error).
- The control can use switching inputs/outputs as digital I/O's.

  If no internal BE 901 EPN function is connected to the switching inputs/outputs, the ports can be addressed as two inputs, two outputs or as one input and one output of a digital I/O component.

*The function as an input or output is set via PROFINET parameters (see chapter 8.4) or using the webConfig configuration tool (**CONFIGURATION > DEVICE > Switching inputs/outputs**, see chapter 9.3.4).*

If SWIO1 or SWIO2 is to be used as digital input or output, the configuration must be performed in module 4 (see chapter 8.4.6) or module 5 (see chapter 8.4.7).

NOTICE

Maximum input current

↳ *The input current of the respective switching input is maximum 8 mA.*

NOTICE

Maximum loading of the switching outputs

↳ *Do not load the respective switching output of the BE 901 EPN with more than 60 mA at + 18 … 30 VDC in normal operation.*

↳ *Each configured switching output is short-circuit proof.*

The two switching inputs/outputs, SWIO1 and SWIO2, are configured as follows by default:

Switching output SWIO1: Position value invalid

Switching input SWIO2: Teach Preset

NOTICE

SWIO1 and SWIO2 as switching output

↳ *At the outputs of the BE 901 EPN (SWIO1 and SWIO2), no switching outputs may be connected from external sensors/devices.*

The switching output of the BE 901 EPN may otherwise malfunction.

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7.4.2 HOST / BUS IN (Host/Bus input, Ethernet)

For the creation of a PROFINET network with multiple participants, the BE 901 EPN is equipped with the incoming PROFINET interface HOST / BUS IN.

4-pin, M12-plug (D-coded) or terminal block for connecting to HOST / BUS IN.

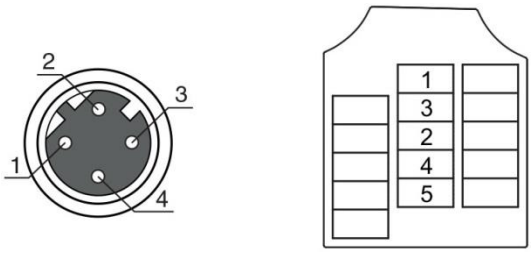

Figure 7.4: HOST / BUS IN connection

Table 7.2: HOST / BUS IN pin assignment

Pin/terminal	Designation	Assignment
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -
5	-	not connected

PROFINET - cable assignments:

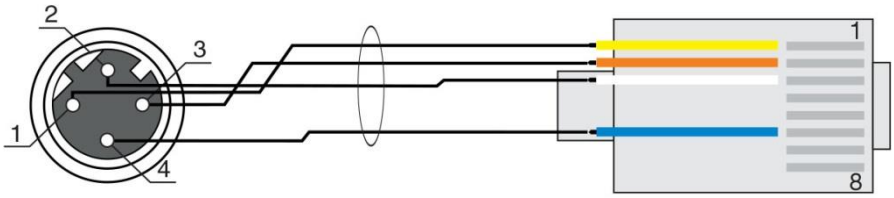

Figure 7.5: HOST / BUS IN connection

Designed as shielded cable, max. 100 m.

Pin (M12)	Designation	Pin/core color (RJ45)
1	TD+	1/yellow
2	RD+	3/white
3	TD-	2/orange
4	RD-	6/blue

NOTICE

Self-configured cables with PROFINET interface!

- *Ensure adequate shielding.*
- *The entire interconnection cable must be shielded and earthed.*
- *The RD+/RD- and TD+/TD- wires must be stranded in pairs.*
- *Use CAT 5 cable for the connection.*

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7.4.3 BUS OUT (host/bus output, Ethernet)

For the creation of a PROFINET network with multiple participants, the BE 901 EPN is equipped with the outgoing BUS OUT PROFINET interface. The use of the BUS OUT interface drastically reduces the cabling requirements, as only the first BE 901 EPN requires a direct connection to the switch, via which it can communicate with the host. All other BE 901 EPN devices are connected in series to the first BE 901 EPN (see chapter 7.5).

4-pin, M12-socket (D-coded) or terminal block for connection to BUS OUT.

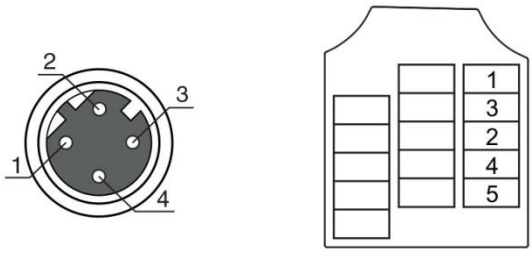

Figure 7.6: BUS OUT connection

Table 7.3: BUS OUT pin assignment

Pin/terminal	Designation	Assignment
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -
5	-	not connected

NOTICE

Self-configured cables with PROFINET interface!

- *Ensure adequate shielding.*
  The entire interconnection cable must be shielded and earthed.
- *The signal lines must be stranded in pairs.*

NOTICE

No BUS OUT termination necessary!

If the termination is activated, the downstream bus cable is disconnected.

- *For the BE 901 EPN as standalone device or as the last participant in a linear PROFINET topology, termination on the BUS OUT socket is not mandatory.*

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7.4.4 Service USB

NOTICE

Connection to PC!

- *The service USB interface of the BE 901 EPN can be connected to the USB interface on the PC with a standard USB cable (plug combination - Mini-B type / Type A).*
- *If possible, use the ready-made cables from TR-Electronic GmbH (see chapter 13.3 “Other accessories”).*

5-pin, Mini-B plug for connecting to the service USB.

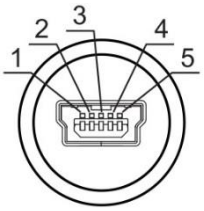

Figure 7.7: Service USB connection

Table 7.4: BUS OUT pin assignment

Pin/terminal	Designation	Assignment
1	VB	Sense input
2	D-	Data -
3	D+	Data +
4	ID	Not connected
5	GND	Ground

NOTICE

Self-configured cables!

- *The entire USB connection cable must be shielded according to the USB specifications.*
- *The maximum cable length of 3 m must not be exceeded.*

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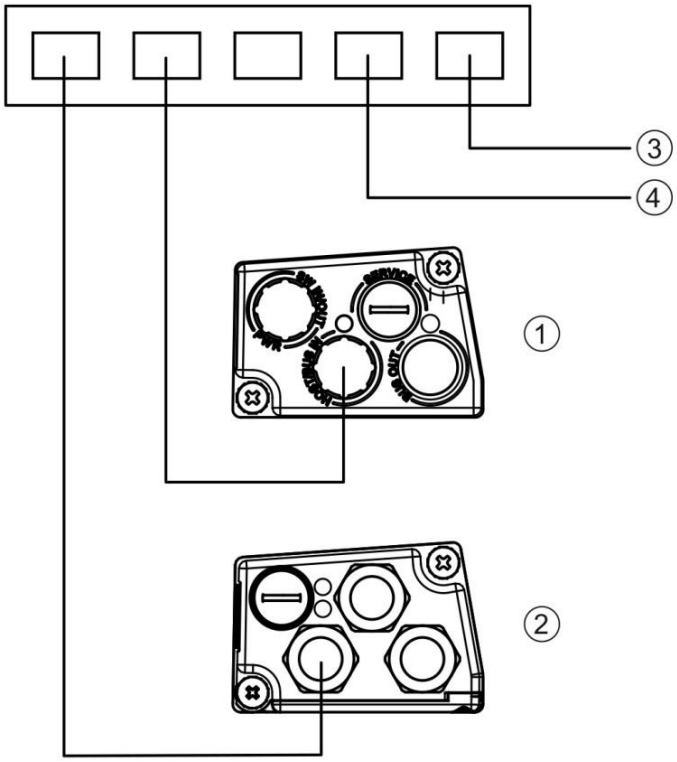
7.5 PROFINET topology

7.5.1 Star topology

The BE 901 EPN can be operated as a single device (standalone) with individual device name in a PROFINET star topology. The PLC must communicate this device name to the participant during the “device naming”; see chapter 8.3.



1: With BE 901 MS EPN connection hood with M12 connectors
2: With BE 901 MK EPN connection hood with spring-cage terminals
3: PC / PLC host interface
4: Other network participants

Figure 7.8: PROFINET in a star topology

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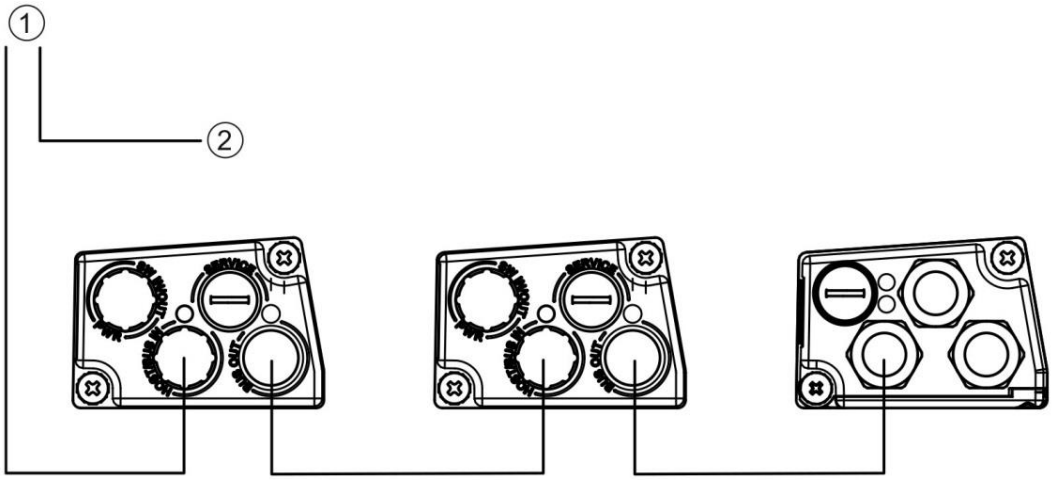
7.5.2 Linear topology

The integrated switch functionality of the BE 901 EPN offers the possibility to network multiple BE 901 EPN devices. In addition to the classic "star topology", a "linear topology" is thus also possible. The wiring of the network in a linear topology is simple and economical since the network connection is looped through from one participant to the next. The maximum length of a segment (connection from one participant to the next) is limited to 100 m.



1: PC / PLC host interface
2: Other network participants

Figure 7.9: PROFINET in a linear topology

Up to 254 BE 901 EPN can be networked. They must all be located in the same subnet.
To do this, the individual “device name” is assigned to each participating BE 901 EPN through “device naming”, using the control's configuration tool; see chapter 8.3.

7.5.3 PROFINET – wiring

NOTICE

Observe during PROFINET wiring!

- *Use the recommended connectors/sockets (see chapter 13.3).*
- *Always use a CAT 5 Ethernet cable for the wiring.*

NOTICE

Observe for self-configured cables!

- *Use the recommended connectors/sockets (see chapter 13.3)*
- *Connect TD+ on the M12 plug to RD+ on the RJ-45 plug.*
- *Connect TD- on the M12 plug to RD- on the RJ-45 plug, etc.*

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7.6 Cable lengths and shielding

Observe the maximum cable lengths and the shielding types:

Connection	Interface	Max. cable length	Shielding
Service	USB	3 m	Shielding absolutely necessary acc. to USB specifications
Host	EtherCAT	100 m	Shielding absolutely necessary
Network from the first BE 901 EPN to the last BE 901 EPN	EtherCAT	Max. segment length: 100 m for 100Base-TX twisted pair (min. CAT 5)	Shielding absolutely necessary
Switching input		10 m	Not necessary
Switching output		10 m	Not necessary
Power supply unit		30 m	Not necessary

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8 Commissioning – Basic configuration

As a rule, the BE 901 EPN is configured via the PROFINET interface. Parameter changes for test purposes and extended configurations for the timing for the position and speed measurements can be performed via the webConfig tool (see chapter 9).

NOTICE

Observe for the configuration of PROFINET devices!

- ***Always** perform the basic configuration using the Generic Station Description Markup Language (GSDML) file.*

  Download the appropriate file from the Internet or directly out of the BE 901 EPN (see chapter 8.3.

  In process operation, only the parameters in the PROFINET modules set via the GSDML file or via the webConfig-Tool (HOME > INSTALLATION > GSDML-file) or the PROFINET default presets are in effect. Parameter changes made via the webConfig tool (see chapter 9) have no effect in PROFINET.

  If you switch the BE 901 EPN to the Service operating mode via the webConfig tool, the BE 901 EPN is disconnected from the PROFINET. All parameters set via the GSDML file initially remain in effect. Parameter changes can now be made via the webConfig tool for test purposes.

  Settings configured with the webConfig tool are overwritten by the PROFINET master with the settings made via the GSDML file upon connection to PROFINET or after deactivation of the Service operating mode.

- *Configuration data is saved in the device **and** in the connection hood.*

8.1 Configuring the PROFINET interface

The BE 901 EPN is designed as a PROFINET-RT device (Real Time; acc. to IEEE 802.3). It supports a transmission rate of up to 100 Mbit/s (100 Base TX/FX), full duplex, as well as auto-negotiation and auto-crossover.

- The functionality of the BE 901 EPN is defined via parameters which are organized in modules. The modules are part of the Generic Station Description Markup Language (GSDML) file.
- Each BE 901 EPN has a unique MAC address (Media Access Control) that is specified on the name plate. The MAC address (MAC-ID) is linked to an IP address during the course of configuration.
- The Simatic Manager for creation of PROFINET networks links the IP address to a freely selectable device name which may only exist once in the network.

Address Link Label:

The “Address Link Label” is an additional stick-on label that is affixed to the device.

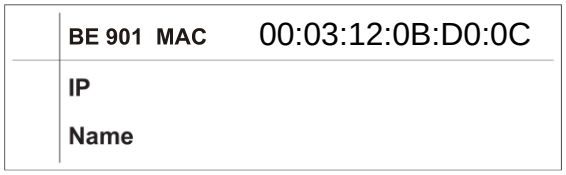

Figure 8.1: Example of an “Address Link Label”; the device type varies depending on the series

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- The “Address Link Label” contains the MAC address (Media Access Control address) of the device and makes it possible to enter the IP address and the device name manually.
  The area of the “Address Link Label” on which the MAC address is printed can be separated from the remainder of the stick-on label if necessary using the perforation.
- The “Address Link Label” can be removed from the device and can be affixed in the installation and layout diagrams to designate the device.
- Once it is affixed in the documents, the “Address Link Label” establishes a unique reference between the mounting location, the MAC address or the device, and the associated control program.
  The time-consuming searching, reading, and manually writing down of the MAC addresses of all devices installed in the system are eliminated.

Each device with Ethernet interface is uniquely identified via the MAC address assigned during production. The MAC address is also listed on the name plate of the device.

If multiple devices are commissioned in a system, the MAC address of each installed device must be correctly assigned, e.g., during programming of the control.

- Remove the “Address Link Label” from the device.
- If necessary, add the IP address and the device name to the “Address Link Label”.
- Affix the “Address Link Label” in the documents, e.g., in the installation diagram, according to the position of the device.

8.1.1 PROFINET - Communication profile

The PROFINET communication profile defines how participants serially transmit their data via the transmission medium. Data exchange with the devices occurs primarily cyclically. For configuration, operation, observation and alarm handling, acyclic communication services are, however, used as well.

Depending on the communication requirements, PROFINET offers suitable protocols and transfer methods:

- Real Time communication (RT) via prioritized Ethernet frames:
  - Cyclical process data (I/O data stored in the I/O area of the control)
  - Alarms
  - Clock synchronization
  - Neighborhood information
  - Address assignment/address resolution via DCP

- TCP/UDP/IP communication via standard Ethernet TCP/UDP/IP frames:
  - Establishing communication
  - Acyclic data exchange, i.e., transfer of various types of information:
    Parameters for the module configuration while communication is being established
    I&M data (Identification & Maintenance functions)
    Reading diagnostic information
    Reading I/O data
    Writing device data

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8.1.2 Conformance Classes

PROFINET devices are categorized into conformance classes to simplify the evaluation and selection of the devices for the users.
The BE 901 EPN corresponds to Conformance Class B (CC-B) and can use an existing Ethernet network infrastructure.

The BE 901 EPN supports the following features:

- Cyclical RT communication
- Acyclic TCP/IP communication
- Alarms/diagnostics
- Automatic address assignment
- I&M 0 functionality
- Neighborhood detection basic functionality
- FAST Ethernet 100 Base-TX/FX
- Convenient device exchange without engineering tools
- SNMP support

8.2 Starting the device

To start the BE 901 EPN:

↳ Connect the supply voltage. The BE 901 EPN starts up and, for devices with a display, the device status is displayed.

↳ Configure the BE 901 EPN, e.g., for a Siemens SIMATIC-S7 control.

↳ Assign the BE 901 EPN its individual device name and name the device.

Power up the device

The default value of the input data bits after switching on the device is the specified initial value (normally ZERO).

For output data with the status IOPS = Bad, the downstream functions are converted into a Safe state. For example, an activated device or an output disabled. This is, for example, the case when the control is switched to the STOP mode becomes.

The device behaves identically when the connection is terminated.

The outputs are deactivated during device acceleration.

8.3 Configuring for the Siemens SIMATIC-S7 control

The functionality of the BE 901 EPN is defined via parameter sets which are organized in modules. The modules are part of the GSDML file (Generic Station Description Markup Language), which is supplied as an integral part of the device.

By using a user-specific project tool, such as, e.g., Simatic Manager for the Siemens programmable logic control, the required modules are integrated into a project during commissioning and its settings and parameters are adjusted accordingly. These modules are provided by the GSDML file.

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NOTICE

Observe SIMATIC Manager version!

↳ *For the Siemens SIMATIC-S7 control, you need at least SIMATIC Manager version 5.4 + service pack 5 (V5.4+SP5).*

The following steps are necessary for commissioning:

- Preparation of the control system (S7 PLC)
- Installation of the GSDML file
- Hardware configuration of the S7 PLC
- Transmission of the PROFINET configuration to the IO controller (S7 PLC)
- Device naming
- Check device name

Proceed as follows:

↳ To prepare the control (S7 PLC):

Assign a PROFINET address to the control (S7 PLC)

Prepare the control system for consistent data transmission.

↳ Install the GSDML file for the subsequent configuration of the BE 901 EPN.

You can find the GSDML file at: **www.tr-electronic.com/f/TR-E-ID-MUL-0010**.

Alternatively, the GSDML file can be loaded from the BE 901 EPN with the webConfig tool (see chapter 9):

HOME > INSTALLATION > GSDML file

The GSDML file stored in the BE 901 EPN is always compatible with the firmware version of the BE 901 EPN.

General information on the GSDML file

The term GSD (Generic Station Description) stands for the textual description of a PROFINET device model. For the description of the more complex PROFINET device model, the XML-based GSDML (Generic Station Description Markup Language) was introduced. In the following, the terms “GSD” or “GSD file” always refer to the GSDML-based format.

- The GSDML file can support an arbitrary number of languages in one file.
- Every GSDML file contains a version of the BE 901 EPN device model. This is also reflected in the file name.

Participants that have not been "named" cannot be contacted yet at this point in time!

- In the GSDML file, all data necessary for operating the BE 901 EPN is described in modules:
  - Input and output data
  - device parameters
  - definition of the control and status bits.
- If parameters are changed in the project tool, for example, these changes are stored by the PLC in the project, not in the GSDML file.

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The functionality of the BE 901 EPN is defined via GSDML parameter sets. The parameters and their functions are structured in the GSDML file using modules. A user-specific configuration tool is used during PLC program creation to integrate the required modules and configure them appropriately for their respective use.

During operation of the BE 901 EPN on the PROFINET all parameters are set to default values. If these parameters are not changed by the user, the device functions with the default settings delivered by TR-Electronic GmbH. The default settings of the BE 901 EPN can be found in the module descriptions.

The GSDML file is a certified and integral part of the device and must not be changed manually. The file is not changed by the system either.

GSDML file name structure:

The file name of the GSDML file is constructed according to the following rule:
GSDML-[GSDML schema version]-TR-[item description]-[date].xml

- **[GSDML schema version] =** Version identifier of the GSDML schema version used, e.g. V2.32
- **[Date] =** Release date of the GSDML file in the format yyyymmdd.
  This date also stands for the release date of the file.
  Example: **GSDML-V2.32-TR-BE901EPN-20170302.xml**

↳ Configure the hardware of the S7 PLC:

Add the BE 901 EPN to your project. The PROFINET system is configured with the help of the hardware configuration (HW-Config) of the SIMATIC Manager.

Assign an IP address a unique device name.

↳ Transfer the PROFINET configuration to the IO Controller (S7 PLC).

Following successful transfer, the following activities take place automatically:

- Check of device names
- Assignment of the IP addresses that were configured in the HW Config to the IO devices
- Establishment of a connection between the IO Controller and configured IO devices
- Cyclical data exchange

Participants that have not been "named" cannot be contacted yet at this point in time!

Device naming:

PROFINET defines the "naming of the device" as the creation of a name-based relationship for a PROFINET device.

↳ Set the device name.

The PROFINET device has a unique MAC address that is part of the factory settings. The MAC address may be found on the name plate of the BE 901 EPN. Multiple BE 901 EPN devices can be distinguished by the MAC addresses displayed.

This information is used to assign a unique, plant-specific device name (“NameOfStation”) to the device via the “Discovery and Configuration Protocol (DCP)”.

Every time the system is started up, PROFINET uses the DCP protocol for the IP address assignment, provided the IO-device is located in the same subnet.

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↳ Assign the device names to the configured IO devices.

Select the BE 901 EPN using its MAC address. The unique device name (which must match the name in the HW Config) is then assigned to the BE 901 EPN.

↳ Assign the IP address to the MAC address (individual device name).

At this point, assign another IP address (suggested by the PLC), a subnet mask and, if required, a router address, and assign this data to the named participant (device name).

From now on, and when programming, only the unique device name (max. 255 characters) is used.

↳ Check device name.

After completing the configuration phase, check the device names that have been assigned.

NOTICE

Assign unique device name!

↳ *Ensure that the device names are unique and that all participants are located in the same subnet.*

8.4 PROFINET project modules

From the perspective of the device, a distinction is made between interface-specific parameters and internal parameters:

- Interface-specific parameters
  Parameters that can be changed via the interface (see modules described in the following).
- Internal parameters
  Parameters that are only can be changed via a service interface.
  They retain their value even after the interface-specific configuration.

NOTICE

Overwriting of data by PLC!

↳ *Note that the PLC overwrites the data set via the service interface.*

↳ *In the interface-specific configuration phase, all interface-specific parameters that were changed via the service interface are overwritten. This also applies for the parameters from modules that were not configured.*

↳ *During the configuration phase, the BE 901 EPN receives parameter telegrams from the controller (master).*

Before the parameter telegrams are evaluated and the respective parameter values are set, all interface-specific parameters are reset to default values. This ensures that the parameters of modules that are not selected are set to the default values.

NOTICE

Do not activate any universal modules!

↳ *If the control makes a so-called "universal module" available, the universal module may not be activated for the BE 901 EPN selected are set to the default values.*

You can find the default values of the BE 901 EPN in the module descriptions.

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8.4.1 Overview of the modules

Module	Module name	Module contents (P) = Parameter, (O) = Output, (I) = Input
DAP_001 see page 66	Position value	Profile (P), Integration depth (P), Tape selection (P)
M1 see page 67	Position value	Sign (P), Unit (P), Position resolution (P), Counting direction (P), Offset (P), Position (I)
M2 see page 68	Static preset	Preset value (P), Teach Preset (O), Reset Preset (O)
M3 see page 69	Dynamic preset	Preset value (P), Teach Preset (O), Reset Preset (O)
M4 see page 69	Input/output IO 1	Function (P), Activation (P), Output (P), Input (P), State (I), Control output (O)
M5 see page 72	Input/output IO 2	Function (P), Activation (P), Output (P), Input (P), State (I), Control output (O)
M6 see page 75	Status and control	Measurement value invalid/not active (I), Preset active (I), Teach Preset toggle (I), Lower/upper position limit value 1 … 2 (I), Control/marker barcode detected (I), Control/ marker barcode toggle (I), Temperature warning/error (I) Hardware defect (I), Read quality warning/Error threshold (I), Standby active (I), Start/stop measurement (O), Activate/deactivate Standby (O), Acknowledge control/marker barcode (O)
M7 see page 77	Position limit value range 1	Upper/Lower pos. limit 1 (P)
M8 see page 77	Position limit value range 2	Upper/Lower pos. limit 2 (P)
M9 see page 77	Error handling procedures	Position value in the case of error (P), Suppress position state (P), Error delay/error delay time (position) (P), Speed in the case of error (P), Suppress speed state (P), Error delay/error delay time (speed) (P)
M10 see page 78	Speed	Speed resolution (P), Averaging (P), Speed (I)
M11 see page 79	Static speed limit value 1	Switching type (P), Selection of direction (P), Speed limit value 1 (P), Speed hysteresis 1 (P), Limit value 1 range start/range end (P)
M12 see page 80	Static speed limit value 2	Switching type (P), Selection of direction (P), Speed limit value 2 (P), Speed hysteresis 2 (P), Limit value 2 range start/range end (P)
M13 see page 80	Static speed limit value 3	Switching type (P), Selection of direction (P), Speed limit value 3 (P), Speed hysteresis 3 (P), Limit value 3 range start/range end (P)
M14 see page 81	Static speed limit value 4	Switching type (P), Selection of direction (P), Speed limit value 4 (P), Speed hysteresis 4 (P), Limit value 4 range start/range end (P)
M15 see page 82	Dynamic speed limit value	Limit value control (P), Switching type (P), selection of direction (P), Speed limit value (P), Hysteresis (P), Limit value range start/range end (P)

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M16 see page 82	Speed state	Speed measurement error (I), Speed limit value 1 … 4 exceeded (I), Dynamic speed limit value exceeded (I), Movement status/direction (I), Speed limit value status 1 … 4 active (I), Dynamic speed limit value active (I)
M20 see page 84	Free resolution	Position (P), Speed (P)
M21 see page 84	Distance to BCB	Distance (I)
M22 see page 84	Control and marker barcodes	Reload (P), Transfer (P) First/second/third character (I)
M23 see page 85	Tape value correction	Real length (P), Range start/end(P)
M24 see page 86	Read quality	Warning threshold/error threshold /read quality smoothing (P), Read quality (I)
M25 see page 86	Device status	Device status (I)
M26 see page 87	Extended status	Tape direction (I)
M28 see page 87	16-bit position value	16-bit position value (I)

8.4.2 DAP module – Permanently defined parameters

On the PROFINET, parameters may be stored in modules or may be defined permanently in a PROFINET participant. Depending on the configuration tool, the permanently defined but adjustable parameters are called “common” parameters or device-specific parameters.

- The common parameters must always be present. They are defined outside configuration modules and are thus connected to the base module (DAP: Device Access Point) that is addressed via Slot 0 / Subslot 0.
- Each PROFINET device requires a DAP module. The DAP module represents the communication access point to the BE 901 EPN.
- The following list contains the device parameters that are permanently defined in the BE 901 EPN (DAP Slot 0 / Subslot 0) but are configurable. These parameters always exist and are available independent of the modules.

NOTICE

Set the tape selection!

↳ *Set the Tape selection parameter according to the used barcode tape grid:*

- *30 mm grid for the BCB G30*
- *40 mm grid for the BCB G40*

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Module ID: Profinet_DAP_001

Common parameters/device-specific parameters (DAP: Device Access Point)

The module contains device-specific parameters, but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Profile	0	Byte	2	2	----------		Defines the used device profile. **Note:** Currently, only the BE901 profile is stored. Thus, no selection is possible. Number of the activated profile. 2: BE901 profile
Integration depth	1.0 … 1.4	Bit field	2 … 16	8	Measure-ments		Number of successive measurements that the BE 901 EPN uses for position determination.
Tape selection	1.5 … 1.6	Bit field	1: 30 mm BCB G30 2: 40 mm BCB G40	2	----------		Changeover between barcode tape (BCB G30) with 30 mm grid and (BCB G40) with 40 mm grid.

8.4.3 Module 1 – Position value

Module ID: 1001 with submodule ID: 1

Module for output of the current position value. The module also includes the most important parameters for formatting the output value.

The module contains parameters (with parameter data length of 6 bytes) and input data (with consistent input data length of 4 bytes), but no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Sign	0.0	Bit	0 … 1	0	----------		Output mode of the sign. Affects position value and speed output: 0: Two's complement 1: Sign + quantity
Unit	0.1	Bit	0 … 1	0	----------		The selection of the measurement unit affects all values with measurement units. The parameter applies to all interfaces: 0: Metric (mm) 1: Inch (in)
Position resolution	0.2 … 0.4	Bit	1 … 6	4	mm	in/100	Resolution of the position value. Affects only the interface-specific output. The resolution has no effect on the set parameter values such as offset or preset: 001 = 1: 0.001 010 = 2: 0.01 011 = 3: 0.1 100 = 4: 1 101 = 5: 10 110 = 6: Free resolution

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Counting direction	0.5	Bit	0 … 1	0	----------		Count direction for position calculation or sign for speed calculation. The parameter affects all interfaces: 0: Positive 1: Negative
Offset	1 … 4	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	Output value=measurement value+offset. The parameter affects all interfaces. **Note:** If a preset is active, this has priority over the offset.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Position	0.0	sign 32 bit	-2,000,000,000 … +2,000,000,000	0	Scaled		Current position.

NOTICE

Convert numerical values when changing the unit of measurement!

- *If the unit of measurement is changed from metric to inch (or vice versa), previously entered numerical values (e.g. for offset, preset, limit values etc.) are not automatically converted.*

  Example: Offset = 10000 mm – after changing from metric to inch: Offset = 10000 inch/100

- *Manually convert the numerical values when changing the unit of measurement.*

8.4.4 Module 2 – Static preset

Module ID: 1002 with submodule ID: 1

With the module, it is possible to specify a static preset as a parameter and to activate this preset value at a suitable position (Teach Preset). The preset value is deactivated using the Reset Preset function. If the preset is activated, a set offset (module 1) is not used for the calculation of the position value (module 1).

An activated preset is stored in the BE 901 EPN and in the connection hood. In the event of a device exchange, the values in the connection hood are retained. In the event of a device exchange including the connection hood, the preset value must be reactivated at the intended position (Teach Preset).

The module contains parameters (with parameter data length of 4 bytes) and output data (with output data length of 1 byte), but no input data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Preset value	0	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	New position value for a teach event via the output data.

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Output data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Preset teach	0.0	Bit	0 … 1	---	----------		Reading of the preset value (output value = preset value): Transition 0 → 1: Teach Preset
Preset reset	0.1	Bit	0 … 1	---	----------		Preset value is deactivated (output value = measurement value + offset): Transition 0 → 1: Reset Preset

8.4.5 Module 3 – Dynamic preset

Module ID: 1003 with submodule ID: 1

With the module, it is possible to specify a dynamic preset as part of the output data and to activate this preset value at a suitable position (Teach Preset). The preset value is deactivated using the *Reset Preset* function. If the preset is activated, a set offset (module 1) is not used for the calculation of the position value (module 1).

A dynamic preset value can be ascertained at runtime in the PLC program and transmitted to the BE 901 EPN. A static preset value (module 2) can only be stored in the configuration.

An activated preset is stored in the BE 901 EPN and in the connection hood. In the event of a device exchange, the values in the connection hood are retained. In the event of a device exchange including the connection hood, the preset value must be reactivated at the intended position (Teach Preset).

The module contains output data (with output data length of 5 bytes), but no parameters and no input data.

Output data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Preset teach	0.0	Bit	0 … 1	---	----------		Read in the preset value: Transition 0 → 1: Teach Preset
Preset reset	0.1	Bit	0 … 1	---	----------		Preset value is deactivated: Transition 0 → 1: Reset Preset
Preset value	1	sign 32 bit	-10,000,000 … +10,000,000	---	----------		New position value for a teach event via bit 0.0.

8.4.6 Module 4 – Input/output IO 1

Module ID: 1004 with submodule ID: 1

This module is used to set the mode of operation of digital input/output IO 1. The connection can be used as either an input or an output.

The output is activated by various events in the device.

If used as an input, a device function is controlled by an external signal. Alternatively, the connection can also be used decoupled from the device:
- If used as an input, the state of an external signal is transmitted to the control in the input data.
- If used as an output, the connection is operated via the output data.

The module contains parameters (with parameter data length of 4 bytes), input data

(with input data length of 1 byte) and output data (with output data length of 1 byte).

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Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Function	0.0	Bit	0 … 1	1	----------		Mode: 0: Input 1: Output
Activation	0.1	Bit	0 … 1	1	----------		The parameter defines the level of the output at which the Output event occurs. 0: LOW (output), transition 1 → 0 1: HIGH (output), transition 0 → 1 If the I/O is configured as an input, it responds edge triggered.
Output							Event for activating the output. The individual functions are OR-linked to one another.
	1.0	Bit	0 … 1	0	----------		**Position limit value 1:** If the position value lies outside of configured limit value range 1, the output is set: 0: OFF 1: ON
	1.1	Bit	0 … 1	0	----------		**Position limit value 2:** If the position value lies outside of configured Limit value range 2, the output is set: 0: OFF 1: ON
	1.2	Bit	0 … 1	0	----------		**Speed limit value:** If the speed value lies outside of the configured values, the output is set. 0: OFF 1: ON
	1.3	Bit	0 … 1	0	----------		**Position value invalid:** If no valid position value can be ascertained because, e.g., no barcode tape is read or the barcodes are destroyed or soiled, the output is set. 0: OFF 1: ON
	1.4	Bit	0 … 1	0	----------		**Speed value invalid:** The output is set if no valid speed can be calculated. 0: OFF 1: ON
	1.5	Bit	0 … 1	0	----------		**Warning threshold read quality:** If the ascertained read quality is below the configured warning threshold, the output is set. 0: OFF 1: ON

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Output	1.6	Bit	0 … 1	0	----------	**Error threshold read quality:** If the ascertained read quality is below the configured error threshold, the output is set. 0: OFF 1: ON
	1.7	Bit	0 … 1	0	----------	**Control or marker barcode recognized:** If a control or marker barcode is in the scanning beam, the output is set. 0: OFF 1: ON
	2.0	Bit	0 … 1	0	----------	**Pseudo dynamic output:** The control can set and reset the output on the BE 901 EPN via bit 0.0 in the output data 0: OFF 1: ON
	2.1	Bit	0 … 1	0	----------	**Device error:** If the BE 901 EPN detects a device error, the output is set. 0: OFF 1: ON
	2.2	Bit	0 … 1	0	----------	**Speed limit value 1:** If the speed value 1 lies outside of the configured values, the output is set. 0: OFF 1: ON
	2.3	Bit	0 … 1	0	----------	**Speed limit value 2:** If the speed value 2 lies outside of the configured values, the output is set. 0: OFF 1: ON
	2.4	Bit	0 … 1	0	----------	**Speed limit value 3:** If the speed value 3 lies outside of the configured values, the output is set. 0: OFF 1: ON
	2.5	Bit	0 … 1	0	----------	**Speed limit value 4:** If the speed value 4 lies outside of the configured values, the output is set. 0: OFF 1: ON
Input	3	Bit field	0 … 3	0		**Internal functionality** that is triggered in the device. If no internal function is selected, the control can read the state of an arbitrary external signal via bit 0.0 of the input data. 0: No internal function 1: Stop/start measurement 2: Teach Preset 3: Reset Preset

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Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation Metr.
					Metr.	Inch	
State	0.0	Bit	0 … 1	---	----------		Signal state of the input or output: 0: Input/output not active at signal level 1: Input/output active at signal level

Output data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Control output	0.0	Bit	0 … 1	---	----------		Control of the output. The function must be activated/ deactivated via the parameters: 0: Output not active at signal level 1: Output active at signal level

Behavior of the BE 901 EPN during measurement stop/start

If the scanning beam is incident on the BCB at the moment the laser diode is switched on, the BE 901 EPN returns valid measurement values after approx. 10 ms.

If the BE 901 EPN is reactivated from standby, the motor must first reach its nominal rotational speed. It takes a few seconds before the BE 901 EPN returns any valid measurement values.

8.4.7 Module 5 – Input/output IO 2

Module ID: 1005 with submodule ID: 1

This module is used to set the mode of operation of digital input/output IO 2. The connection can be used as either an input or an output.

The output is activated by various events in the device.

If used as an input, a device function is controlled by an external signal. Alternatively, the connection can also be used decoupled from the device:
- If used as an input, the state of an external signal is transmitted to the control in the input data.
- If used as an output, the connection is operated via the output data.

The module contains parameters (with parameter data length of 4 bytes), input data (with input data length of 1 byte) and output data (with output data length of 1 byte).

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Function	0.0	Bit	0 … 1	0	----------		Mode: 0: Input 1: Output
Activation	0.1	Bit	0 … 1	1	----------		The parameter defines the level of the output at which the *Output* event occurs. 0: LOW (output), transition 1 → 0 1: HIGH (output), transition 0 → 1 If IO 2 is configured as an input, it responds edge triggered.

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Output						Event for activating the output. The individual functions are OR-linked to one another.
	1.0	Bit	0 … 1	0	----------	**Position limit value 1:** If the position value lies outside of configured Limit value range 1, the output is set: 0: OFF 1: ON
	1.1	Bit	0 … 1	0	----------	**Position limit value 2:** If the position value lies outside of configured Limit value range 2, the output is set: 0: OFF 1: ON
	1.2	Bit	0 … 1	0	----------	**Speed limit value:** If the speed value lies outside of the configured values, the output is set. 0: OFF 1: ON
	1.3	Bit	0 … 1	0	----------	**Position value invalid:** If no valid position value can be ascertained because, e.g., no barcode tape is read or the barcodes are destroyed or soiled, the output is set. 0: OFF 1: ON
	1.4	Bit	0 … 1	0	----------	**Speed value invalid:** The output is set if no valid speed can be calculated. 0: OFF 1: ON
	1.5	Bit	0 … 1	0	----------	**Warning threshold read quality:** If the ascertained read quality is below the configured warning threshold, the output is set. 0: OFF 1: ON
	1.6	Bit	0 … 1	0	----------	**Error threshold read quality:** If the ascertained read quality is below the configured error threshold, the output is set. 0: OFF 1: ON
	1.7	Bit	0 … 1	0	----------	**Control or marker barcode recognized:** If a control or marker barcode is in the scanning beam, the output is set. 0: OFF 1: ON

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Output	2.0	Bit	0 … 1	0	----------	**Pseudo dynamic output:** The control can set and reset the output on the BE 901 EPN via bit 0.0 in the output data 0: OFF 1: ON
	2.1	Bit	0 … 1	0	----------	**Device error:** If the BE 901 EPN detects a device error, the output is set. 0: OFF 1: ON
	2.2	Bit	0 … 1	0	----------	**Speed limit value 1:** If the speed value 1 lies outside of the configured values, the output is set. 0: OFF 1: ON
	2.3	Bit	0 … 1	0	----------	**Speed limit value 2:** If the speed value 2 lies outside of the configured values, the output is set. 0: OFF 1: ON
	2.4	Bit	0 … 1	0	----------	**Speed limit value 3:** If the speed value 3 lies outside of the configured values, the output is set. 0: OFF 1: ON
	2.5	Bit	0 … 1	0	----------	**Speed limit value 4:** If the speed value 4 lies outside of the configured values, the output is set. 0: OFF 1: ON
Input	3	unsign 8 bit	0 … 3	0	----------	**Internal functionality** that is triggered in the device. If no internal function is selected, the control can read the state of an arbitrary external signal via bit 0.0 of the input data. 0: No internal function 1: Stop/start measurement 2: Teach Preset 3: Reset Preset

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
State	0.0	Bit	0 … 1	---	----------		Signal state of the input or output: 0: Input/output not active at signal level 1: Input/output active at signal level

Output data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Control output	0.0	Bit	0 … 1	---	----------		Control of the output. The function must be activated via the parameters: 0: Output not active at signal level 1: Output active at signal level

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Behavior of the BE 901 EPN during measurement stop/start

If the scanning beam is incident on the BCB at the moment the laser diode is switched on, the BE 901 EPN returns valid measurement values after approx. 10 ms.

If the BE 901 EPN is reactivated from standby, the motor must first reach its nominal rotational speed. It takes a few seconds before the BE 901 EPN returns any valid measurement values.

8.4.8 Module 6 – Status and control

Module ID: 1006 with submodule ID: 1

The module signals various status information of the BE 901 EPN. Various device functions are controlled via the output data.

The module contains input data (with input data length of 2 bytes) and output data (with output data length of 2 bytes), but no parameters.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Measurement value invalid	0.0	Bit	0 … 1	0	----------		Signals that no valid measurement value can be ascertained. 0: Measurement value valid 1: Measurement value invalid
Measurement not active	0.1	Bit	0 … 1		----------		Signals an inactive measurement. 0: Measurement active 1: Measurement not active
Preset active	0.2	Bit	0 … 1	0	----------		Signals a position value output with active preset. 0: No preset active 1: Preset active
Teach Preset toggle	0.3	Bit	0 … 1	0	----------		This toggle bit changes its state on each Teach Preset event. 0: OK 1: Value less than limit
Lower position limit value 1	0.4	Bit	0 … 1	0	----------		Signals that the value is less than lower position limit 1. 0: OK 1: Value less than limit
Upper position limit value 1	0.5	Bit	0 … 1	0	----------		Signals that upper position limit 1 has been exceeded. 0: OK 1: Value greater than limit
Lower position limit value 2	0.6	Bit	0 … 1	0	----------		Signals that the value is less than lower position limit 2. 0: OK 1: Value less than limit
Upper position limit value 2	0.7	Bit	0 … 1	0	----------		Signals that upper position limit 2 has been exceeded. 0: OK 1: Value greater than limit
Control or marker barcode detected	1.0	Bit	0 … 1	0	----------		Signals a detected control or marker barcode. 0: No marker 1: Marker detected
Control or marker barcode toggle	1.1	Bit	1 … 5	0	----------		This toggle bit changes its state on each detected control or marker barcode. 0, 1: New marker

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Temperature warning	1.2	Bit	1 … 5	0	----------	Signals that temperature is no longer within the specified temperature range. 0: OK 1: Temperature warning
Temperature error	1.3	Bit	0 … 1	0	----------	Signals that the maximum permissible temperature has been exceeded. 0: OK 1: Temperature error
Hardware defect	1.4	Bit	0 … 1	0	----------	Signals a hardware defect. 0: OK 1: Hardware defect
Warning threshold read quality	1.5	Bit	0 … 1	0	----------	Signals that the ascertained read quality has dropped below the configured warning threshold. 0: OK 1: Value less than limit
Error threshold read quality	1.6	Bit	0 … 1	0	----------	Signals that the ascertained read quality has dropped below the configured error threshold. 0: OK 1: Value less than limit
Standby active	1.7	Bit	0 … 1	0	----------	Signals an active standby. 0: No standby 1: Standby active

Output data	**Rel. addr.**	**Data type**	**Value range**	**Init value**	**Unit**		**Explanation**
					Metr.	**Inch**	
Stopping/ starting the measurement	0.0	Bit	0 … 1	0	----------		With this bit, the measurement can be stopped and restarted. If the measurement is stopped, the BE 901 EPN only deactivates the laser beam. If the measurement is restarted, measurement values are available again after a few milliseconds. 0: Measurement active 1: Stop measurement
Activate/ deactivate standby	0.1	Bit	0 … 1	0	----------		With this bit, the BE 901 EPN can be switched to standby; the BE 901 EPN deactivates laser beam and motor. If standby is then deactivated, the motor must first reach its nominal rotational speed; as a result, it takes several seconds before measurement values are available again. 0: Not active 1: Activate
Acknowledge control or marker barcode	0.2	Bit	0 … 1	0	----------		With this bit, the acceptance of the detected control or marker barcode can be acknowledged to the PLC. Transition 0 → 1: Acknowledgment
Acknowledge Event log	0.3	Bit	0 … 1		----------		Deletes the event memory off Module 25 - Device status (input data): 128: Error 129: Warning

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8.4.9 Module 7 – Position limit value range 1

Module ID: 1007 with submodule ID: 1

The module defines a position range with lower and upper limits. If the measured position value is outside of the configured range, the corresponding status bit is set in module 6 and, if configured, an output is set.

The module contains parameters (with parameter data length of 8 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Lower pos. limit 1	0 … 3	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	Lower position limit.
Upper pos. limit 1	4 … 7	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	Upper position limit.

8.4.10 Module 8 – Position limit value range 2

Module ID: 1008 with submodule ID: 1

The module defines a position range with lower and upper limits. If the measured position value is outside of the configured range, the corresponding status bit is set in module 6 and, if configured, an output is set.

The module contains parameters (with parameter data length of 8 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Lower pos. limit 2	0 … 3	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	Lower position limit.
Upper pos. limit 2	4 … 7	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	Upper position limit.

8.4.11 Module 9 – Error handling procedures

Module ID: 1009 with submodule ID: 1

The module makes parameters available to handle any errors should they occur.

If there is a brief disturbance in the position value or the speed calculation in the device, the BE 901 EPN sends the last valid measurement value for a configured time.

If the BE 901 EPN can again calculate valid measurement values within the error delay time, these are output. The disturbance is made evident only as a small increase in the output measurement value.

If the problem with the calculation lasts for a longer period of time, it is possible to configure how the BE 901 EPN is to behave.

The module contains parameters (with parameter data length of 8 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Position value in the case of error	0.0 … 0.1	Bit	0 … 1	1	----------		Position value in the case of an error after the error delay time elapses: 0: Last valid value 1: Zero

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Suppress position status	0.2	Bit	0 … 1	1	----------	Status bit (module 6 bit 0.0) in the case of an error: 0: OFF (status bit is set immediately) 1: ON (status bit is suppressed for the configured error delay time)
Error delay (position)	0.3	Bit	0 … 1	1	----------	Position value in the case of an error: 0: OFF (immediately the value of the *Position value in the case of error* parameter) 1: ON (the last valid position value for the configured error delay time)
Error delay time (position)	1 … 2	unsign 16 bit	10 … 4,000	50	1 ms	Errors that occur are suppressed for the configured time, i.e., if no valid position value can be ascertained in the configured time, the last valid position value is always output. If the error persists after the time elapses, the value of the *Position value in the case of error* parameter is output.
Speed in the case of failure	3.0 … 3.1	Bit	0 … 1	1	----------	Speed value in the case of an error after the error delay time elapses (speed): 0: Last valid value is output 1: Zero is output
Suppress speed status	3.2	Bit	0 … 1	1	----------	Status bit (module 16 bit 0.0) in the case of an error: 0: OFF (status bit is set immediately) 1: ON (status bit is suppressed for the configured error delay time)
Error delay (speed)	3.3	Bit	0 … 1	1	----------	Speed in the case of an error: 0: OFF (immediately outputs the value of the *Speed in the case of error* parameter) 1: ON (outputs the last valid speed for the configured error delay time)
Error delay time (speed)	4 … 5	unsign 16 bit	10 … 4,000	50	1 ms	Errors that occur are suppressed for the configured time, i.e., if no valid speed can be ascertained in the configured time, the last valid speed is always output. If the error persists after the time elapses, the value of the *Speed in the case of error parameter* is output.

8.4.12 Module 10 – Speed

Module ID: 1010 with submodule ID: 1

The module is used to output the current speed in the desired resolution.

The unit (metric or inch) is set via module 1 (position value) and also applies to the speed. If module 1 is not configured, the value is output with the default unit of measurement (metric). The sign of the speed is dependent on the count direction selected in module 1. With the default counting direction (positive), a positive speed is output for movement towards larger tape values. Movement towards smaller tape values results in negative velocities. Measurement value preparation averages all speed values calculated during the selected period (averaging) to yield a speed output value.

The module contains parameters (with parameter data length of 2 bytes) and input data (with consistent input data length of 4 bytes), but no output data.

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Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Speed resolution	0.0 … 0.2	Bit	1 … 5	1	mm/s	(in/100)/s	Resolution for the speed value: 001 = 1: 1 010 = 2: 10 011 = 3: 100 100 = 4: 1000 101 = 5: Free resolution
Averaging	0.3 … 0.5	Bit	0 … 5	2	----------		All calculated velocities are averaged over the specified time: 000 = 0: No averaging 001 = 1: 2 ms 010 = 2: 4 ms 011 = 3: 8 ms 100 = 4: 16 ms 101 = 5: 32 ms

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Speed	0	sign 32 bit	-1,000,000 … +1,000,000	0	Scaled		Current speed.

8.4.13 Module 11 – Static speed limit value 1

Module ID: 1011 with submodule ID: 1

The module provides all parameters for the Static speed limit value 1 function.

This function compares the current speed with a limit speed stored via the configuration. The comparison takes place in the configured range, which is defined by the *Range start* and *Range end* parameters.

If a direction-dependent limit value check is activated via the *Direction selection* parameter, the values of the *Range start* and *Range end* parameters also define the direction. The check is always performed from range start to range end.

Example: If the range start is *5500* and the range end is *5000*, the direction-dependent check is only performed in the direction from *5500* to *5000*. The limit value is not active in the opposite direction.

If the check is independent of direction, the order of range start and range end is irrelevant. Depending on the selected switching mode, if the value is above or below the defined limits, the limit value status in module 16 (see chapter 8.4.18) is set and, if configured, the switching output is appropriately set via module 4 (see chapter 8.4.6) or module 5 (see chapter 8.4.7).

If the range start is identical to the range end, a continuous, direction-independent limit value check is performed.

The module contains parameters (with parameter data length of 13 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Switching type	0.0	Bit	0 … 1	0	----------		Condition for the *Speed limit value 1* signal, which applies to the switching output (module 4/5) and the status bit (module 16): 0: Exceeded 1: Below minimum value
Direction selection	0.1	Bit	0 … 1	0	----------		Selection of the limit value check: 0: Direction independent 1: Direction dependent

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Speed limit value 1	1 … 2	unsign 16 bit	0 … +20,000	0	mm/s	(in/100)/s	Limit value is compared to the current speed.
Speed hysteresis 1	3 … 4	unsign 16 bit	0 … 1,000	100	mm/s	(in/100)/s	Relative shift of the switching point to prevent signal bouncing.
Limit value 1 range start	5 … 8	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored beginning at this position.
Limit value 1 range end	9 … 12	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored up to this position.

8.4.14 Module 12 – Static speed limit value 2

Module ID: 1012 with submodule ID: 1

The module provides all parameters for the Static speed limit value 2 function.

Further explanations on the *Range start* and *Range end* parameters see chapter 8.4.13 "Module 11 – Static speed limit value 1".

The module contains parameters (with parameter data length of 13 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Switching type	0.0	Bit	0 … 1	0	----------		Condition for the *Speed limit value 2* signal, which applies to the switching output (module 4/5) and the status bit (module 16): 0: Exceeded 1: Below minimum value
Direction selection	0.1	Bit	0 … 1	0	----------		Selection of the limit value check: 0: Direction independent 1: Direction dependent
Speed limit value 2	1 … 2	unsign 16 bit	0 … +20,000	0	mm/s	(in/100)/s	Limit value is compared to the current Speed.
Speed hysteresis 2	3 … 4	unsign 16 bit	0 … 1,000	100	mm/s	(in/100)/s	Relative shift of the switching point to prevent signal bouncing.
Limit value 2 range start	5 … 8	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored beginning at this position.
Limit value 2 range end	9 … 12	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored up to this position.

8.4.15 Module 13 – Static speed limit value 3

Module ID: 1013 with submodule ID: 1

The module provides all parameters for the Static speed limit value 3 function.

Further explanations on the *Range start* and *Range end* parameters see chapter 8.4.13 "Module 11 – Static speed limit value 1".

The module contains parameters (with parameter data length of 13 bytes), but no input data and no output data.

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Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Switching type	0.0	Bit	0 … 1	0	----------		Condition for the *Speed limit value 3* signal, which applies to the switching output (module 4/5) and the status bit (module 16): 0: Exceeded 1: Below minimum value
Direction selection	0.1	Bit	0 … 1	0	----------		Selection of the limit value check: 0: Direction independent 1: Direction dependent
Speed limit value 3	1 … 2	unsign 16 bit	0 … +20,000	0	mm/s	(in/100)/s	Limit value is compared to the current speed.
Speed hysteresis 3	3 … 4	unsign 16 bit	0 … 1,000	100	mm/s	(in/100)/s	Relative shift of the switching point to prevent signal bouncing.
Limit value 3 range start	5 … 8	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored beginning at this position.
Limit value 3 range end	9 … 12	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored up to this position.

8.4.16 Module 14 – Static speed limit value 4

Module ID: 1014 with submodule ID: 1

The module provides all parameters for the Static speed limit value 4 function.

Further explanations on the *Range start* and *Range end* parameters see chapter 8.4.13 "Module 11 – Static speed limit value 1"

The module contains parameters (with parameter data length of 13 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Switching type	0.0	Bit	0 … 1	0	----------		Condition for the *Speed limit value 4* signal, which applies to the switching output (module 4/5) and the status bit (module 16): 0: Exceeded 1: Below minimum value
Direction selection	0.1	Bit	0 … 1	0	----------		Selection of the limit value check: 0: Direction independent 1: Direction dependent
Speed limit value 4	1 … 2	unsign 16 bit	0 … +20,000	0	mm/s	(in/100)/s	Limit value is compared to the current speed.
Speed hysteresis 4	3 … 4	unsign 16 bit	0 … 1,000	100	mm/s	(in/100)/s	Relative shift of the switching point to prevent signal bouncing.
Limit value 4 range start	5 … 8	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored beginning at this position.
Limit value 4 range end	9 … 12	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored up to this position.

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8.4.17 Module 15 – Dynamic speed limit value

Module ID: 1015 with submodule ID: 1

The module provides the *dynamic speed limit value* function via output data.

The *dynamic speed limit value function* compares the current speed with a limit speed stored via the output data. The speed limit value can be dynamically changed, i.e., at runtime via the control program.

The speed comparison takes place in a range defined via the output data. Further explanations on the *Range start* and *Range end* parameters see chapter 8.4.13 "Module 11 – Static speed limit value 1".

The module contains output data (with parameter data length of 13 bytes), but no input data and no parameters.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Limit value control	0.0	Bit	0 … 1	---	----------		Controls internal processing of the transferred dynamic limit value parameters: 0: Do not process 1: Parameter now valid / process
Switching type	0.1	Bit	0 … 1	---	----------		Condition for the signal change of the switching out-put/status bit: 0: Speed limit value exceeded 1: Speed limit value not met
Direction selection	0.2	Bit	0 … 1	---	----------		Selection of the limit value check: 0: Direction independent 1: Direction dependent
Speed limit value	1 … 2	unsign 16 bit	0 … +20,000	---	mm/s	(in/100)/s	Limit value is compared to the current speed.
Hysteresis	3 … 4	unsign 16 bit	0 … 1,000	---	mm/s	(in/100)/s	Relative shift of the switching point to prevent signal bouncing.
Limit value range start	5 … 8	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored beginning at this position.
Limit value range end	9 … 12	sign 32 bit	-10,000,000 … +10,000,000	0	mm	in/100	The speed limit value is monitored up to this position.

8.4.18 Module 16 – Speed status

Module ID: 1016 with submodule ID: 1

The module supplies the interface master with various status information for measurement of the speed via input data.

The module contains input data (with input data length of 2 bytes), but no parameters and no output data.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Speed measurement error	0.0	Bit	0 … 1	---	----------		Signals that no valid speed could be ascertained: 0: No speed limit value violation 1: Speed limit value violation
Speed limit value 1 exceeded	0.1	Bit	0 … 1	---	----------		Signals that speed limit value 1 has been exceeded: 0: No limit value violation 1: Value greater than limit

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Speed limit value 2 exceeded	0.2	Bit	0 … 1	---	----------	Signals that speed limit value 2 has been exceeded: 0: No limit value violation 1: Value greater than limit
Speed limit value 3 exceeded	0.3	Bit	0 … 1	---	----------	Signals that speed limit value 3 has been exceeded: 0: No limit value violation 1: Value greater than limit
Speed limit value 4 exceeded	0.4	Bit	0 … 1	---	----------	Signals that speed limit value 4 has been exceeded: 0: No limit value violation 1: Value greater than limit
Dynamic speed limit value exceeded	0.5	Bit	0 … 1	---	----------	Signals that the dynamic speed limit value has been exceeded: 0: No limit value violation 1: Value greater than limit
Movement status	0.6	Bit	0 … 1	---	----------	Signals whether a movement > 0.1 m/s is currently being detected: 0: No movement 1: Movement
Direction of movement	0.7	Bit	0 … 1	---	----------	If bit 1 (movement status) is set, this bit indicates the direction: 0: Positive direction 1: Negative direction
Speed limit value 1 active	1.1	Bit	0 … 1	---	----------	Signals whether the current speed is compared with the Speed limit value 1: 0: Comparison not active 1: Comparison active
Speed limit value 2 active	1.2	Bit	0 … 1	---	----------	Signals whether the current speed is compared with the Speed limit value 2: 0: Comparison not active 1: Comparison active
Speed limit value 3 active	1.3	Bit	0 … 1	---	----------	Signals whether the current speed is compared with the Speed limit value 3: 0: Comparison not active 1: Comparison active
Speed limit value 4 active	1.4	Bit	0 … 1	---	----------	Signals whether the current speed is compared with the Speed limit value 4: 0: Comparison not active 1: Comparison active
Dynamic speed limit value active	1.5	Bit	0 … 1	---	----------	Signals whether the current speed is compared with the Dynamic speed limit value: 0: Comparison not active 1: Comparison active

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8.4.19 Module 20 – Free resolution

Module ID: 1020 with submodule ID: 1

The module is used to implement two parameters that facilitate free scaling of the output values for position value and speed value.

The free resolution is used if the adjustable resolutions that can be set in module 1 or module 10 are not suitable for the application. In modules 1 and 10, the *Resolution* parameter is set to value *Free resolution*. The measurement values are then converted for output with (multiplied by) the parameter values stored in this module and output.

The module contains parameters (with parameter data length of 4 bytes), but no input data and no output data.

Para-meter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Position	0 … 1	unsign 16 bit	5 … 50,000	1000	mm/1000	in/100000	Free resolution of the position value: Applies for all interfaces that selected the value free resolution as resolution.
Speed	2 … 3	unsign 16 bit	5 … 50,000	1000	(mm/1000)/s	(in/100000)/s	Free resolution of the speed value. Applies for all interfaces that selected the value free resolution as resolution.

8.4.20 Module 21 – distance to the barcode tape (BCB)

Module ID: 1021 with submodule ID: 1

The module enables the transmission of the current distance between the BCB and read head (in mm) to the interface master.

This can be used to check the correct reading distance in the entire system.

Example: A fault in the position value determination is caused by an impermissible reading distance at this location.

If value *255* is transmitted, a reading distance outside of the permissible reading field was calculated.

If value *0* is transmitted, a valid distance could not be calculated.

The module contains input data (with input data length of 1 byte), but no parameters and no output data.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Distance	0	unsign 8 bit	0 … 255	0	mm	in/10	Current distance between BCB and read head: 0: No distance calculated 255: Distance outside of the reading field

8.4.21 Module 22 – Control and marker barcodes

Module ID: 1022 with submodule ID: 1

The module enables the transmission of control and marker information to the interface master and setting of the corresponding parameters.

The module contains parameters (with parameter data length of 1 byte) and input data (with input data length of 3 bytes), but no output data.

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Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Reload	0.0	Bit	0 … 1	0	----------		Configuration for input data: 0: Immediately overwrite input data 1: Overwrite input data after acknowledgment
Transmission	0.1	Bit field	0 … 2	0	----------		Configuration of which information is transmitted in the input data: 0: Control and marker barcodes 1: Only marker barcodes 2: Only control barcodes

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
First character	0	unsign 8 bit	0 … 255	0	----------		First character of the detected control or marker barcode.
Second character	1	unsign 8 bit	0 … 255	0	----------		Second character of the detected control or marker barcode.
Third character	2	unsign 8 bit	0 … 255	0	----------		Third character of the detected control or marker barcode.

8.4.22 Module 23 – Tape value correction

Module ID: 1023 with submodule ID: 1

The module enables the *Tape value correction* functionality for correcting the deviation of the BCB from the correct (calibrated) millimeter scaling that results from the manufacturing process.

A suitable measuring device must be used to determine the real (calibrated) length of one meter of barcode tape (as printed). If, for example, one meter of tape corresponds to an actual (calibrated) length of *1001.4* mm, the value *10014* is entered in the *Real length* parameter of this module. The real length is specified with a resolution of 0.1 millimeters.

To use the exact resolution, it is useful to measure a longer section of BCB and convert the deviation to a length of one meter.

The *Range start* parameter must be configured according to the real starting value of the used barcode tape. If multiple, different BCBs are pieced together, the *Range end* parameter of the corrected section of tape must also be configured. The entire BCB is corrected with the default value of *10,000,000* for the range end.

The module contains parameters (with parameter data length of 10 bytes), but no input data and no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Real length	0	unsign 16 bit	0 … 65,535	10,000	mm/10		Real (calibrated) length of one meter of BCB (according to imprint).
Range start	2	unsign 32 bit	0 … 10,000,000	0	mm		The tape value is corrected with the *Real length* starting from this position.
Range end	6	unsign 32 bit	0 … 10,000,000	10,000,000	mm		The tape value is corrected with the *Real length* up to this position.

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8.4.23 Module 24 – Read quality

Module ID: 1024 with submodule ID: 1

The module enables the Read quality functionality for transmitting the BE 901 EPN read quality and for configuring the parameters for warning threshold, error threshold and smoothing of the read quality.

By transmitting the read quality, continuous monitoring is possible. The operator can immediately see when the read quality deteriorates due to wear or soiling.

Correct calculation of the reading quality

The evaluation of the reading quality is influenced by several factors, see chapter 4.5 "Evaluation of the read quality".

The signaling of the read quality is configured via the status information in module 6 (see chapter 8.4.8) and via the switching output functions in module 4 (see chapter 8.4.6) or module 5 (see chapter 8.4.7).

The module contains parameters (with parameter data length of 2 bytes) and input data (with input data length of 1 byte), but no output data.

Parameter	Rel. addr.	Data type	Value range	Default	Unit		Explanation
					Metr.	Inch	
Warning threshold read quality	0	unsign 8 bit	30 … 90	60	----------		Below this threshold for read quality in units of [%], the BE 901 EPN generates a warning event.
Error threshold read quality	1	unsign 8 bit	10 … 70	30	----------		Below this threshold for read quality in units of [%], the BE 901 EPN generates an error event.
Read quality smoothing	2	unsign 8 bit	0 … 100	5	----------		Insensitivity towards changes of the quality. The higher this value is, the less of an effect a change has on the read quality.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Read quality	0	unsign 8 bit	0 … 100	0	%	%	Read quality in units of [%] as smoothed value, dependent on the *Smoothing of read quality* parameter.

8.4.24 Module 25 – Device status

Module ID: 1025 with submodule ID: 1

The module signals various device states via input data.

The module contains input data (with input data length of 1 byte), but no parameters and no output data.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Device status	0	unsign 8 bit	0: Initial value 1: Initialization 10: Standby 11: Service 12: Diagnostics 15: Device is ready 128: Error 129: Warning	0	----------		This byte represents the current device status. The following event messages can be acknowledged via "Module 6 – Status and control" (output data bit 0.3): 128: Error 129 Warning
Input data length: 1 byte							

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8.4.25 Module 26 – Extended status

Module ID: 1026 with submodule ID: 1

Via input data, the module signals various pieces of extended status information, such as the current read direction of the barcode tape.

The module contains input data (with input data length of 2 bytes), but no parameters and no output data.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
Increasing tape direction	0.0	bit	0: Not increasing 1: Increasing	0	----------		The orientation between BE 901 EPN and barcode tape (BCB) results in an increasing read direction. If bits 0.0 and 0.1 are not set (0), no read direction can currently be determined.
Decreasing tape direction	0.1	bit	0: Not decreasing 1: Decreasing	0	----------		The orientation between BE 901 EPN and barcode tape (BCB) results in a decreasing read direction. If bits 0.0 and 0.1 are not set (0), no read direction can currently be determined.
Input data length: 2 bytes							

8.4.26 Module 28 - 16-bit position value

Module ID: 1028 with submodule ID: 1

Module for the output of the current position value as 16-bit value. The resolution of the position value is fixed and is one decimeter (100 mm) or one inch (in).

The display of the sign and the measurement unit can be changed in module 1 (see chapter 8.4.3).

In the default setting, the display is in two's complement and with metric units. If the 16-bit value range is exceeded, e.g., above an output value of 3.27675 km (= 32768 dm), the value zero (0) is transmitted as position value in this module.

The module contains input data (with input data length of 2 bytes), but no parameters and no output data.

Input data	Rel. addr.	Data type	Value range	Init value	Unit		Explanation
					Metr.	Inch	
16-bit position value	0	sign 16 bit	With two's complement: -32768 … 32767 With sign and magnitude: -32767 … 32767	0	dm (100 mm)	inch	Position value as 16-bit value with fixed resolution of one decimeter (100 mm) or one inch (in).
Input data length: 2 bytes							

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9 Commissioning – webConfig tool

The webConfig tool provides a graphical user interface based on web technology for the configuration of the BE 901 EPN.
The webConfig tool can be run on any Internet-ready PC. The webConfig tool uses HTTP as communication protocol and the client-side restriction to standard technologies (HTML, JavaScript and AJAX) that are supported by modern browsers.

The webConfig tool is offered in the following languages:
German, English, French, Italian, Spanish

NOTICE

Configuration changes via the webConfig tool have no effect in PROFINET!

↳ ***Always*** *perform the basic configuration using the GSDML file (see chapter 8 "Commissioning –* Basic configuration*").*

In process operation, only the parameters in the PROFINET modules set via the GSDML file or the PROFINET default presets are in effect. Parameter changes made via the webConfig tool are no longer in effect on the PROFINET.

The parameters for the timing of the switching inputs/outputs can only be adjusted with the webConfig tool.

If you switch the BE 901 EPN to the Service operating mode via the webConfig tool, the BE 901 EPN is disconnected from the PROFINET. All parameters set via the GSDML file initially remain in effect. Parameter changes can now be made via the webConfig tool for test purposes.

Settings configured with the webConfig tool are overwritten by the PROFINET master with the settings made via the GSDML file upon connection to PROFINET or after deactivation of the Service operating mode. Settings that cannot be configured via PROFINET, e.g., timing functions, are not overwritten.

NOTICE

BE 901 EPN configuration via webConfig tool

↳ *The webConfig tool displays* ***no*** *PROFINET parameters.*

↳ *The configuration data is saved in the device* ***and*** *in the connection hood.*

9.1 Install the software

In order for the BE 901 EPN to be automatically detected by the connected PC, the USB driver must be installed once on your PC. Administrator rights are required for driver installation.

If a USB driver for the webConfig tool is already installed on your computer, the USB driver does not need to be installed again.

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9.1.1 System requirements

Regularly update the operating system and the Internet browser.
Install the current Windows Service Packs.

Table 9.1: webConfig system requirements

Operating system	Windows 10 Windows 8, 8.1 Windows 7
Computer	PC, Laptop or Tablet with USB interface version 1.1 or higher
Graphics card	Min. 1280 x 800 pixels
Required disk space for USB driver	10 MB
Internet browser	A current version of: - Mozilla Firefox - Google Chrome - Microsoft Edge Other Internet browsers are possible, but not tested with the current device firmware.

9.1.2 Install USB driver

- Start your PC with administrator privileges and log on.
- Download the setup program from the Internet:
  www.tr-electronic.com/f/zip/TR-E-SW-MUL-0001
- Start the setup program and follow the instructions.

*Alternatively you can install the USB driver **LEO_RNDIS.inf** manually.*
Contact your network administrator if the installation failed.

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9.2 Start webConfig tool

Prerequisite: The USB driver for the webConfig tool is installed on the PC.

- Connect the operating voltage to the BE 901 EPN.
- Connect the SERVICE USB interface of the BE 901 EPN to the PC.

  The connection to the SERVICE USB interface of the BE 901 EPN is established via the PC-side USB interface.

  Use a standard USB cable with one Type A plug and one Mini-B type plug.
- Start the webConfig tool using your PC's Internet browser with IP address

  192.168.61.100
- ➢ The webConfig start page appears on your PC.

The user interface of the webConfig tool is largely self-explanatory.

The webConfig tool is completely contained in the firmware of the BE 901 EPN.

The pages and functions of the webConfig tool may appear and be displayed differently depending on the firmware version.

Clearing browser history:

The cache of the Internet browser must be deleted if different device types or devices with different firmware have been connected to the webConfig tool.

- Delete cookies and temporary Internet and website data from the browser history before starting the webConfig tool.

Note limit of Firefox sessions for version 30.0 and higher:

If the limited number of Firefox sessions is exceeded, it may no longer be possible to address the BE 901 EPN via the webConfig tool.

- Do **not** use the refresh functions of the Internet browser:

  [Shift] [F5] or [Shift] + mouse click

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9.3 Short description of the webConfig tool

9.3.1 Overview

Operating modes

For configurations with the webConfig tool, you can switch between the following operating modes:

- ***Process***
  The BE 901 EPN is connected to the control.
  - The process communication to the control is activated.
  - The switching inputs/outputs are activated.
  - Configuration and diagnostic functions available, cannot be changed.
  - *PROCESS* function available.
  - Alignment and maintenance function not available.

- ***Service***
  - The process communication to the control is interrupted.
  - The switching inputs/outputs are deactivated.
  - The configuration can be changed.
  - *PROCESS* function not available.
  - Alignment, configuration, diagnostic and maintenance functions available.

Operating mode ***Process***
The webConfig tool has the following main menus or functions in the operating mode *Process*:

- ***PROCESS***
  Check and save the current read data in process mode (see chapter 9.3.2).
  - Tabular display of the following values:
    Scan number, position, speed, read quality, distance from BCB and info on the control label

- ***CONFIGURATION*** (see chapter 9.3.4)
  Information on the current BE901 configuration – no change to the configuration:
  - Selection of the used barcode tape (30 mm grid or 40 mm grid)
  - Display of the tape value correction (deviation of the BCB from scaling)
  - Display of the device components (switching inputs/outputs, display)
  - Data processing (position / speed detection or monitoring, data preparation)
  - Display of the warning threshold and the error threshold for the read quality
  - Display of the interface parameters

Operating mode ***Service***
The webConfig tool has the following main menus or functions in the operating mode *Service*:

- ***ALIGNMENT*** (see chapter 9.3.3)
  - Display of the following values:
    Scan number, position, speed, quality, distance, number of labels in the scanning beam
  - Graphical displays of the following values:
    Position, speed, quality

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- ***CONFIGURATION*** (see chapter 9.3.4)
  - Configuration of device components (switching inputs/outputs, display)
  - Selection of the used barcode tape
  - Configuration of the data processing (position / speed detection or monitoring, data preparation)
  - Configuration of the warning threshold and the error threshold for the read quality
  - Configuration of the interface parameters

- ***DIAGNOSIS*** (see chapter 9.3.5)
  - Event logging of warnings and errors.

- ***MAINTENANCE*** (see chapter 9.3.6)
  - Firmware update
  - User management
  - Backup/Restore

9.3.2 *PROCESS* function

The *PROCESS* function serves to control the current measurement data in the *Process* operating mode.
The measurement results are output in tabular form – strictly as monitor output.
The **Pause/Start** icon can be used to interrupt and resume monitor recording.

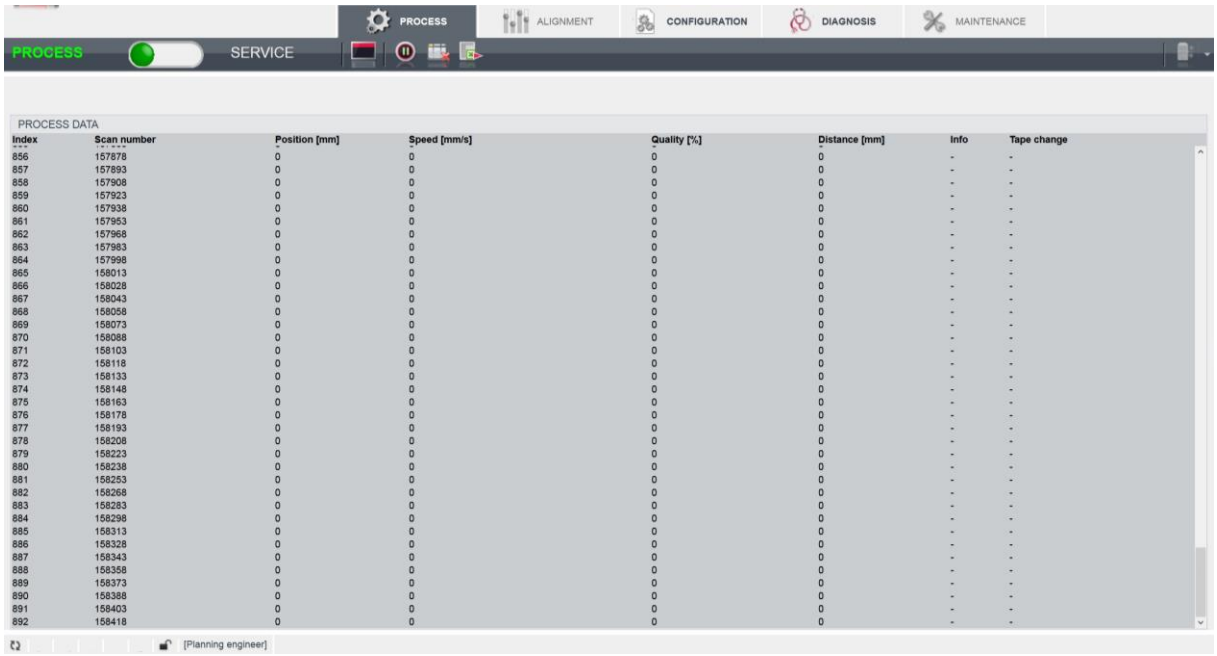

Figure 9.1: *PROCESS* webConfig function

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9.3.3 *ALIGNMENT* function

NOTICE

ALIGNMENT function only in the Service operating mode!

↳ *The BE 901 EPN can only be aligned using the ALIGNMENT function in the Service operating mode.*

The *ALIGNMENT* function serves to simplify mounting and alignment of the BE 901 EPN. The laser is to be activated via the **Start** icon so that the function can monitor and directly display the measurement values for position and speed and determine the optimum installation location.

In addition, reading quality (in %), working distance and the number of labels in the scanning beam can be displayed. Using this information, it is possible to assess how well the BE 901 EPN is aligned with the BCB.

During output of the read results, the BE 901 EPN is controlled by the webConfig tool.

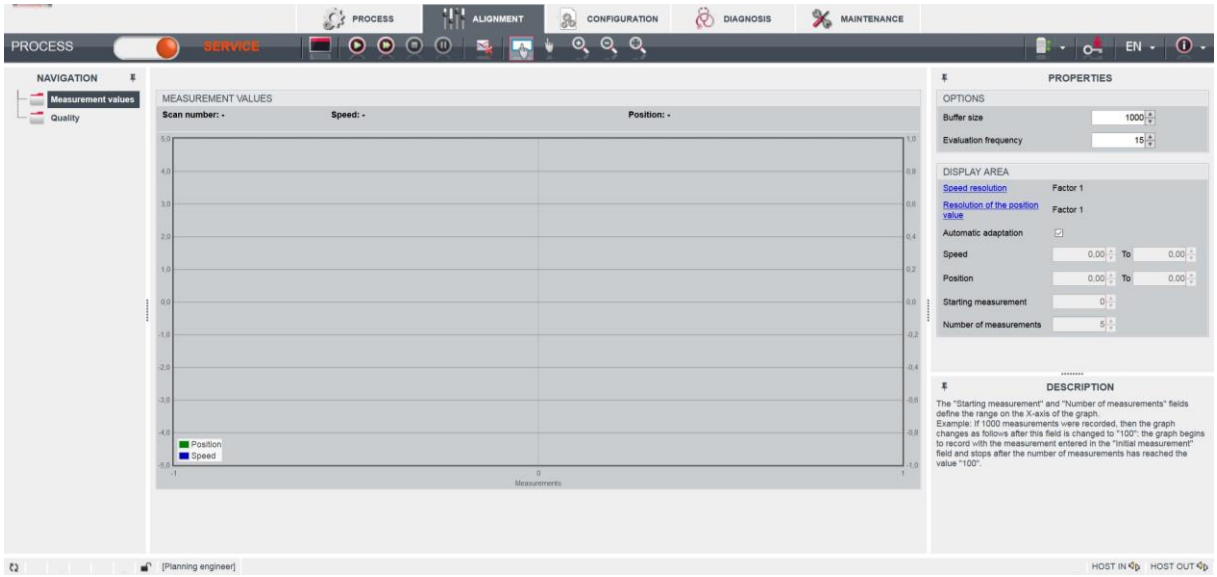

Figure 9.2: *ALIGNMENT* webConfig function

9.3.4 *CONFIGURATION* function

NOTICE

Configuration changes only in the Service operating mode!

↳ *Changes made using the CONFIGURATION function can only be performed in the Service operating mode.*

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Overview of the webConfig configuration functions:

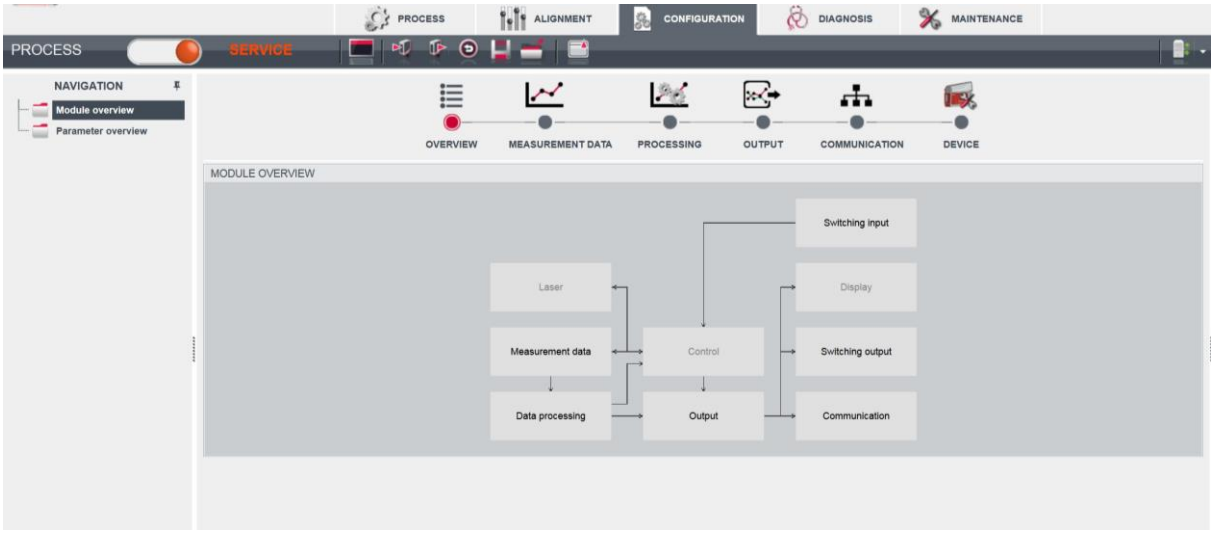

Figure 9.3: *CONFIGURATION* webConfig function

Configuration of the switching inputs/outputs (*DEVICE* tab):

- I/O mode: switching input or switching output *
- Output function *
- Function input *
- Timing functions
  - Signal delay **
  - Pulse duration **
  - Switch-on/switch-off delay **
  - Debounce time **
  - Inversion yes/no *

webConfig configuration parameters

**: PROFINET parameters, see chapter 8.4*
***: Parameter can only be configured via webConfig*

NOTICE

Start-up configuration of the switching inputs and outputs!

- *The configuration for switching inputs and outputs SWIO 1 and SWIO 2 is generally performed via the GSDML file.*

  The settings configured with the webConfig tool that differ from the GSDML configuration are overwritten on startup by the PROFINET master with the settings made via the GSDML file. Settings that cannot be configured via PROFINET, e.g., timing functions, are not overwritten.
- *The PROFINET modules 4 and 5 configure switching inputs and outputs (I/O's) SWIO 1 and SWIO 2 (see chapter 8.4.6 and see chapter 8.4.7), e.g.*
  - *whether SWIO 1 and SWIO 2 operate as input or output*
  - *which events act on the output*
  - *the function of the input*

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Timing functions of the switching inputs/outputs:

The timing functions (e.g., startup delay) can **only** be configured with the webConfig tool.
The configuration of the timing functions is not overwritten by the PROFINET master on startup.

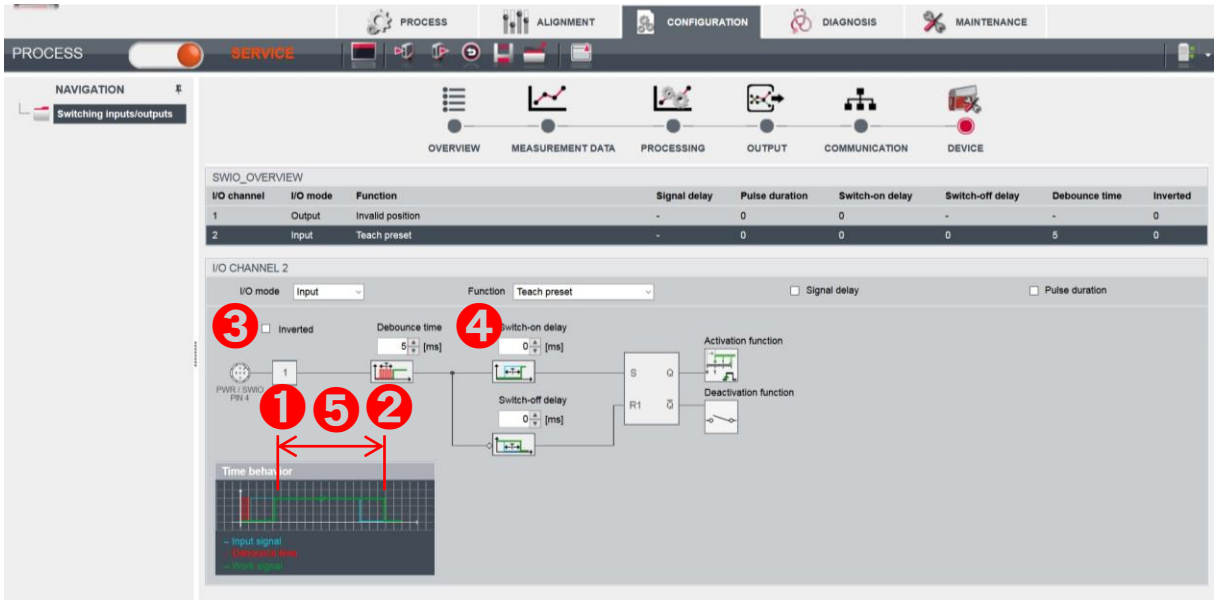
- Start-up delay

  With this setting, the output pulse is delayed by the specified time (in ms).

- Switch-on time

  Defines the switch-on time period for the switching input. Any activated switch-off function then no longer has any function.

  If the output is deactivated via the switch-off signal before the startup delay lapses, only a brief pulse appears at the output following the startup delay.



1: Start-up signal
2: Switch-off signal
3: Output
4: Start-up delay
5: Switch-on time

Figure 9.4: Start-up delay > 0 and switch-on time > 0

- Debounce time

  Parameter for setting the software debounce time for the switching input. The definition of a debounce time extends the signal transition time accordingly.

  If this parameter has the value 0, no debouncing takes place. Otherwise, the set value corresponds to the time (in ms) that the input signal must be present and stable.

- Switch-off delay

  This parameter specifies the duration of the switch-off delay (in ms).

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Configuration of the barcode tape selection and tape value correction
(*MEASUREMENT DATA* tab, *Barcode tape*)

- Barcode tape with 30 mm grid (BCB G30) or 40 mm grid (BCB G40) *
- Tape value correction **

Configuration of position detection
(*DATA PROCESSING* tab, *Position >Detection*)

- Integration depth *
- Scaling free resolution *
- Preset *
- Offset *
- Error handling procedures *

Configuration of position monitoring
(*DATA PROCESSING* tab, *Position > Monitoring*)

- Position limit value 1/2 *

Configuration of speed detection
(*DATA PROCESSING* tab, *Speed > Detection*)

- Speed measurement averaging *
- Scaling free resolution *
- Error handling procedures *

Configuration of speed monitoring
(*DATA PROCESSING* tab, *Measurement data > Speed > Monitoring*)

- Speed limit value 1-4 *

Configuration of the measurement value display
(*DATA PROCESSING* tab, *General preparation*)

- Unit * (Unit of measurement metric or inch)
- Count direction *
- Output mode sign *

Configuration of monitoring of the read quality
(*DATA PROCESSING* tab, *Read quality*)

- Warning threshold for read quality in %**
- Error threshold for read quality in % **

Configuration of the data output
(*DATA PROCESSING* tab, *Output, Preparation*)

- Position resolution *
- Speed resolution *

Configuration of the communication data
(*COMMUNICATION* tab)

- Parameters of the PROFINET interface
  The PROFINET parameters are displayed for viewing only.
- Configuration of the SERVICE USB interface

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9.3.5 *DIAGNOSIS* function

The *DIAGNOSTICS* function is available in the Process and Service operating modes.
The device event log is displayed with the *DIAGNOSTICS* function.

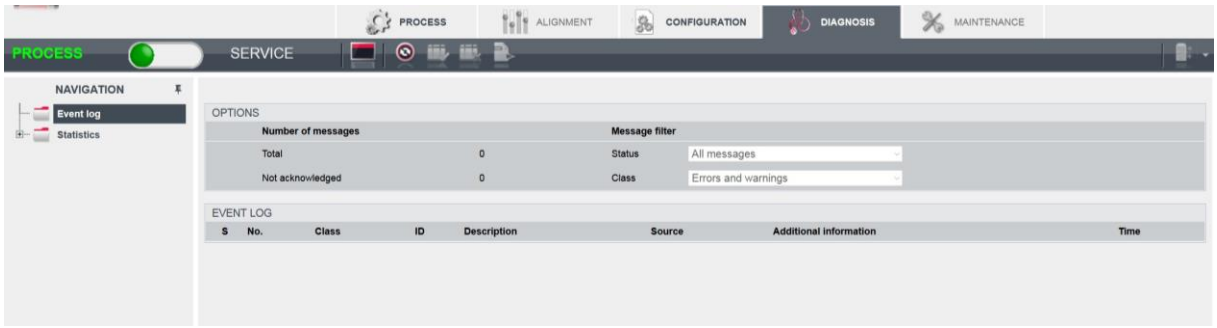

Figure 9.5: *DIAGNOSTICS* webConfig function

9.3.6 *MAINTENANCE* function

The *MAINTENANCE* function is only available in the Service operating mode.

Functionalities:

- User management
- Devices Backup/Restore
- Firmware update
- System clock
- Setting of the user interface

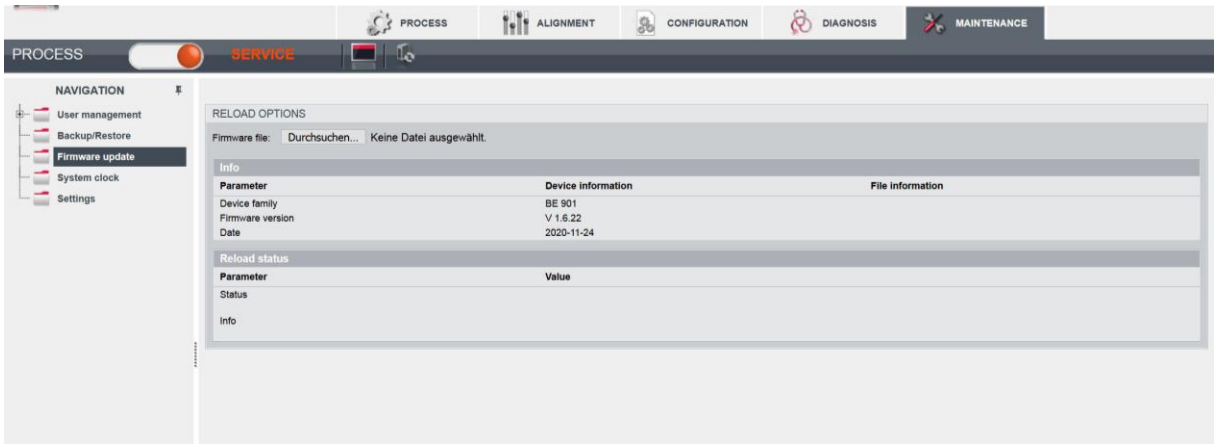

Figure 9.6: *MAINTENANCE* webConfig function

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9.4 The role concept of the webConfig users

The web-based graphical operating program is structured in such a way as to create a logical operating sequence, which depends on the activities to be performed and the associated roles. This means that all activities that belong to a work step or a role are arranged close together (if possible on a control panel)

9.4.1 Roles

The webConfig operating concept provides the following roles for the customer:

- "Observer" Display of general information
- "Operator" Operating the sensor
- "Maintenance" Operate and set up the sensor
- "Planning Engineer" Advanced competences, eg: Manage projects

These roles serve the end customer to operate the system. In addition, there are 3 further roles, which are used by TR-Electronic GmbH for user support, device setup and test purposes. The authorizations of the individual roles are to be understood in ascending order.

Assigning roles as a "Planning Engineer".

In order to preserve all access rights to the measurement system, a role "Planning Engineer" must be created before the installation of further roles. As a "Planning Engineer", subordinate roles can be managed.

The following definitions show what the individual roles are and what the difference are.

9.4.1.1 The role "Observer"

The "Observer" takes a purely passive role. The Observer can only see the general device data that is offered on the main page and does not need a password to log in because it has no other powers. An observer can also be called a "guest".

Allowed activities:

- See general / public data:
  - Main page
  - Nameplate
  - Hardware and software version numbers
  - Installation description
  - Technical specifications
- Login

An "Observer" can't change any device parameters and can't place the device in a different operating state ("Process" or "Service" mode).

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9.4.1.2 The role “Operator”

The "Operator" is a pure operator of the sensor, which accompanies / monitors the production process ("Process" mode). The “Operator” is also an “Observer”. It can read the parameters of the production plant but not change it.

Allowed activities:

- *Allowed activities of the role "Observer"*
- Perform adjustment actions without changing the parameter properties of the device.
- Switching the operating state ("Process" mode, "Service" mode)
- Restart the device ("Reset")
- Viewing selected device parameters
- Viewing selected production parameters
- Monitoring the current production progress (current result, production statistics, error messages)
- Calling diagnostic functions with a reading character:
  - Read the event log
  - Confirm the event log
  - Read the statistics
  - Read firmware information

9.4.1.3 The role “Maintenance”

A "Maintenance" worker is an operator who can influence the production operation within the limits specified by the current profile (set threshold values) and call diagnostic functions.

Allowed activities:

- *Allowed activities of the role "Operator"*
- Advanced switching of the operating state ("Host In"/"Host Out" switch)
- Performing "Teach" functions to parameterize the device
- Change selected device parameters
- Change I/O parameters ("Digital I/O" and communication parameters)
- Resetting process-related statistics
- Delete event log

9.4.1.4 The role “Planning Engineer”

A "Planning Engineer" (or "Specialist"/"Supervisor") controls the production process by creating profiles/projects beyond the maintenance role, managing test programs and changing their processes. It can modify I/O parameters, update firmware, and manage users (roles).

Allowed activities:

- *Allowed activities of the role "Maintenance"*
- Resetting the unit to factory settings
- Create / delete test programs (run-oriented sensor)
- Edit the program sequence (create, delete or change tools, run-oriented sensor)
- Manage user data (create, delete or change users)
- Set startup role (Observer, Operator, Maintenance or Planning Engineer)
- Reset selected statistics (customer)
- Update firmware (customer)

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10 Diagnostics and troubleshooting

10.1 What to do in case of failure?

After switching on the BE 901 EPN, display elements (see chapter 3.3) assist in checking the proper function and troubleshooting.
In case of error, you can determine the error from the LED displays. With the error message you can determine the cause of the error and initiate measures to rectify it.

- Switch off the system and leave it switched off.
- Analyze the cause of the error using the operation indicators, the error messages and the diagnostic tools (also with the help of the webConfig tool, *DIAGNOSTICS* tab) and rectify the error.

NOTICE

Contact TR-Electronic GmbH.

- *If you are unable to rectify a fault, contact the TR-Electronic GmbH.*

10.1.1 PROFINET-specific diagnostics

The following diagnostics options are available with PROFINET:

- Event-related diagnostics
- State-related diagnostics

The BE 901 EPN uses the event-related diagnostics for high-prioritized events/errors and the state-related diagnostics for preventative maintenance and the signaling of low-prioritized events or warnings.

Event-related diagnostics:

PROFINET transmits events within an automation process as alarms that must be acknowledged by the application process.

The following events are possible:

- Process alarms: Events that originate from the process and are reported to the control.
- Diagnostic alarms: Events that indicate the malfunctioning of an IO device.
- Maintenance alarms: Transmission of information to avoid the failure of a device through preventative maintenance work.
- Manufacturer-specific diagnostics

To identify the alarms uniquely, they are always reported via a slot/subslot.
The user can prioritize diagnostic and process alarms differently.
In addition, all alarms are entered into the diagnostics buffer. The diagnostics buffer can be read by a superior instance via acyclic read services.

State-related diagnostics:

To report malfunctioning or status changes in a field device to a system control, it is possible to enter low priority diagnostics messages or status messages only in the diagnostic buffer instead of actively reporting them to the superior control. This option can also be used for preventative maintenance or for low-priority warnings, for example.

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Table 10.1: BE 901 EPN alarm and diagnostic messages

Diagnos-tics	Description	BE 901 EPN-category	API/ Slot/ Subslot	Type	Coming/ going
Parameter error	Error in the configuration of a module.	Error	0/nn = Module-number/ 0	Diagnostic alarm Only diagnostic or process alarms actually trigger the sending of an alarm. All other types (preventive maintenance or status messages) only mean an entry in the diagnostic buffer and thus belong to the status-based diagnostics.	Coming
Configurati on error	Error in the configuration of a module.	Error	0/n/0	Diagnostic alarm	Coming

10.1.2 Diagnostics with webConfig tool

System events are displayed in the webConfig tool via the *DIAGNOSTICS* tab. Noteworthy system events are recorded in the event log. Depending on their importance, the events are classified as info, warning, error and critical error.

The statistics counters detect the number of all recorded as well as non-acknowledged messages. With the message filters, the events can be filtered according to their status and their class.

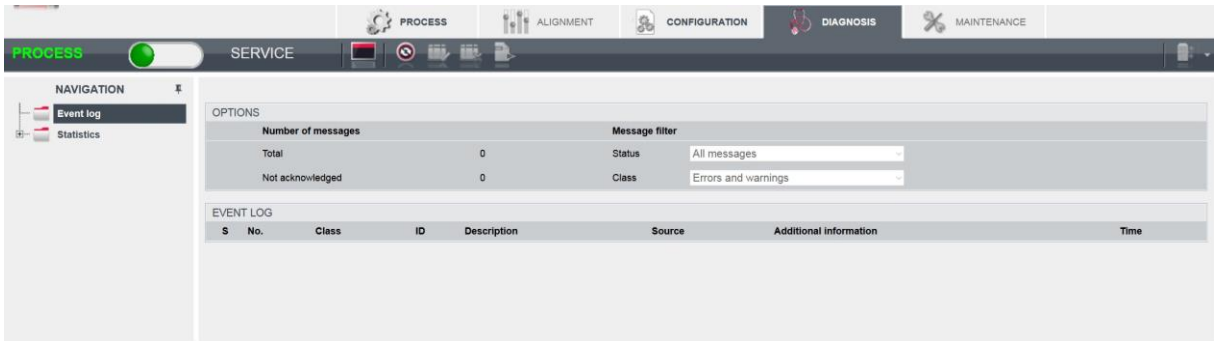

Figure 10.1: *DIAGNOSTICS* webConfig function

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10.2 Operating indicators of the LEDs

You can ascertain general causes of errors via the PWR and BUS status LEDs (see Table 10.5).

Table 10.2: PWR LED displays – causes and measures

Faults	Possible cause	Measures
Off	- No supply voltage connected to the device - Hardware error	- Check supply voltage - Contact TR-Electronic GmbH
Green, flashing	- Device is being initialized	
Red, flashing	- No barcode in the scanning beam - No valid measurement value	- Query BCB diagnostic data and carry out the resulting measures (see chapter 10.4 “Checklist for causes of errors”)
Red, continuous light	- Error - Device function is limited - Internal device error	- Determine the cause of the device error using the event log of the webConfig diagnostics - Contact TR-Electronic GmbH
Orange, continuous light	- Device in *Service* mode	- Reset the device to *Process* mode using the webConfig tool

10.3 Error messages on the display

Via the optional display of the BE 901 EPN, the device outputs the following possible error status information while it has the *BE901 Info* device status:

- *System OK*: BE 901 EPN operating error-free.
- *Warning*: Warning message. Query device status using PROFINET module 6.
- *Error*: Device function is not ensured.

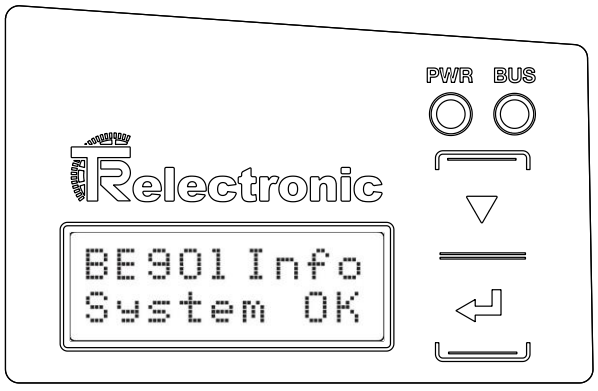

Figure 10.2: Example: Device status/error status information on the display

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10.4 Checklist for causes of errors

Table 10.3: Service interface errors – causes and measures

Error	Possible cause	Measures
webConfig does not start	- Incorrectly connected interconnection cable - Connected BE 901 EPN is not recognized - No communication via USB service interface - Old webConfig configuration in the browser cache - IP address not correct	- Check interconnection cable - Install USB driver - Clear browser history

Table 10.4: Process interface errors – causes and measures

Error	Possible cause	Measures
Sporadic network errors	- Check wiring for proper contacting	Check wiring: - Enter the correct IP address in the browser. Default IP address, see Chapter 9.2 "Start webConfig tool". - Check wire shielding - Check wires used
	- EMC coupling	- Observe contact quality of screwed or soldered contacts in the wiring - Avoid EMC coupling caused by power cables laid parallel to device lines - Separate laying of power and data communications cables
	- Network expansion exceeded	- Check max. network expansion as a function of the max. cable lengths

Table 10.5: LED indicators - interface errors – causes and measures

Error	Possible cause	Measures
BUS LED “Off”	- No supply voltage connected to the device	- Check supply voltage
	- Device not yet recognized by the PROFINET	- Check device name, check link and activity LEDs on the connection hood
	- Hardware error	- Contact TR-Electronic GmbH
BUS LED “red flashing”	- Incorrect wiring	- Check wiring
	- Communication error: Configuration failed - IO Error: “no data exchange”	- Check configuration, in particular with respect to address assignment - Carry out a reset on the control
	- Communication error on the PROFINET: No communication established to the IO controller (“no data exchange”)	- Check protocol settings - Check configuration, in particular with respect to address assignment (device names/IP address/MAC ID)
	- Protocol not released	- Activate TCP/IP or UDP
	- Wrong device name set	- Check configuration, in particular with respect to address assignment
	- Incorrect configuration	- Check configuration, in particular with respect to address assignment
	- Different protocol settings	- Check protocol settings

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Table 10.6: Position measurement errors – causes and measures

Error	Possible cause	Measures
Measurement value or read quality is continuously instable	- Soiling of the BE 901 EPN optics	- Clean the optics of the BE 901 EPN
Measurement value or read quality is poor - at certain position values - always at the same position values	- Soiling of the barcode tape	- Clean the barcode tape - Replace the barcode tape
No measurement value can be determined	- No code in scanning beam - Code not in the working range of the BE 901 EPN	- Align the scanning beam with the barcode tape - Align the BE 901 EPN with the barcode tape (working range 50 mm … 170 mm)
Faulty measurement value	- Wrong barcode tape - BCB grid different from BE901 configuration - Preset or offset active - Wrong unit of measurement or resolution configured	- Change BE901 configuration to the barcode tape that is being used

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11 Care, maintenance and disposal

11.1 Cleaning

If there is dust on the BE 901 EPN device:

↳ Clean the BE 901 EPN device with a soft cloth; use a cleaning agent (commercially available glass cleaner) if necessary.

NOTICE

Do not use aggressive cleaning agents!

↳ *Do not use aggressive cleaning agents such as thinner or acetone for cleaning the BE 901 EPN device.*

11.2 Servicing

The BE 901 EPN does not normally require any maintenance by the operator. Repairs to the device must only be carried out by the manufacturer.

↳ For repairs, contact TR-Electronic GmbH.

11.2.1 Firmware update

A firmware update can only be performed by TR-Electronic GmbH.

↳ For firmware updates, contact TR-Electronic GmbH.

11.2.2 BCB repair with repair kit

If the barcode tape has been damaged, e.g. by falling parts, you can download a repair kit for the BCB.

NOTICE

Do not use the BCB repair kit on a permanent basis!

↳ *Use the barcode tape created with the repair kit only temporarily as an emergency solution.*

The optical and mechanical properties of the self-printed barcode tape do not correspond to those of the original barcode tape.

Self-printed barcode tape should not remain in the system on a permanent basis.

↳ *Original repair tapes can be ordered on request from TR-Electronic GmbH.*

Repair kit download:

BCB G30: **www.tr-electronic.com/f/zip/TR-E-TI-MUL-0109**
0.9 m of barcode tape is provided on each A4 sheet.
Five lines of 18 cm with six code-information segments of 30 mm each
Tape lengths: 0 ... 9999.99 m in different files per 500 m

BCB G40: **www.tr-electronic.com/f/zip/TR-E-TI-MUL-0110**
1 m of barcode tape is provided on each A4 sheet.
Five lines of 20 cm with five code-information sections of 40 mm each
Tape lengths: 0 ... 9999.99 m in different files per 500 m

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Replacing a section of defective barcode tape:

- Determine the coding of the defective area.
- Print out the coding for the given area.
- Affix the printed code over the defective section of barcode tape.

NOTICE

Printing coding

- *Select only those pages that are actually required.*
- *Change the printer settings so that the barcode is not distorted.*
- *Check the print results and measure the distance between two barcodes:*
  - *BCB G40: 40 mm (see Figure 11.1)*
  - *BCB G30: 30 mm (see Figure 11.2)*
- *Cut the code strips and arrange them next to one another. The code content must always increase or decrease in increments of 30 mm or 40 mm.*

  Check that the printed values increase by 3 or 4.

Figure 11.1: Checking the print results of the BCB G40 repair kit (40 mm grid)

Figure 11.2: Checking the print results of the BCB G30 repair kit (30 mm grid)

11.3 Disposing

- For disposal observe the applicable national regulations regarding electronic components.

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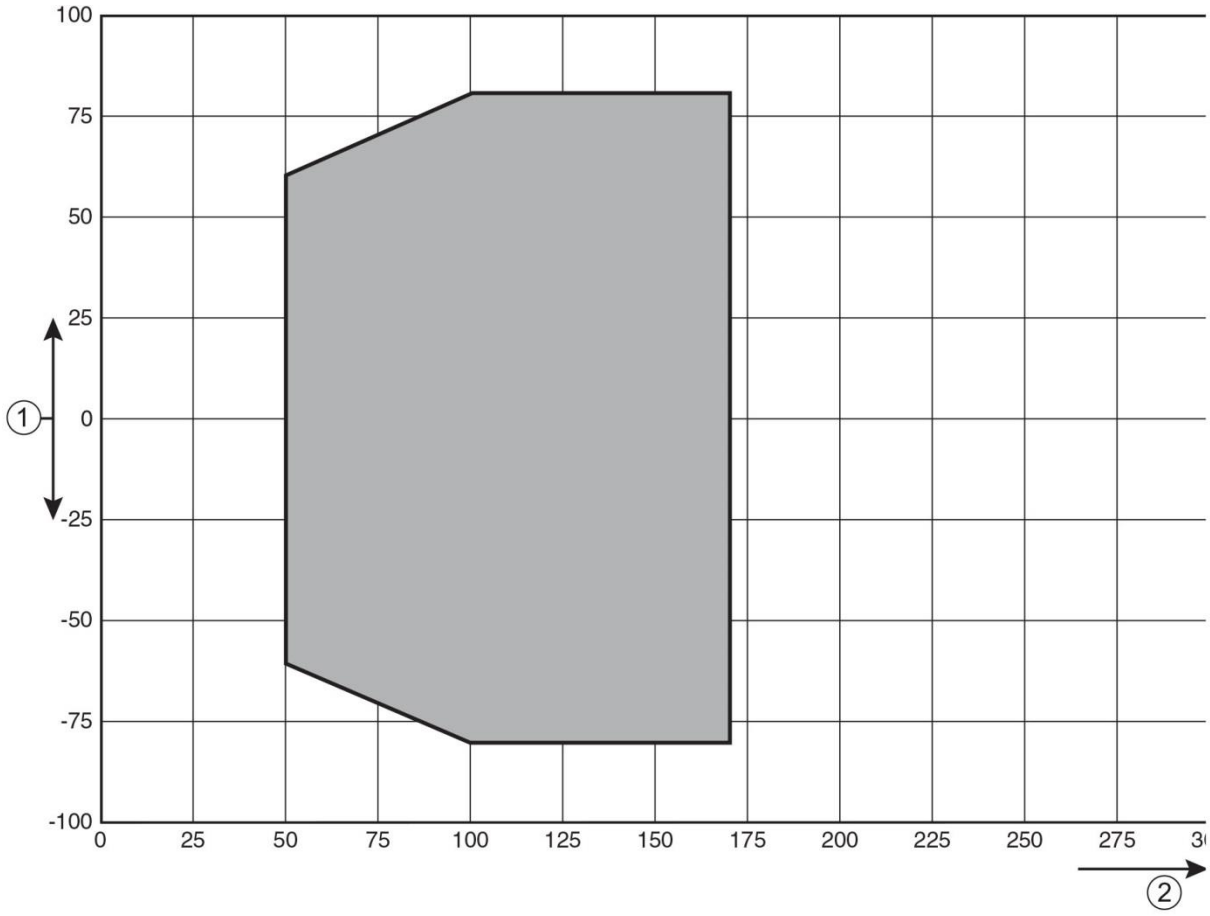
12 Technical data

12.1 General specifications

Table 12.1: Optics

Light source	Laser diode
Wavelength	655 nm
Pulse duration	< 150 µs
Max. output power	1.8 mW
Life expectancy laser diode	100,000 h (typ. at +25 °C)
Beam deflection	Via rotating polygon wheel
Exit window	Glass
Laser class	1 according to IEC/EN 60825-1:2014
Working range	50 mm … 170 mm At a reading distance of 50 mm, the reading field width is 120 mm. At a reading distance beyond 100 mm, the reading field width is 160 mm (see Figure 12.1: BE 901 EPN reading field curve).



1: Reading field width [mm]
2: Reading distance [mm]

Figure 12.1: BE 901 EPN reading field curve

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Table 12.2: Measurement data

Reproducibility (1 sigma)	± 0.05 mm
Output time	2 ms
Response time	8 ms factory setting (adjustable)
Basis for contouring error calculation	4 ms
Measurement range	0 … 10,000,000 mm
Resolution	0.1 mm factory setting (adjustable)
Max. traverse rate	10 m/s

Table 12.3: Operating and display elements

Display	Monochromatic graphical display, 128 x 32 pixels, With background lighting
Keyboard	Two buttons
LEDs	Two LEDs for power (PWR) and bus state (BUS), two-colored (red/green)

Table 12.4: Mechanical data

Housing	Diecast aluminum
Connection technology	- BE 901 EPN with BE 901 MS EPN: M12 connectors - BE 901 EPN with BE 901 MK EPN: Terminal blocks with spring cage terminals (5-pin)
Degree of protection	IP 65
Weight	Approx. 580 g (without connection hood)
Dimensions (without connection hood)	(H x W x D) 108.7 mm x 100.0 mm x 48.3 mm
Dimensions (with BE 901 MS EPN connection hood)	(H x W x D) 108.7 mm x 100.0 mm x 48.3 mm
Dimensions (with BE 901 MK EPN connection hood)	(H x W x D) 147.4 mm x 100.0 mm x 48.3 mm
Dimensions of BE 901 MS EPN connection hood	(H x W x D) 64.0 mm x 43.5 mm x 33.5 mm
Dimensions of BE 901 MK EPN connection hood	(H x W x D) 64.0 mm x 43.5 mm x 83.5 mm

Table 12.5: Environmental data

Air humidity	Max. 90% rel. humidity, non-condensing
Vibration	IEC 60068-2-6, test Fc
Shock Continuous shock	IEC 60068-2-27, test Ea
Electromagnetic compatibility	IEC 61000-6-3 IEC 61000-6-2 (contains IEC 61000-4-2, -3, -4, -5, -6)

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Table 12.6: Product Reliability

MTTF	83 years *
$MTTF_d$	166 years *

* at 25 °C ambient temperature

Table 12.7: Certifications, conformity

Conformity	CE, CDRH
Certifications	UL 60950-1, CSA C 22.2 No. 60950-1

⚠ CAUTION

UL applications!

For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

12.1.1 BE 901 EPN without heating

⚠ CAUTION

UL applications!

For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

Table 12.8: Electrical equipment

Interface type	PROFINET-RT with integrated switch for BUS IN and BUS OUT Protocol: PROFINET RT communication Conformance Class: B
Service USB interface	Mini-B type USB 2.0 socket
Switching input/Switching output	Two switching inputs/outputs Functions are freely programmable via PROFINET interface Switching input: 18 … 30 VDC, depending on supply voltage, I max. = 8 mA Switching output: 18 … 30 VDC, depending on supply voltage, I max. = 60 mA (short-circuit proof) Switching inputs/outputs protected against polarity reversal!
PWR LED green	Device ready (power on)
Operating voltage U_B	18 … 30 VDC (Class 2, safety class III)
Power consumption	max. 3.7 W

Table 12.9: Ambient temperature

Ambient temperature (operation)	-5 °C … +50 °C
Ambient temperature (storage)	-35 °C … +70 °C

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12.1.2 BE 901 EPN with heating

⚠ CAUTION

UL applications!

For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).

Table 12.10: Electrical equipment

Operating voltage UB	18 … 30 VDC
Power consumption	Max. 17.7 W
Structure of the heating	Housing heating and separate heating of the optics glass
Warmup time	Minimum 30 min at +24 VDC and an ambient temperature of -35 °C
Minimum conductor cross section	Conductor cross section of at least 0.75 mm² for the supply voltage supply line. **Note:** Wiring through of the voltage supply to multiple heating devices is not permissible. Standard, M12 ready-made cable not usable (insufficient conductor cross section).

Table 12.11: Ambient temperature

Ambient temperature (operation)	-35 °C … +50 °C
Ambient temperature (storage)	-35 °C … +70 °C

12.2 Barcode tape

Table 12.12: BCB dimensions

	BCB G40	**BCB G30**
Grid	40 mm	30 mm
Standard height	47 mm, 25 mm	47 mm, 25 mm
Length	0 … 5 m, 0 … 10 m, 0 … 20 m, …,0 … 150 m, 0 … 200 m; Special lengths and special coding (see chapter 13.5)	0 … 5 m, 0 … 10 m, 0 … 20 m, …,0 … 150 m; Special lengths and special coding (see chapter 13.5)
Tape tolerance	± 1 mm per meter	± 1 mm per meter

NOTICE

Twin tapes on request

↳ *Twin tapes can be ordered on request (see chapter 13.5 “Barcode tapes”).*

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Table 12.13: BCB structure

Manufacturing process	Film setting
Surface protection	Polyester, matt
Base material	Polyester film, affixed without silicone
Adhesive	Acrylate adhesive
Strength of adhesive	0.1 mm
Adhesive strength (average values)	On aluminum: 25 N/25 mm On steel: 25 N/25 mm On polycarbonate: 22 N/25 mm On polypropylene: 20 N/25 mm

Table 12.14: BCB structure

Recommended processing temperature	0 °C … +45 °C
Ambient temperature	-40 °C … +120 °C
Dimensional stability	No shrinkage, tested according to DIN 30646
Curing	Final curing after 72 h; the BE 901 EPN can detect the position immediately after the BCB is affixed.
Tear resistance	150 N
Elongation at tear	Min. 80%, tested in accordance with DIN 50014, DIN 51220
Weathering resistance	UV-light, humidity, salt spray (150 h/5 %)
Chemical resistance (tested at 23 °C for 24 h)	Transformer oil, diesel oil, white spirit, heptane, ethylene glycol (1:1)
Behavior in fire	Self-extinguishing after 15 s, does not drip
Mounting surface	Grease-free, dry, clean, smooth
Mechanical properties	Scratch and wipe resistant, UV resistant, moisture resistant, partly chemical resistant

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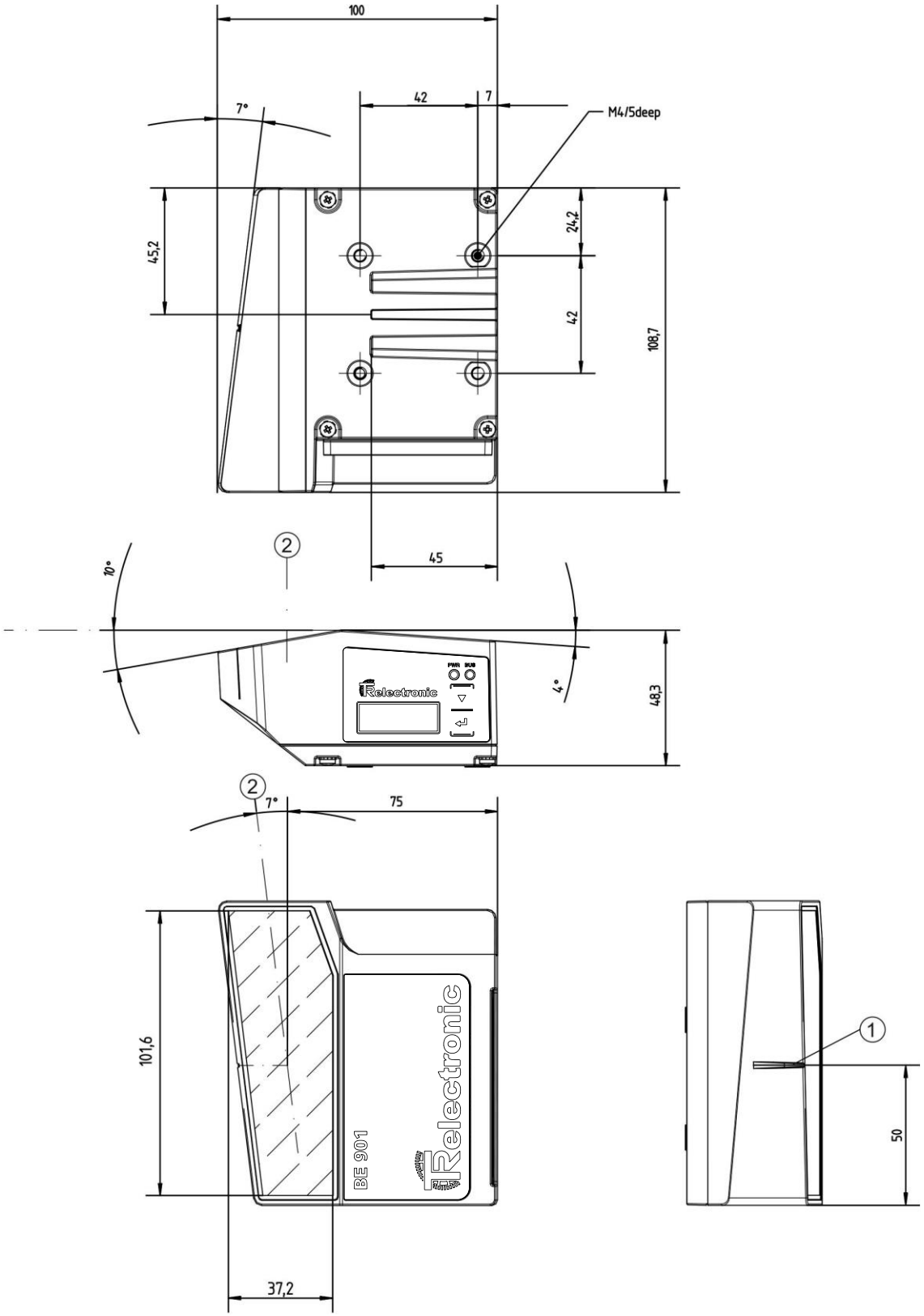
12.3 Dimension drawings



1: Reference point for the barcode position
2: Optical axis

Figure 12.2: Dimension drawing BE 901 EPN without connection hood (all dimensions in mm)

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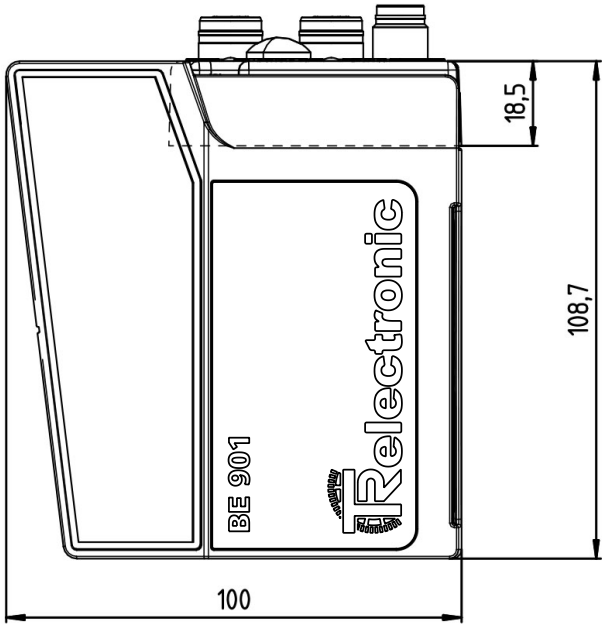

Figure 12.3: Dimension drawing BE 901 EPN with BE 901 MS EPN connection hood (all dimensions in mm)

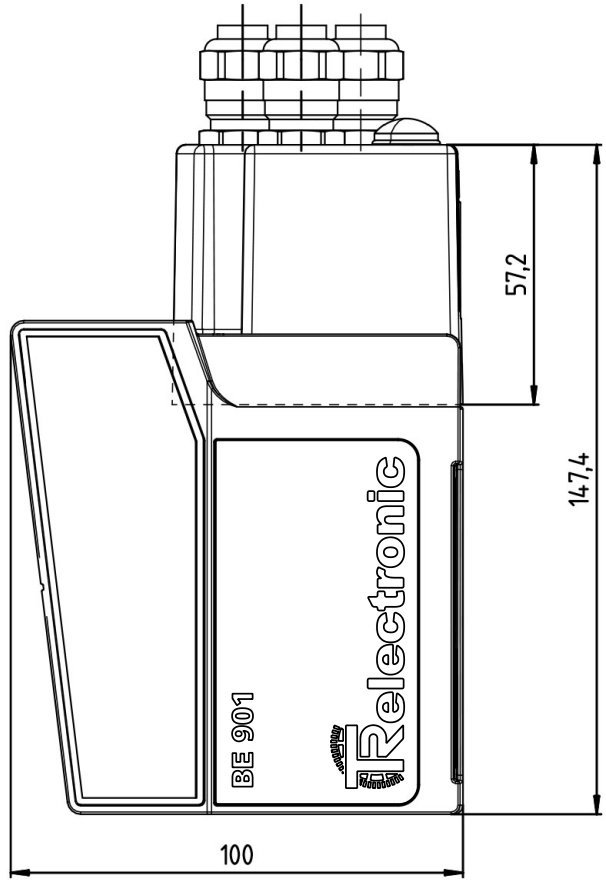

Figure 12.4: Dimension drawing BE 901 EPN with BE 901 MK EPN connection hood (all dimensions in mm)

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12.4 : Accessories dimension drawings

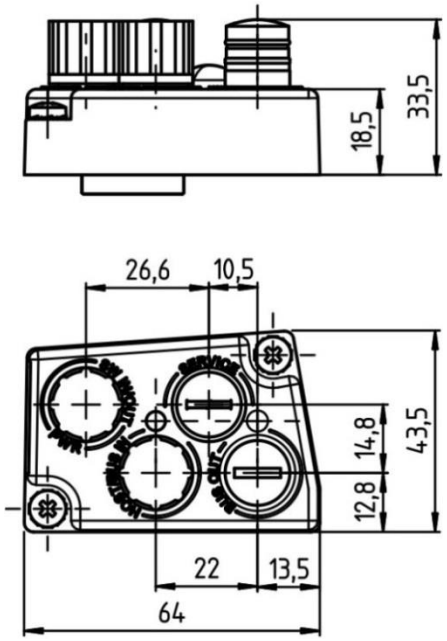

Figure 12.5: Dimension drawing BE 901 MS EPN connection hood (all dimensions in mm)

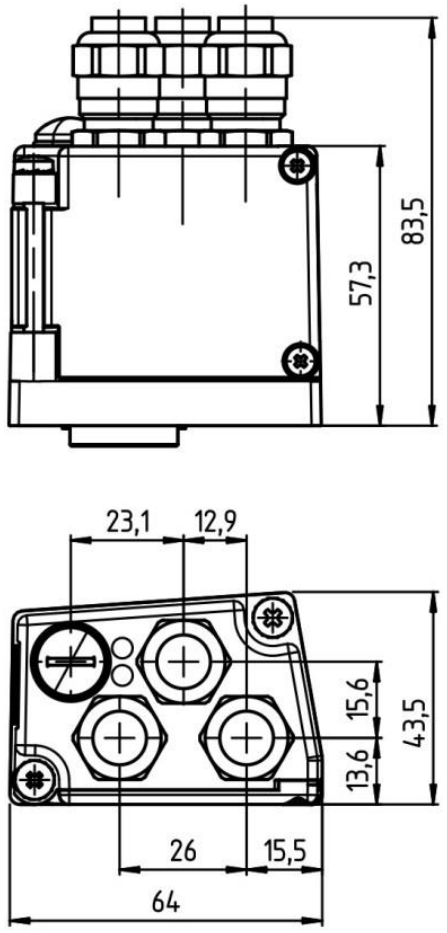

Figure 12.6: Dimension drawing BE 901 MK EPN connection hood (all dimensions in mm)

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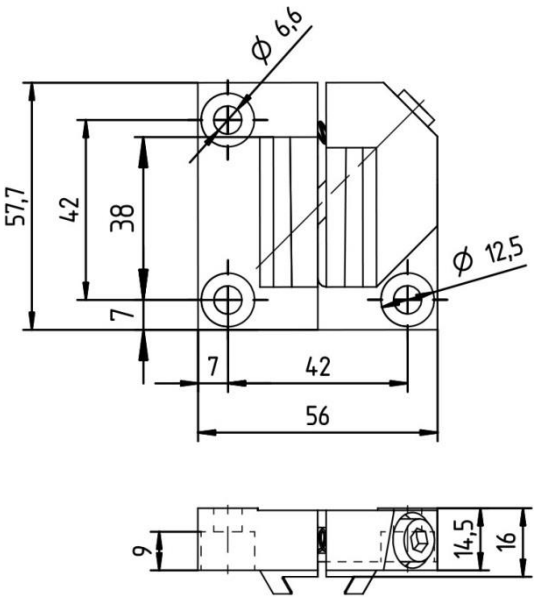

Figure 12.7: Dimension drawing BE 901 FA-001 mounting device (all dimensions in mm)

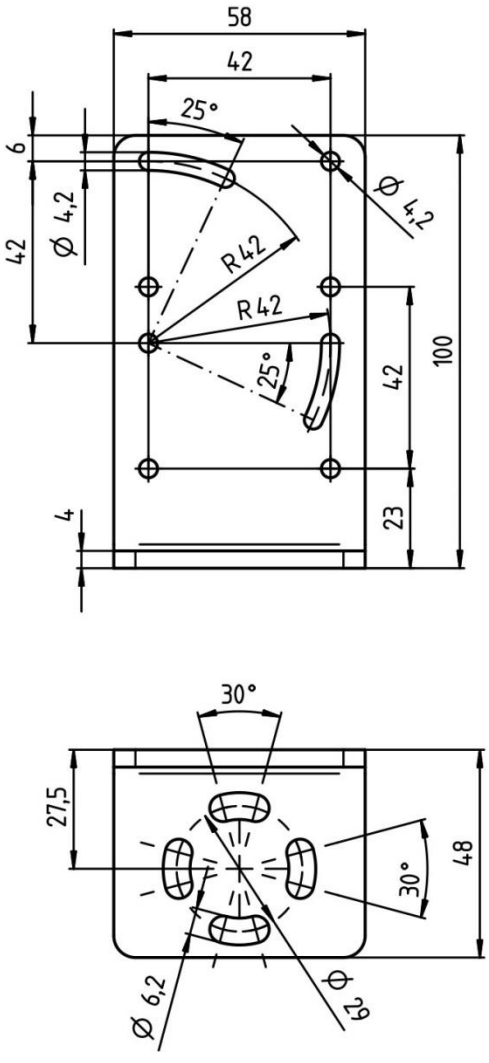

Figure 12.8: Dimension drawing BE 901 FA-002 mounting device (all dimensions in mm)

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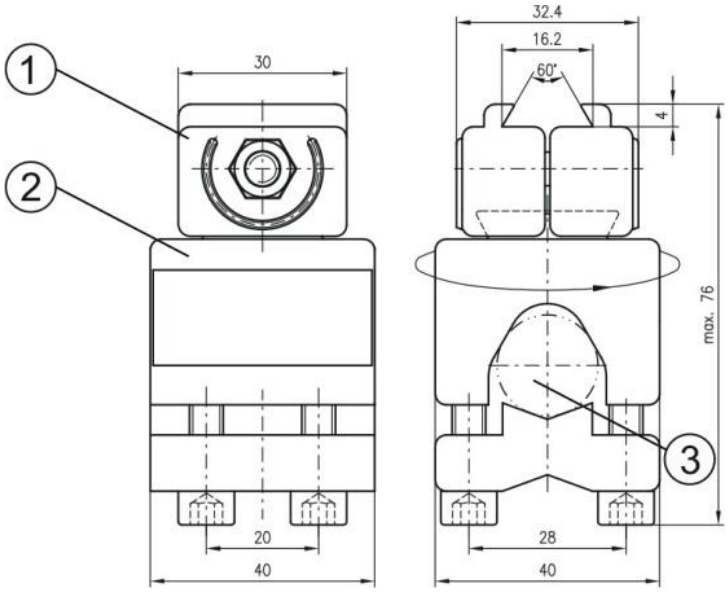

1: Clamping jaws for mounting on the BE 901 EPN
2: Clamp profile for fastening to round or oval pipes (Ø 16 … 20 mm)
3: Rod holder, turnable 360 °

Figure 12.9: Dimension drawing BE 90 FA-001 mounting device (all dimensions in mm)

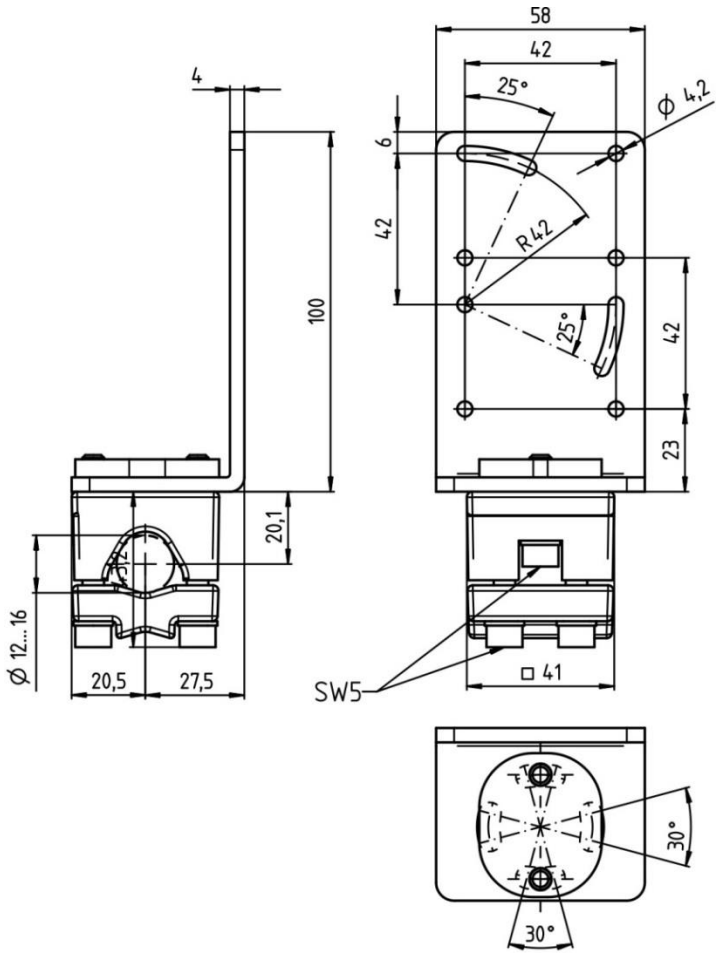

Figure 12.10: Dimension drawing BE 901 FA-003 mounting device (all dimensions in mm)

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12.5 Barcode tape dimension drawings

Figure 12.11: Dimension drawing barcode tape BCB G40 with 40 mm grid (all dimensions in mm)

Figure 12.12: Dimension drawing barcode tape BCB G30 with 30 mm grid (all dimensions in mm)

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13 Ordering information and accessories

13.1 BE 901 EPN type overview

Table 13.1: BE 901 EPN type overview

Art.-No.	Part designation	Description
40804-13000	BE 901 EPN	BE 901 EPN with PROFINET RT interface
40804-13002	BE 901 EPN D	BE 901 EPN with PROFINET RT interface and display
40804-13001	BE 901 EPN D H	BE 901 EPN with PROFINET RT interface, display and heating

13.2 Connection hoods

Table 13.2: BE 901 EPN connection hoods

Art.-No.	Part designation	Description
40804-23001	BE 901 MS EPN	Connection hood with M12 connectors
40804-23002	BE 901 MK EPN	Connection hood with spring-cage terminals

13.3 Other accessories

Table 13.3: Accessories – BE 901 EPN connectors

Art.-No.	Part designation	Description
40803-40006	BE90-CO-PI-5P	M12 axial socket, 5 pin A-coded, PG9, for supply voltage

Order numbers for the Ethernet connector, suitably for the D-coded female socket M12x1-4 pin.
(Not available from TR-Electronic GmbH!)

Manufacturer	Name	Art-No.:
Binder	Series 825	99-3729-810-04
Phoenix Contact	SACC-M12MSD-4CON-PG 7-SH (PG 7)	15 21 25 8
Phoenix Contact	SACC-M12MSD-4CON-PG 9-SH (PG 9)	15 21 26 1
Harting	HARAX® M12-L	21 03 281 1405

Table 13.4: Accessory – USB cable

Art.-No.	Part designation	Description
64070120	USB-A to USB-miniB cable	USB service cable, 1 Type A and Mini-B type connector, length 3 m

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13.4 Mounting device

Table 13.5: Accessories – Mounting device

Art.-No.	Part designation	Description
40803-50001	BE 90 FA-001	Mounting device for rod
40804-50001	BE 901 FA-001 (BE901 Befestigung)	Mounting device for wall mounting - precise alignment of the BE 901 EPN without adjustment
40804-50002	BE 901 FA-002 (BE901 Befestigungswinkel)	Mounting bracket for wall mounting
40804-50003	BE 901 FA-003 (BE901 Befestigung kompl.)	Mounting bracket for rod

13.5 Barcode tapes

Table 13.6: Accessories – BCB G40-Barcode tapes with 40 mm grid

Art.-No.	Part designation	Description
40803-60000	BCB-005	Barcode tape 5 m length, 47 mm height
40803-60001	BCB-010	Barcode tape 10 m length, 47 mm height
40803-60002	BCB-020	Barcode tape 20 m length, 47 mm height
40803-60003	BCB-030	Barcode tape 30 m length, 47 mm height
40803-60004	BCB-040	Barcode tape 40 m length, 47 mm height
40803-60005	BCB-050	Barcode tape 50 m length, 47 mm height
40803-60006	BCB-060	Barcode tape 60 m length, 47 mm height
40803-60007	BCB-070	Barcode tape 70 m length, 47 mm height
40803-60008	BCB-080	Barcode tape 80 m length, 47 mm height
40803-60009	BCB-090	Barcode tape 90 m length, 47 mm height
40803-60010	BCB-100	Barcode tape 100 m length, 47 mm height
40803-60011	BCB-110	Barcode tape 110 m length, 47 mm height
40803-60012	BCB-120	Barcode tape 120 m length, 47 mm height
40803-60013	BCB-130	Barcode tape 130 m length, 47 mm height
40803-60015	BCB-150	Barcode tape 150 m length, 47 mm height
40803-60018	BCB-180	Barcode tape 180 m length, 47 mm height
40803-60020	BCB-200	Barcode tape 200 m length, 47 mm height
40803-60023	BCB-230	Barcode tape 230 m length, 47 mm height
40803-60025	BCB-250	Barcode tape 250 m length, 47 mm height
40803-60026	BCB-260	Barcode tape 260 m length, 47 mm height
40803-60027	BCB-270	Barcode tape 270 m length, 47 mm height
40803-60028	BCB-280	Barcode tape 280 m length, 47 mm height
40803-69001	MVS label 40 mm 10 pieces	MVS label, 40 mm grid; packaging unit: 10 pieces
40803-69002	MVO label 40 mm 10 pieces	MV0 label, 40 mm grid; packaging unit: 10 pieces

…

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…

on request	BCB G40 special length 47 mm height	Barcode tape with special length, 47 mm high
on request	BCB G40 special length 25 mm height	Barcode tape with special length, 25 mm high
on request	BCB G40 special length / height	Barcode tape with special length and height
on request	BCB G40 special length / height / winding	Barcode tape with special length, height and wrapping direction

Table 13.7: Accessories – BCB G30-Barcode tapes with 30 mm grid

Art.-No.	Part designation	Description
40803-80001	BCB G30-010	Barcode tape, 10 m length, 47 mm high
40803-80005	BCB G30-050	Barcode tape, 50 m length, 47 mm high
on request	MVS Iabel 30 mm 10 pieces	MVS label, 30 mm grid; packaging unit: 10 pieces
on request	MVO Iabel 30 mm 10 pieces	MV0 label, 30 mm grid; packaging unit: 10 pieces
on request	BCB G30 special length 47 mm height	Barcode tape with special length, 47 mm high
on request	BCB G30 special length 25 mm height	Barcode tape with special length, 25 mm high
on request	BCB G30 special length / height	Barcode tape with special length and height

Table 13.8: Accessories – Twin tapes

Art.-No.	Part designation	Description
on request	BCB G40 twin tape special length / height	BCB G40 twin tape, 40 mm grid, with special length and high; delivery contents: Two barcode tapes with the same value range
on request	BCB G30 twin tape special length / height	BCB G30 twin tape, 30 mm grid, with special length and high; delivery contents: Two barcode tapes with the same value range
on request	BCB G40 twin tape special length	BCB G40 twin tape, 40 mm grid, 47 mm high; delivery contents: Two barcode tapes with the same value range
on request	BCB G30 twin tape special length	BCB G30 twin tape, 30 mm grid, 47 mm high; delivery contents: Two barcode tapes with the same value range

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14 EC Declaration of Conformity

The barcode positioning systems of the BE 901 EPN series have been developed and manufactured in accordance with the applicable European standards and directives.
The manufacturer of the product, TR-Electronic GmbH in D-78647 Trossingen, possesses a certified quality assurance system in accordance with ISO 9001.

Download of the EC Declaration of Conformity: **www.tr-electronic.com/f/TR-E-KE-DGB-0026**

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15 Appendix

15.1 Barcode sample

15.1.1 BCB G40 barcode tape with 40 mm grid

Figure 15.1: Continuous, 40 mm grid

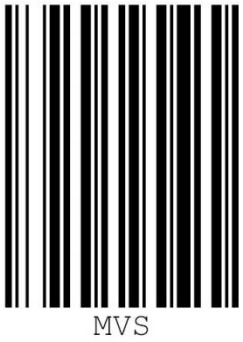

Figure 15.2: Single label MVS, 40 mm grid

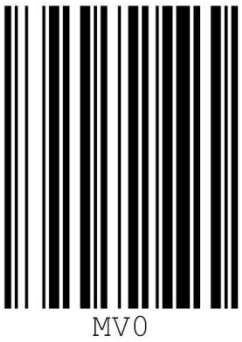

Figure 15.3: Single label MV0, 40 mm grid

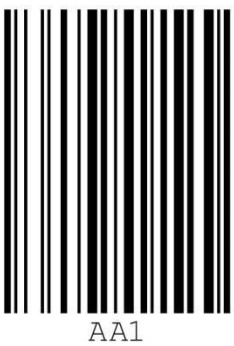

Figure 15.4: Single marker label, 40 mm grid

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15.1.2 BCB G30 barcode tape with 30 mm grid

Figure 15.5: Continuous, 30 mm grid

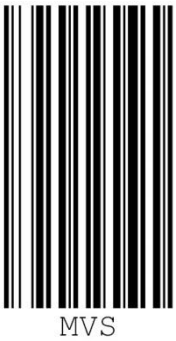

Figure 15.6: Single label MVS, 30 mm grid

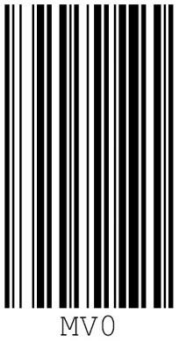

Figure 15.7: Single label MV0, 30 mm grid

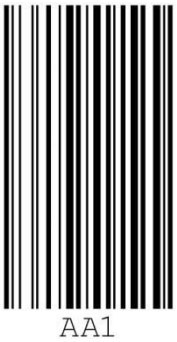

Figure 15.8: Single marker label, 30 mm grid

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