Translation of original operating instructions

BPS 358i

Bar Code Positioning System

The Sensor People

We reserve the right to make technical changes
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1 About this document

1.1 Used symbols and signal words

Tab. 1.1: Warning symbols and signal words

	Symbol indicating dangers to persons
	Symbol indicating dangers from harmful laser radiation
	Symbol indicating possible property damage
NOTE	Signal word for property damage Indicates dangers that may result in property damage if the measures for danger avoidance are not followed.
CAUTION	Signal word for minor injuries Indicates dangers that may result in minor injury if the measures for danger avoidance are not followed.
WARNING	Signal word for serious injury Indicates dangers that may result in severe or fatal injury if the measures for danger avoidance are not followed.

Tab. 1.2: Other symbols

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

Tab. 1.3: Terms and abbreviations

BCB	Bar code tape
BPS	Bar code positioning system
CFR	Code of Federal Regulations
DAP	Device Access Point
DHCP	Process for automatically assigning the IP address (Dynamic Host Configuration Protocol)
DLR	Process for networking devices in a ring topology (Device Level Ring)
EDS	Standardized electronic data sheet (Electronic Data Sheet)
EMC	Electromagnetic compatibility
EN	European standard
FE	Functional earth
IO or I/O	Input/Output

IP	Internet Protocol
LED	Light Emitting Diode
MAC	Media Access Control
MVS	Type of control bar code
MV0	Type of control bar code
NEC	National Electric Code
ODVA	User organization (Open DeviceNet Vendor Association)
OSI	Open Systems Interconnection model
PELV	Protective Extra-Low Voltage
RT	Real Time
PLC	Programmable Logic Control
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
USB	Universal Serial Bus
UL	Underwriters Laboratories
UV	Ultraviolet

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 of laser class 1 to determine its position relative to a permanently mounted bar code tape.

All accuracy details for the BPS 300 measurement system refer to the position relative to the permanently mounted bar code tape.

CAUTION

Use only approved bar code tapes!

The bar code tapes approved by Leuze and listed on the Leuze website as accessories are an essential part of the measurement system.

Bar code tapes not approved by Leuze are not allowed.
The use of such bar code tapes is contrary to the intended use.

Areas of application

The BPS is designed for positioning in the following areas of application:

- Electrical monorail system
- 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 personnel and the device cannot be guaranteed if the device is operated in a manner not complying with its intended use.

- Only operate the device in accordance with its intended use.
- Leuze electronic GmbH + Co. KG is not liable for damages caused by improper use.
- Read these operating instructions before commissioning the device. Knowledge of the operating instructions is an element of proper use.

NOTICE

Comply with conditions and regulations!

- Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

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 medical purposes
- as own safety component in accordance with the machinery directive

NOTICE

Use as safety-related component within the safety function is possible, if the component combination is designed correspondingly by the machine manufacturer.

NOTICE
Do not modify or otherwise interfere with the device! ↳ Do not carry out modifications or otherwise interfere with the device. The device must not be tampered with and must not be changed in any way. ↳ The use of a bar code tape not approved by Leuze is equivalent to an intervention in or change to the device/measurement system. ↳ The device must not be opened. There are no user-serviceable parts inside. ↳ Repairs must only be performed by Leuze electronic GmbH + Co. KG.

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 operating instructions for 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 DGUV (German Social Accident Insurance) provision 3 (e.g. electrician foreman). In other countries, there are respective regulations that must be observed.

2.4 Disclaimer

Leuze electronic GmbH + Co. KG 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

⚠ ATTENTION
LASER RADIATION – CLASS 1 LASER PRODUCT The device satisfies the requirements of IEC 60825-1:2014 / EN 60825-1:2014+A11:2021 safety regulations for a product of **laser class 1** and complies with 21 CFR 1040.10 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019. ↳ Observe the applicable statutory and local laser protection regulations. ↳ The device must not be tampered with and must not be changed in any way. There are no user-serviceable parts inside the device. **CAUTION!** Opening the device may result in hazardous radiation exposure! Repairs must only be performed by Leuze electronic GmbH + Co. KG.

3 Device description

3.1 Device overview

3.1.1 General information

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

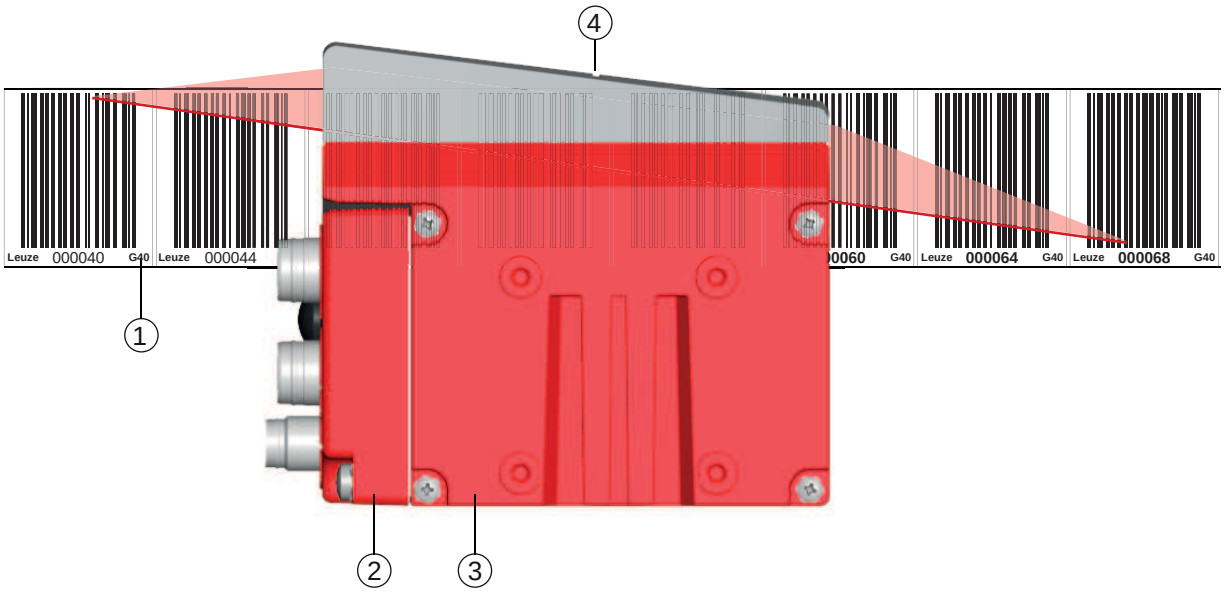
- Read a code on the bar code tape (see following figure)
- Determine the position of the read code in the scanning beam
- Calculate the position to within less than a millimeter using the code information and the code position relative to the device's center.

The position and speed values are then output to the controller via the host interface.

The BPS consists of device housing and interface connection hood for the connection to the control. The BPS can optionally be delivered with display and optics heating.

The following connection hoods are available for the connection of the EtherNet/IP interface:

- MS 358 connection hood with M12 connectors
- MK 358 connection hood with spring-cage terminals



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

Fig. 3.1: Device construction, device arrangement and beam exit

3.1.2 Performance characteristics

The most important performance characteristics of the bar code 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: EtherNet/IP, PROFINET fieldbus, PROFIBUS fieldbus, SSI, RS 232/RS 422, RS 485
- Binary inputs and outputs for control and process monitoring
- Configuration via webConfig tool or fieldbus
- Diagnosis 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 bar code positioning system. The accessories are optimally matched to the BPS:

- Highly flexible, scratch-, smudge- and UV-resistant bar code tape
- Mounting devices for precise mounting with one screw (easy-mount)
- Modular connection technology via connection hoods with M12 connectors, spring-cage terminals or with cables

3.1.4 Device model with heating

The bar code 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 BPS to -35°C
- Supply voltage 18 … 30 V DC
- BPS release through an internal temperature switch (switch-on delay of about 30 min for 24 V DC 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 preassembled cables!** ↳ It is not possible to use preassembled cables. The current consumption of the BPS is too high for the preassembled cables.

Function

When the supply voltage is applied to the BPS, 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 BPS 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 up to an inside temperature of 25°C. Above this, the front cover heater switches off and switches on again with a switching hysteresis of 3°C at an inside temperature of below 22°C.

3.2 Connection technology

For the electrical connection of the BPS, the following connection variants are available:

- MS 358 connection hood with M12 connectors
- MK 358 connection hood with spring-cage terminals

The voltage supply (18 … 30 VDC) is connected according to the connection technology selected.

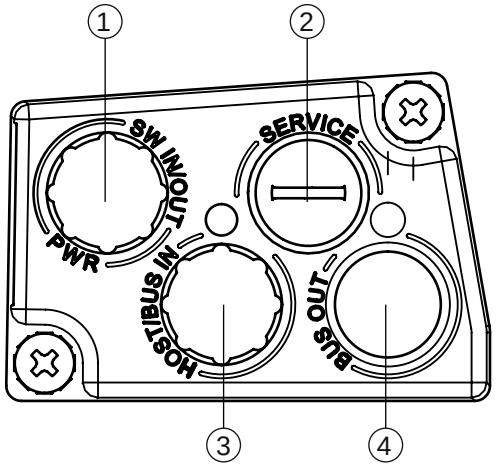
Two freely programmable switching inputs/switching outputs for individual adaptation to the respective application are also available here.

3.2.1 MS 358 connection hood with M12 connectors

The MS 358 connection hood features three M12 connector plugs and a Mini-B type USB port as a service interface for BPS configuration and diagnostics.

NOTICE
The integrated parameter memory for the simple replacement of the BPS is located in the MS 358 connection hood. Both the settings and the network address are saved in the integrated parameter memory. They are automatically transferred to the new device when the device is replaced.

NOTICE
With Ethernet in linear topology, the network is interrupted when the BPS 358i is removed from the MS 358i connection hood.



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

Fig. 3.2: MS 358 connection hood, connections

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

3.2.2 MK 358 connection hood with spring-cage terminals

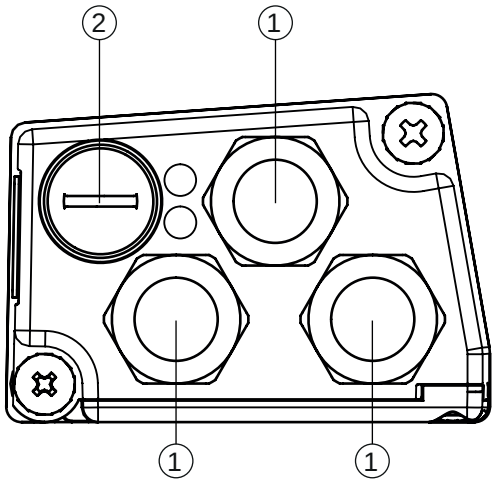
The MK 358 connection hood makes it possible to connect the BPS directly and without additional connectors.

- The MK 358 connection hood has three cable bushings, which also contain the shield connection for the interface cable.
- A Mini-B type USB port is used for service purposes and for BPS configuration and diagnostic.

NOTICE

The integrated parameter memory for the simple replacement of the BPS is located in the MK 358 connection hood.

Both the settings and the network address are saved in the integrated parameter memory. They are automatically transferred to the new device when the device is replaced.



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

Fig. 3.3: MK 358 connection hood, connections

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.

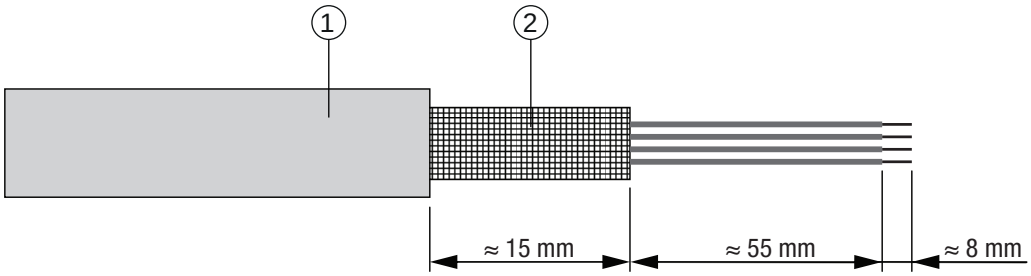
NOTICE

Do not use wire-end sleeves!

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

NOTICE

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

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

3.3 Display elements

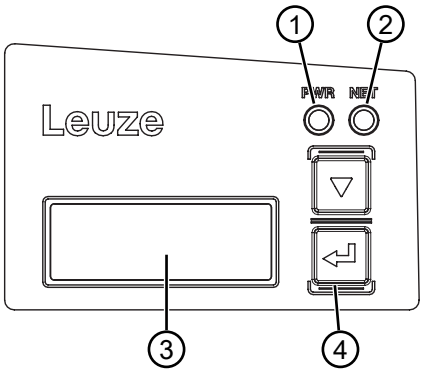
The BPS is available optionally with display, two control buttons and LEDs or with only two LEDs as indicators on the device housing.

The connection hood (MS 358 or MK 358) contains two split two-color LEDs as status indicators for the HOST / BUS IN and BUS OUT Ethernet connections.

3.3.1 LED indicators

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

- PWR
- NET



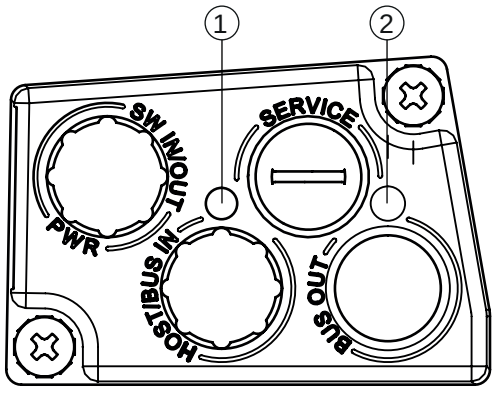
1 PWR LED
2 LED NET
3 Display
4 Control buttons

Fig. 3.5: Indicators on the device housing

Tab. 3.1: Meaning of the LED indicators on the device housing

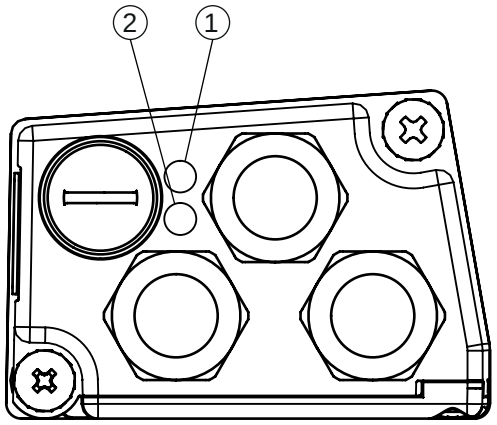
LED	Color, state	Description
LED 1 PWR	Off	Device is switched off • No supply voltage
	Green, flashing	Device is being initialized • Supply voltage connected • Initialization running • No measurement value output
	Green, continuous light	Device in operation • Initialization finished • Measurement value output
	Red, flashing	Warning set • No measurement (e.g. no bar code tape)
	Red, continuous light	Device error • Device function is limited • Details via event log (see chapter 11.1.1 "Diagnosis with webConfig tool")
	Orange, continuous light	Service active • No data on the host interface • Configuration via USB service interface
LED 2 NET	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
	Red, flashing	• Parameterization or configuration failed • No data exchange
	Red, continuous light	• Network error • Fatal communication error

LED indicators on the connection hood (MS 358 or MK 358)



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

Fig. 3.6: MS 358, LED indicators



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

Fig. 3.7: MK 358, LED indicators

Tab. 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)

3.3.2 Display indicators

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

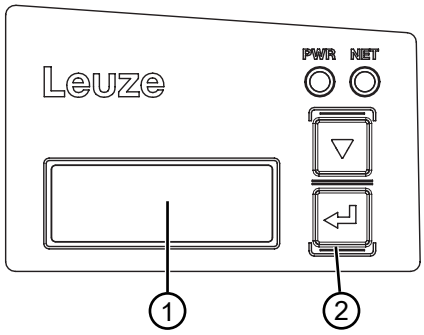
- Monochromatic with white background lighting
- Double line, 128 x 32 pixels
- Display language: English

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

Fig. 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

    Display with "." as decimal separator character (e.g., *+ 34598.7 mm*)
- Reading quality
  - *Quality*
  - 0 … 100%
- Device status
  - *BPS 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
- Version information

  Software and hardware version of the device
  - *Version*
  - *SW: V1.3.0 HW:1*

NOTICE	
	**Laser activation by selecting *Quality*!** ↳ If the position measurement is stopped and the laser is therefore switched off, activating *Quality* switches the laser on and starts the position measurement.

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 the button ↵ : Display flashes
2. Press the button ▼ : Display changes from position value (*Position value*to reading quality (*Quality*)
3. Press the button ▼ : Display changes from reading quality (*Quality*) to device status (*BPS Info*)
4. Press the button ▼ : Display changes from device status (*BPS Info*) to I/O status (*I/O status*)
5. Press the button ↵ : I/O status (*I/O status*) is displayed; display stops flashing

Display during device start-up

During device start-up, a start-up display first appears which is briefly followed by the display with the version information.

The standard display after starting up the BPS is *Position Value*.

3.4 Bar code tape

3.4.1 General information

The bar code tape is available in different variants:

- BCB G40 … bar code tape with 40 mm grid

  Code128 with character set C, increasing in increments of 4 (e.g., 000004, 000008, …)
- BCB G30 … bar code tape with 30 mm grid

  Code128 with character set C, increasing in increments of 3 (e.g. 000003, 000006, …)

A bar code 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 BCB 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 max. 300 m.

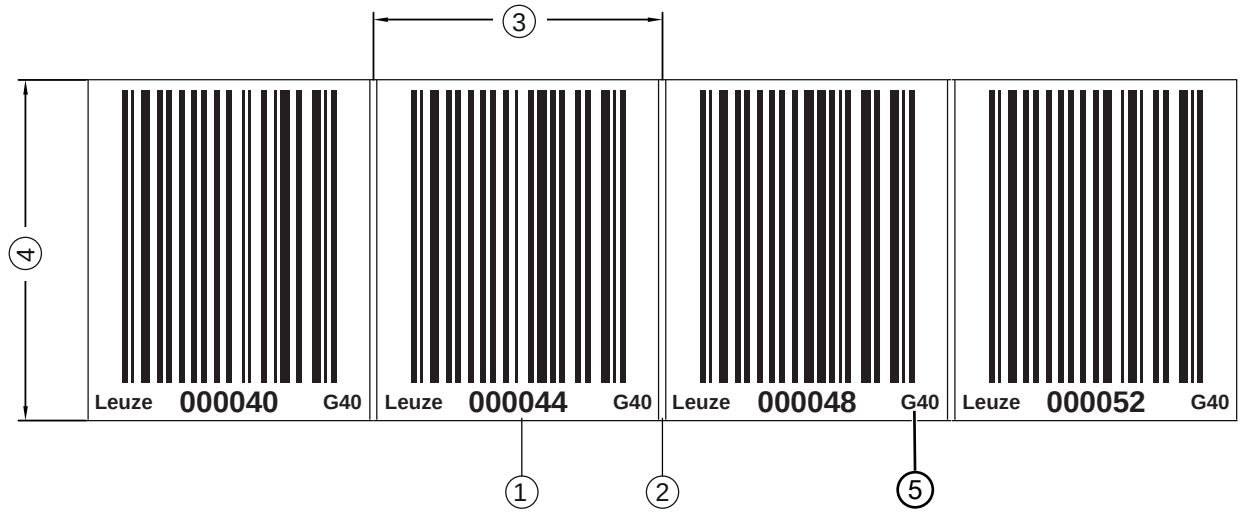
Standard bar code tapes in fixed length increments as well as special bar code tapes with custom tape start value, tape end value, custom length and height can be found on the Leuze website in the accessories for the BPS 300 devices.

An entry wizard for special bar code tapes is available on the Leuze website under the BPS 300 devices – *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

	NOTICE
	**Only one BCB type per system!** ↳ In a given system, use either only BCB G30 … with 30 mm grid or only BCB G40 … with 40 mm grid. If different BCB G30 … or BCB G40 … models are used in one system, the BPS cannot ensure an exact position determination.

	NOTICE
	**Configure the BPS for the BCB type used!** ↳ The BCB type used must be set in the BPS configuration with the parameter *Tape selection* . ↳ On delivery, the BPS is set for BCB G40 … with a 40 mm grid. If the BCB G30 … is used in a 30 mm grid, the *Tape selection* in the BPS configuration must be adjusted. ↳ If the BCB type used does not correspond to the *Tape selection*configured in the BPS, the BPS cannot determine the exact position.

BCB G40 … bar code tape with 40 mm grid



1 Position label with position value
2 Cut mark
3 Grid dimension = 40 mm
4 Height
Standard heights: 47 mm and 25 mm
5 G40 = designation in plain-text for 40 mm grid

Fig. 3.9: BCB G40 … bar code tape with 40 mm grid

NOTICE

Standard BCB G40 … bar code tapes are available in various length increments in the following heights:

- 47 mm
- 25 mm

Special BCB G40 … bar code tapes are available in mm height increments between 20 and 140 mm.

An entry wizard for special bar code tapes is available on the Leuze website under the BPS 300 devices – *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

BCB G30 … bar code tape with 30 mm grid

1 Position label with position value
2 Cut mark
3 G30 = designation in plain-text for 30 mm grid

Fig. 3.10: BCB G30 … bar code tape with 30 mm grid

NOTICE

Standard BCB G30 … bar code tapes are available in various length increments in the following heights:

- 47 mm
- 25 mm

Special BCB G30 … bar code tapes are available in mm height increments between 20 and 140 mm.

An entry wizard is available for special bar code tapes on the Leuze website under devices BPS 300 - *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

3.4.2 Control bar codes

With the help of control bar codes that are affixed on top of the bar code tape at appropriate positions, functions in the BPS can be activated or deactivated, e.g., for changing various position values at switches.

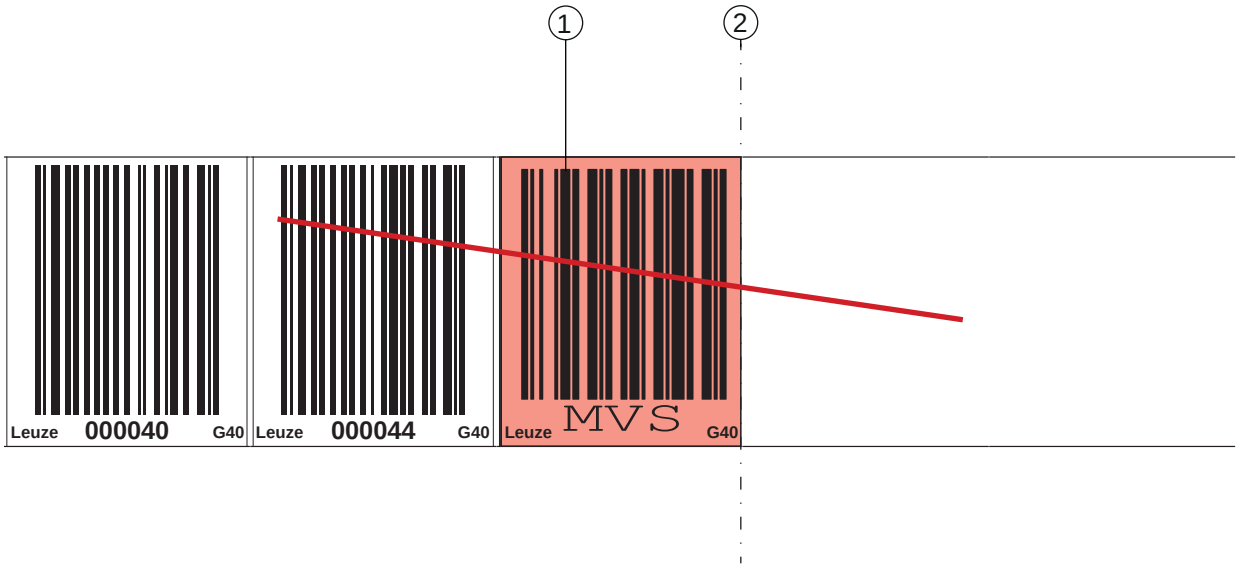
Code type Code128 with character set B is used for the control bar code.

MVS label

Designation: BCB G40 … MVS or BCB G30 … MVS

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 BPS does not detect the new BCB 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 bar code
2 Deactivation of the position determination at the end of the MVS label

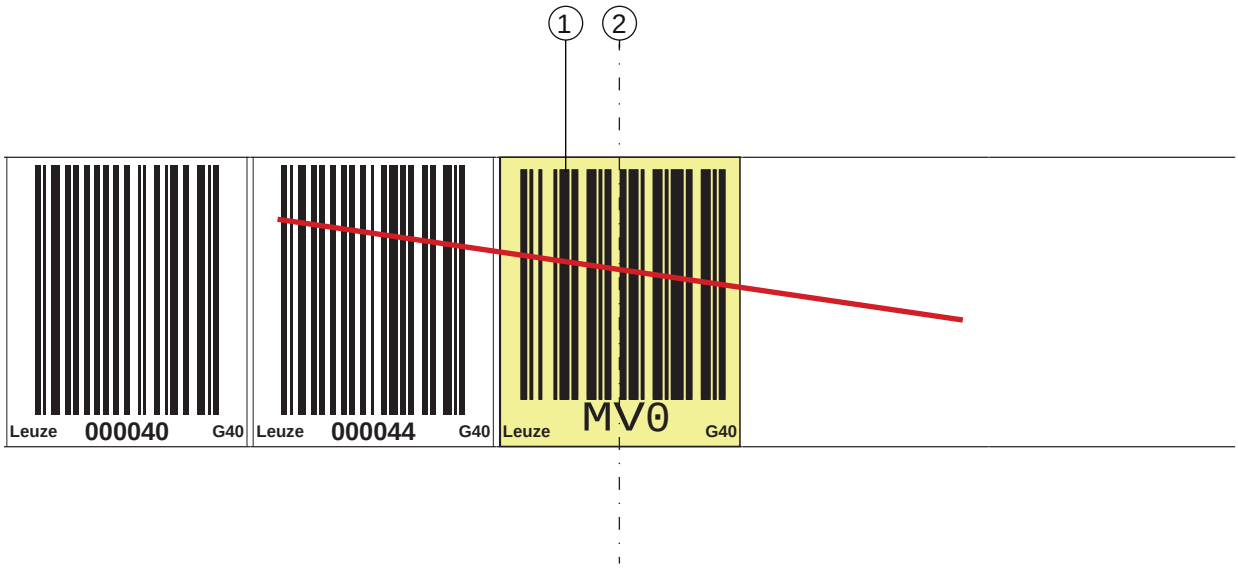
Fig. 3.11: Arrangement of the MVS control bar code

MV0 label

Designation: BCB G40 … MV0 or BCB G30 … MV0

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 BPS does not detect the new BCB section in the scanning beam, no position is output after the middle of the *MV0* label for.



1 Control bar code
2 Deactivation of position determination from the middle of the control bar code

Fig. 3.12: Arrangement of the MV0 control bar code

Arrangement of the control bar codes

The control bar code is attached in such a way that it replaces one position bar code or seamlessly connects two bar code tapes with different value ranges to one another.

A position label does not need to follow immediately after the MVS or MV0 control bar code. For an uninterrupted measurement value determination, a gap less than or equal to one label width (40 mm) may be present between the control bar code and the subsequent position label.

NOTICE

Distance between two control bar codes!

↳ Make certain that there is only one control bar code (or marker label) in the scanning beam at a time.
The minimum distance between two control bar codes is determined by the distance between the BPS and bar code tape and the resulting length of the scanning beam.

The control bar codes are simply affixed over the existing bar code tape.

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

- 30 mm with BCB G30 … bar code tapes
- 40 mm with BCB G40 … bar code tapes

NOTICE

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

1 Control bar code perfectly affixed on the bar code tape
2 Control bar code at small gap between two bar code tapes

Fig. 3.13: Correct positioning of the control bar code

NOTICE

Gaps in bar code tape!

↳ Avoid polished and high-gloss surfaces.

↳ Keep the gaps between the two bar code tapes and the control bar code as small as possible.

Measurement value switching between two bar code tapes with different value ranges

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

NOTICE

1 m difference in the bar code position values for correct measurement value switching!

- For different BCB value ranges, make certain that the position value has a value distance of minimum 1 m between the preceding position bar code (before the control bar code) and the subsequent position bar code (after the control bar code).
  If the minimum distance between the bar code values is not maintained, position determination may be faulty.
- Example (BCB with 40 mm grid): If the last position bar code on the BCB before the control bar code is *75120*, the following position bar code on the BCB after the control bar code must be at least *75220*.

- The end of the preceding bar code tape and the start of the subsequent bar code tape can end and begin, respectively, with completely different position bar codes.
- Position value changeover by means of a control bar code 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 BPS reaches the transition point of the control bar code, the device switches to the second BCB, provided the next position label is in the BPS's scanning beam.

  The output position value is thereby always uniquely assigned to one BCB.

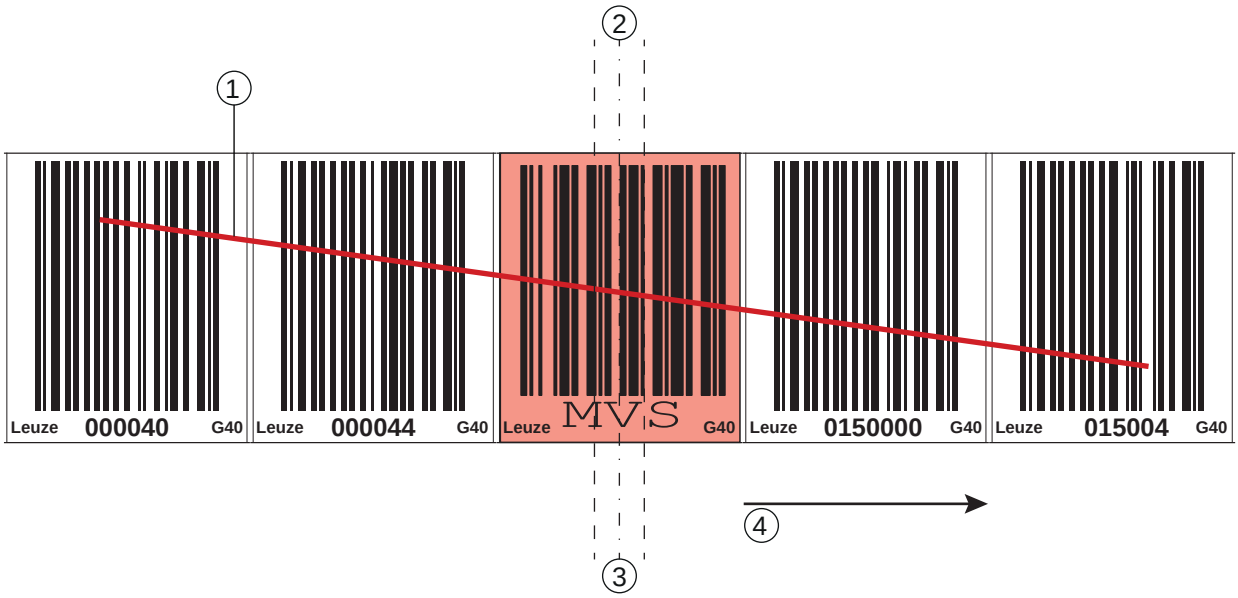
NOTICE

If the BPS does not detect the new BCB section upon reaching the changeover position, the position-value output is dependent on the used control bar code.

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

MV0 control bar code: 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 Control bar code center
3 Middle of the BPS
4 Direction of movement

Fig. 3.14: Changeover position with *MVS* control bar code for BCB changeover

3.4.3 Marker labels

Designation: BCB G30 … ML … or BCB G40 … ML …

Marker labels, which are affixed at the appropriate locations on top of the bar code tape, can be used to trigger various functions in the superior control. The BPS 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 bar code) in the scanning beam at a time.
The minimum distance between two marker labels is determined by the distance between the BPS and bar code 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

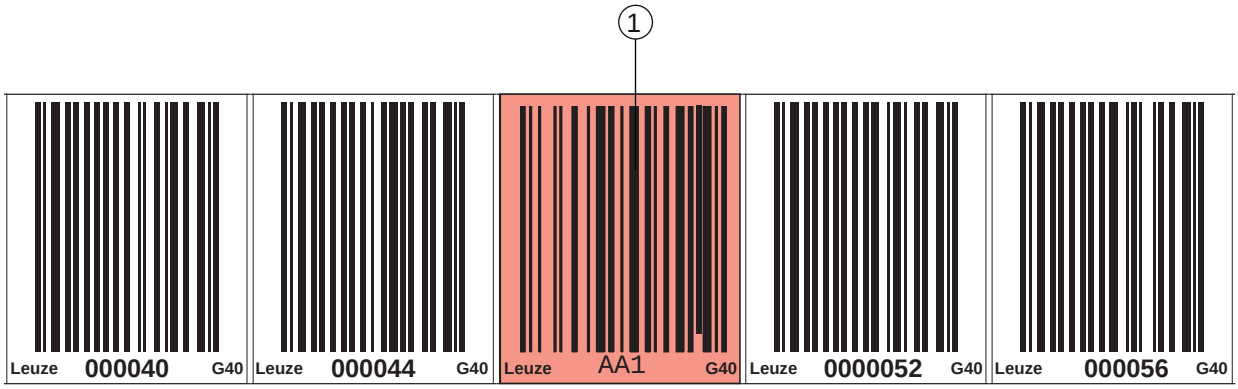
Marker labels are implemented as follows:

- Color red
- Height 47 mm
- in grid dimension 40 mm (BCB G40 … ML)
- in grid dimension 30 mm (BCB G30 … ML)
- Code 128 B

Marker labels are individual labels and are supplied in a packaging unit containing 10 pieces.

Arrangement when using the marker label with positioning

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



1 Marker labels

Fig. 3.15: System arrangement of marker labels

Arrangement when using the marker label without positioning

The marker label must be positioned within the BPS's detection range.

3.4.4 Twin tapes

Designation: BCB G40 … TWIN … or BCB G30 … TWIN …

Twin tapes are jointly manufactured bar code tapes with the same value range.

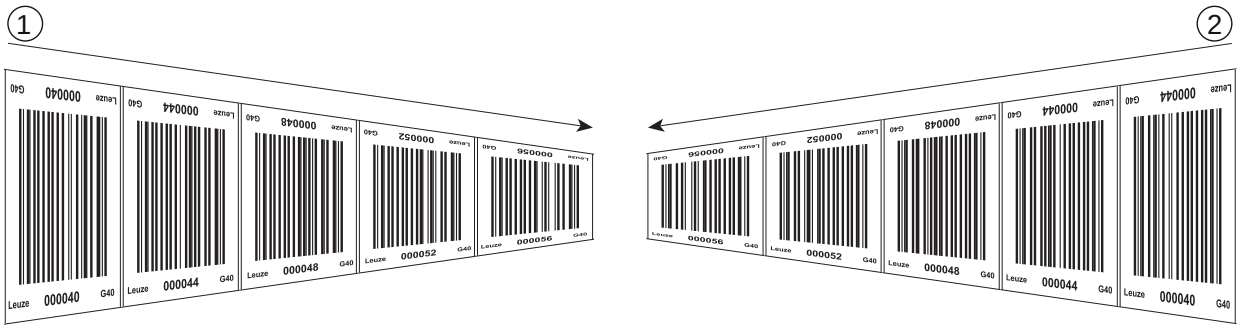
NOTICE

A twin tape always consists of two bar code tapes!

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

Twin tapes are used if positioning with two bar code 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 bar code tapes that are manufactured separately.



1 Twin bar code tape 1
2 Twin bar code tape 2

Fig. 3.16: Twin bar code tape with double numbering

NOTICE

Twin tapes are always delivered in pairs on two rolls.
If twin tapes are replaced, both tapes are to be replaced.
An entry wizard for twin tapes with custom tape start value, tape end value, custom length and height is available on the Leuze website under devices BPS 300 - *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

4 Functions

This chapter describes the functions of the BPS 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 time behavior of the position and speed measurement:

- Measurement value preparation

  Configurable response time
- Measurement error tolerance

  Configurable time-based error suppression

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.	0.01 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:

Parameter	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 or Free resolution
Averaging	The parameter specifies the averaging time of the calculated speed values in steps.	Steps: 1 to 32 ms

4.3 Time behavior

The BPS of the 300i series operate with a scanning rate of 1000 scans per second. A measurement value is ascertained every 1 ms.

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

Parameter	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 BPS uses for position determination. The integration results in smoothing of the output measurement value. With the BPS 300i, an *integration depth* of 8 yields 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 WebConfig tool

The webConfig configuration tool offers a graphical user interface for the display of process data, configuration and diagnosis of the BPS via a PC; see chapter 10 "Starting up the device – webConfig tool".

4.5 Evaluation of the reading quality

NOTICE
Output of the reading quality The bar code positioning system can diagnose the reading quality from the arrangement of the BPS relative to the bar code tape. ↳ The reading quality is displayed in % values. ↳ In spite of optimum operating conditions, the reading quality may be slightly below 100%. This does not indicate a defect of the BPS or of the bar code tape.

NOTICE
The warning threshold preset ex works for a reading quality < 60% as well as a switch-off threshold for a reading quality < 30% corresponds to Leuze's experience in a typical application. For applications that involve an intentional interruption of the bar code tape (switches, expansion gaps, vertical slopes/descents), the preset limit values can be adapted to the respective application.

The reading quality is dependent on several factors:

- Operation of the BPS in the specified depth of field
- Number of bar codes in the transmitted beam
- Number of bar codes in the reading field
- Soiling of the bar code
- Traverse rate of the BPS (number of bar code symbols within the time window)
- Ambient light incident on the bar code and on the optics (glass exit window) of the BPS

The reading quality is affected, in particular, in the following cases:

- Switches, expansion gaps and other transition points at which the bar code tape is not affixed interruption-free.
- Vertical travel if at least three bar code symbols are not completely in the reading field of the sensor at any given point in time.
- Vertical curve in which the bar code tape was separated at the marked cut marks for adapting to the curve.

NOTICE
If the reading quality is influenced by the factors listed above, the reading quality can be reduced to as low as 0%. ↳ This does not mean that the BPS is defective, but rather that the reading quality characteristics are reduced to as low as 0% in the given arrangement. ↳ If, at a reading quality of 0%, a position value is output, it is correct and valid.

NOTICE
The reading quality values are shown on the optional display (*Quality*), the serial communication protocol and via the webConfig tool (see chapter 10.3.3 "ALIGNMENT function").

The evaluation of the reading quality provides the following information, e.g.:

- The reading quality is constantly bad: Soiling of the BPS optics
- The reading quality is always bad at certain position values: Soiling of the BCB

4.6 Distance measurement to the bar code tape

Within the reading field, the BPS 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.

Output of the distance measurement value:

- In the webConfig tool via the function *ALIGNMENT* (Menu *Quality*), which is only available in operating mode *Service* (see chapter 10.3.3 "ALIGNMENT function")
- Via 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 Leuze bar code positioning system (BPS) 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 Leuze bar code positioning systems impresses with a variety of advantages:

- The laser simultaneously scans three bar codes 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 BPS 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 BPS 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 (easy-mount).
- The unique encoding of the position value on the bar code tape allows the system to be put back into operation without problem even after a brief voltage drop without, e.g., needing to utilize a reference point.
- The Leuze bar code 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 BPS include:

- Stacker crane (see chapter 5.1 "High-bay storage device")
- Electrical monorail system (see chapter 5.2 "Electrical monorail system")
- Gantry cranes (see chapter 5.3 "Gantry cranes")

5.1 High-bay storage device

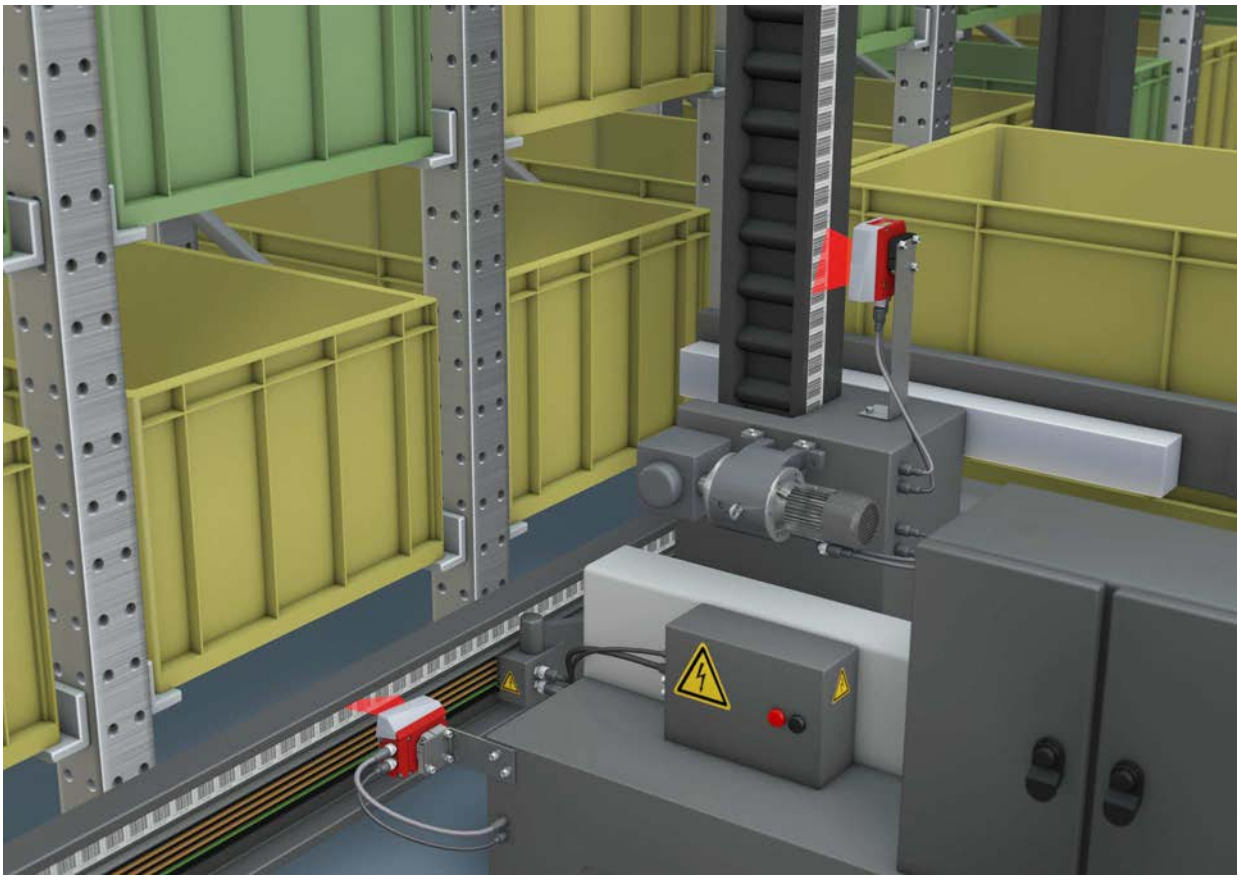


Fig. 5.1: High-bay storage device

- 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

5.2 Electrical monorail system

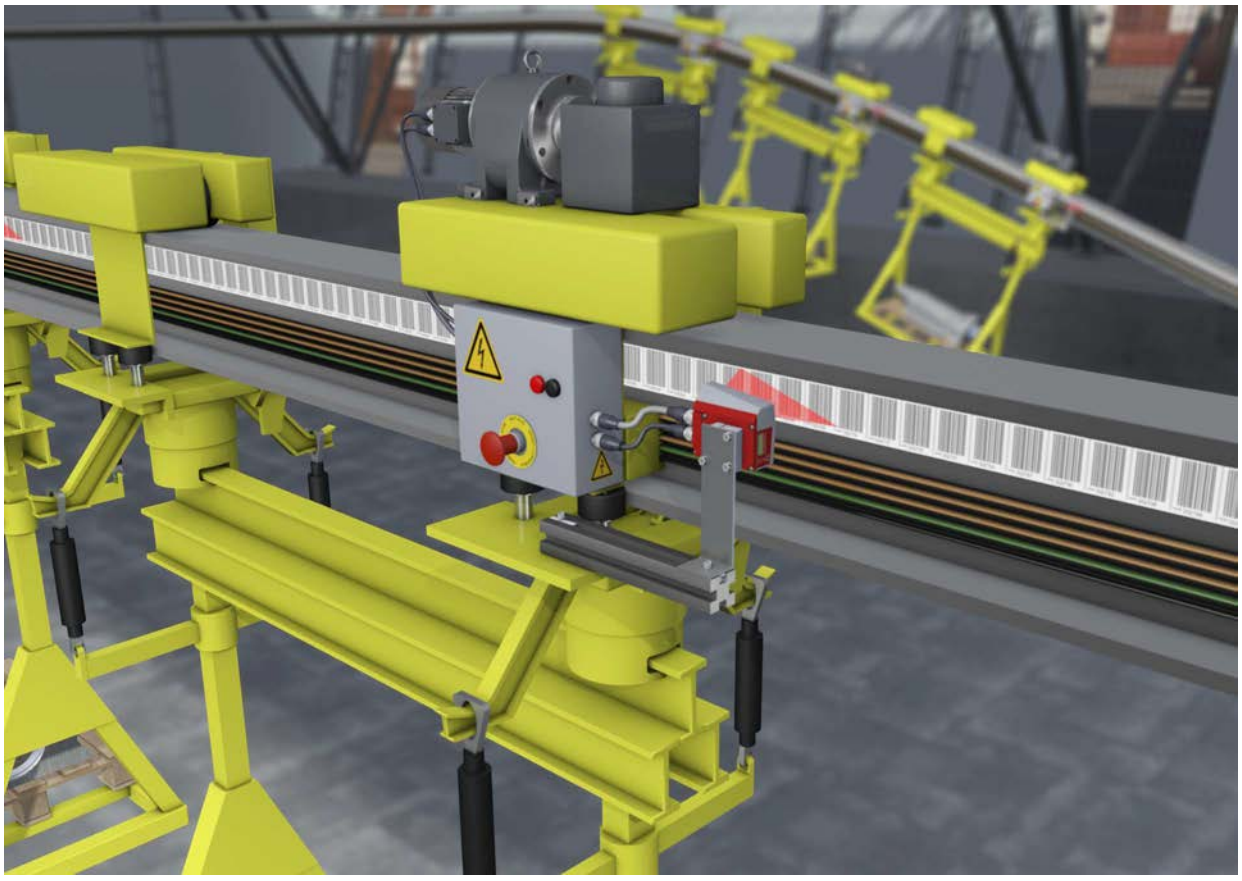


Fig. 5.2: Electrical monorail system

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

5.3 Gantry cranes

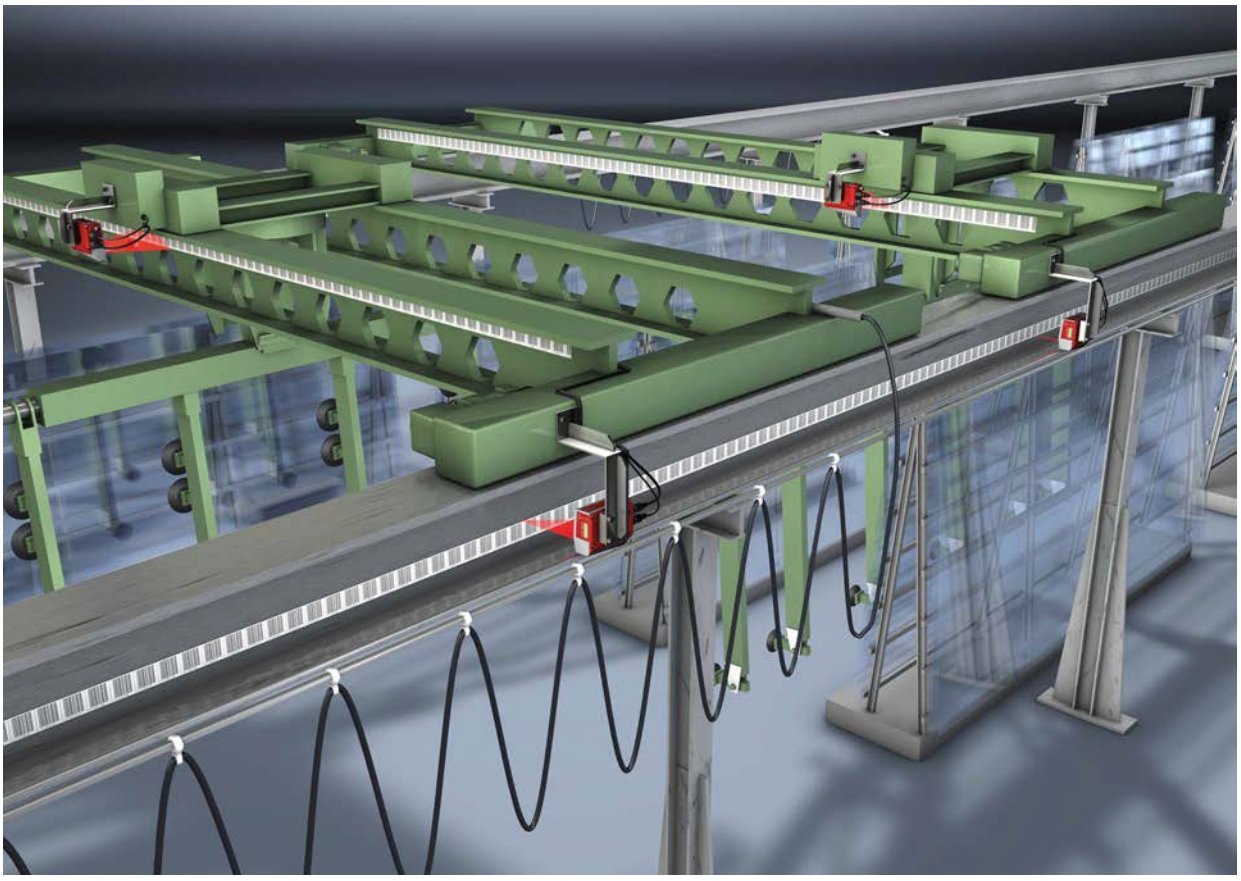


Fig. 5.3: Gantry cranes

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

6 Mounting

6.1 Mounting bar code 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 are at the processing temperature.
- Avoid dirt deposits on both the BCB and the surface to be glued.
  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 BPS 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 BPS 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.

NOTICE

BCB application

- Make certain that the BCB is located in the scanning beam of the BPS over the entire traversing path. The BPS can determine the position on BCBs with arbitrary orientation.
- Bar code tapes with different value ranges may not directly follow one another.
  For different value ranges, a gap of at least 1 m must be maintained between the position value of the last position bar code of the leading BCB and the first position value of the first position bar code of the subsequent BCB (see chapter 3.4.2 "Control bar codes").
- For control bar codes *MVS*/*MV0* (see chapter 3.4.2 "Control bar codes"), the minimum distance of 1 m between the last position bar code before the control bar code and the first position bar code after the control bar code must be maintained.
- For bar code tapes with different value ranges, both BCBs must correspond to the BCB type configured in the BPS (see chapter 3.4.1 "General information").
- Avoid position bar code labels with the value *00000*.
  Measurements to the left of the center of a *00000* label generate negative position values that may not be displayed correctly.

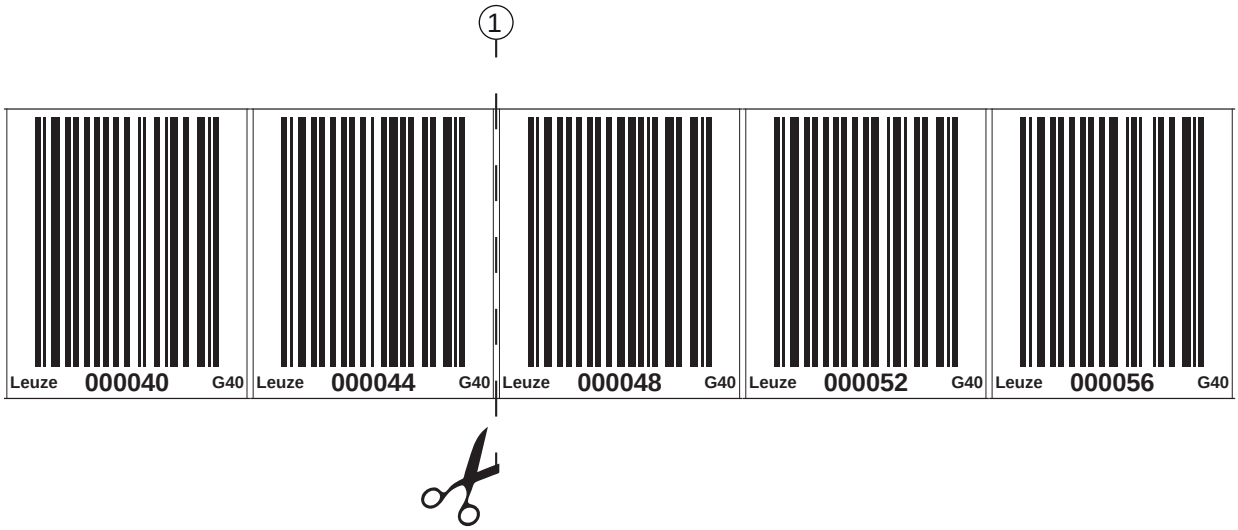
6.1.2 Cutting bar code tapes

NOTICE

Avoid cutting BCB!

- If possible, avoid cutting bar code tapes.
  Optimum position value determination by the BPS is achieved with continuously affixed BCB.
- If there are mechanical gaps, first affix the BCB continuously. Then cut the BCB.

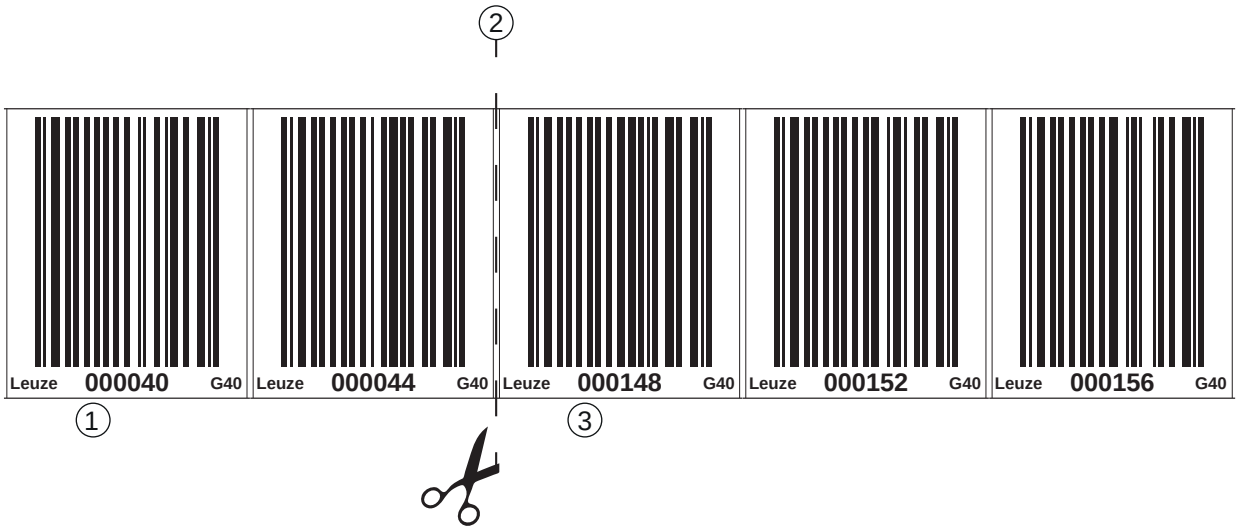
The BCB is cut at the indicated cut marks:



1 Cut mark

Fig. 6.1: Cut mark on the bar code tape

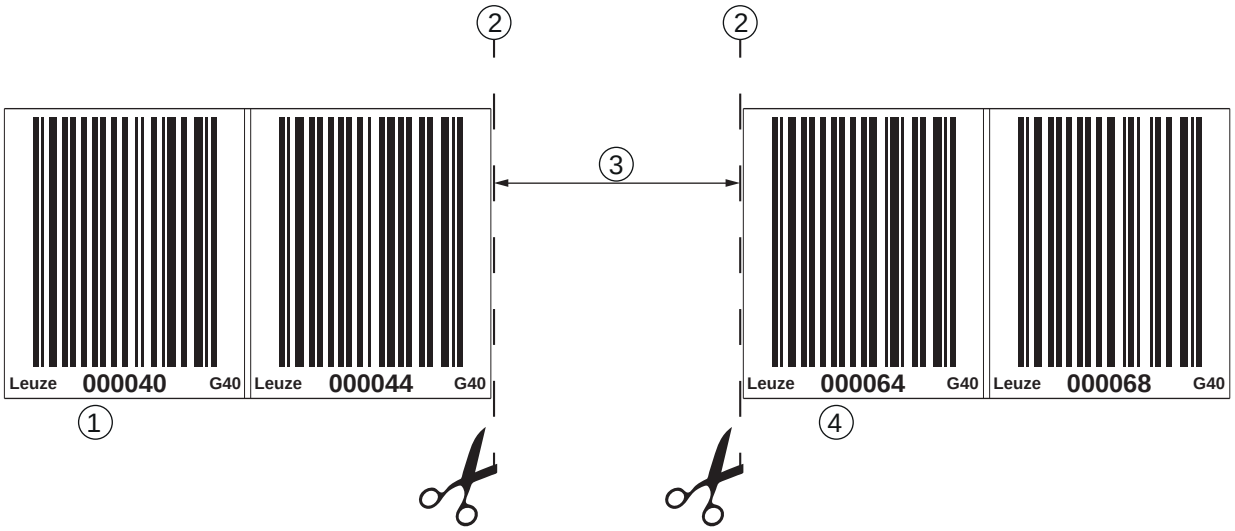
If another BCB is to be affixed directly after the preceding BCB, the subsequent bar code value must differ from the preceding BCB by at least 1 m:



1 Preceding bar code tape
2 Cut mark
3 Subsequent bar code tape, value range + 1 m

Fig. 6.2: Cut bar code tape

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. The first bar code value of the subsequent BCB must differ by at least 20 (200 mm) from the last bar code value of the preceding BCB.



1 Preceding bar code tape
2 Cut mark
3 Gap, at least 300 mm
4 Subsequent bar code tape

Fig. 6.3: Gap in cut bar code tape to avoid double positions

NOTICE

No glossy gaps in the cut bar code 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 BPS.

6.1.3 Mounting the BCB

Mount the BCB as follows:

- Check the surface.
  It must be flat, free of grease and dust, and be dry.
- Define a reference edge (e.g., metal edge of the busbar).
- Remove the backing and affix the BCB along the reference edge tension free.
- Secure the bar code tape 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.

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 BPS 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.

NOTICE

If a bar code tape was damaged, e.g., by falling parts, you can download a repair kit for the BCB from the Internet (see chapter 12.2.2 "BCB repair with repair kit").

- Use the bar code tape created with the repair kit only temporarily as an emergency solution.

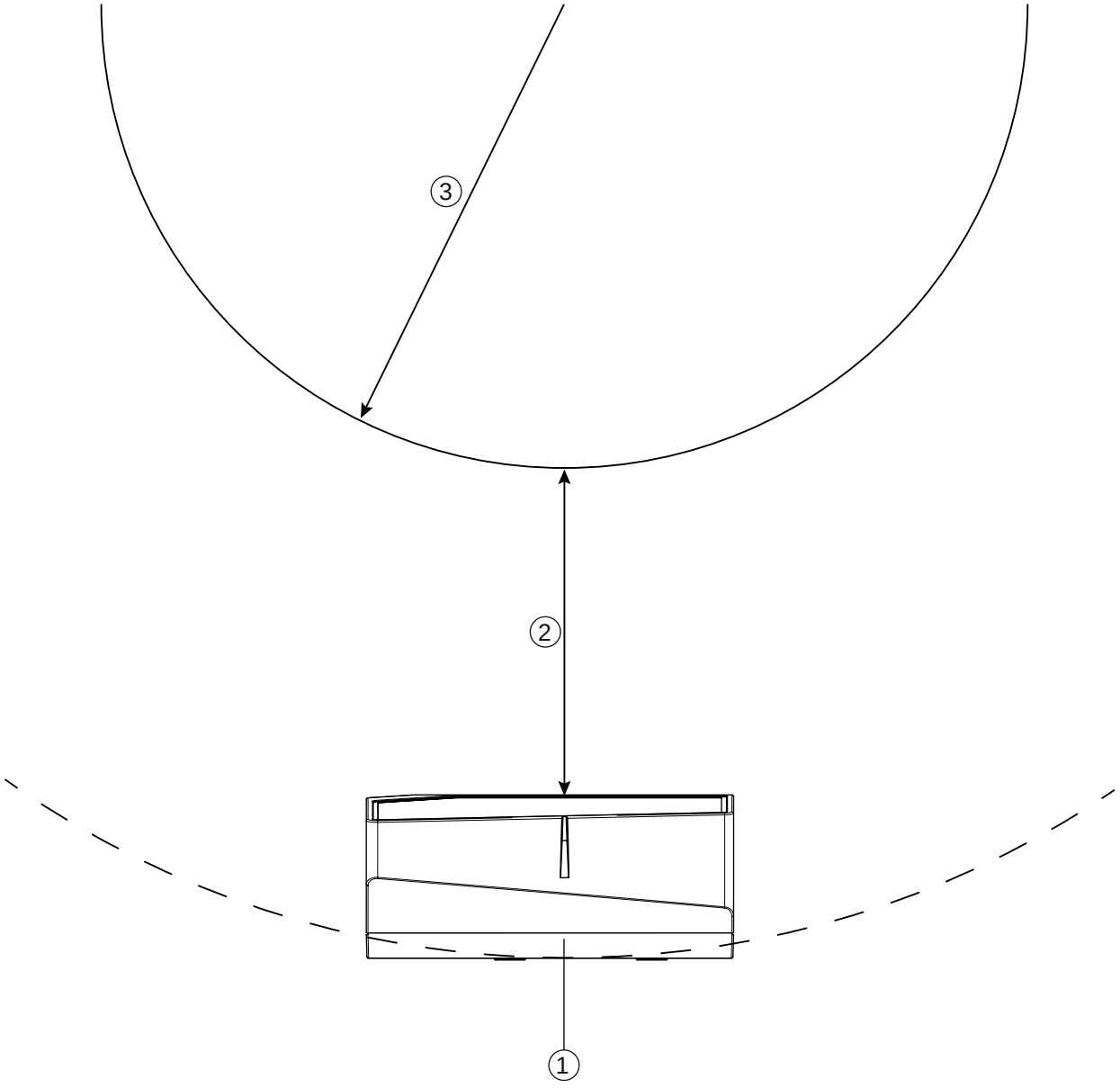
BCB mounting in horizontal curves

NOTICE

Limited absolute measurement accuracy and reproducibility!

BCB mounting in curves reduces the absolute accuracy of the BPS, since the distance between two bar codes is no longer exactly 40 mm or 30 mm due to optical distortions.

- For horizontal curves, maintain a minimum bending radius of 300 mm.



1 BPS
2 Reading distance
3 Radius of the bar code tape, R_{min} = 300 mm

Fig. 6.4: Mounting the bar code tape for use in horizontal curves

BCB mounting in vertical curves

NOTICE

Limited absolute measurement accuracy and reproducibility!

- BCB mounting in curves decreases the absolute measurement accuracy of the BPS, since the distance between two bar codes 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.
- Ensure that the BCB is affixed without mechanical tension.

NOTICE

No glossy gaps in the bar code tape!

- Ensure that there are matt, bright surfaces behind the fanning in the BCB curves. Polished, reflective, and high-gloss surfaces in the scanning beam may impair the measurement quality of the BPS.

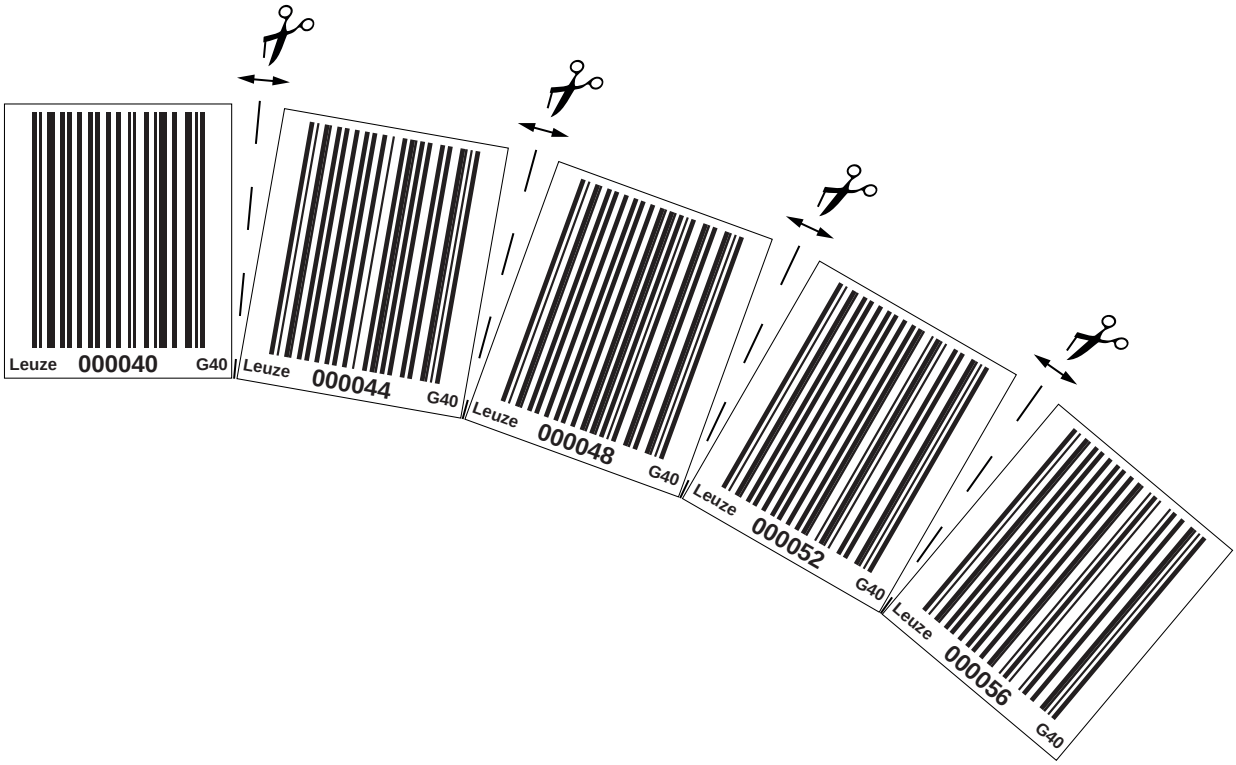
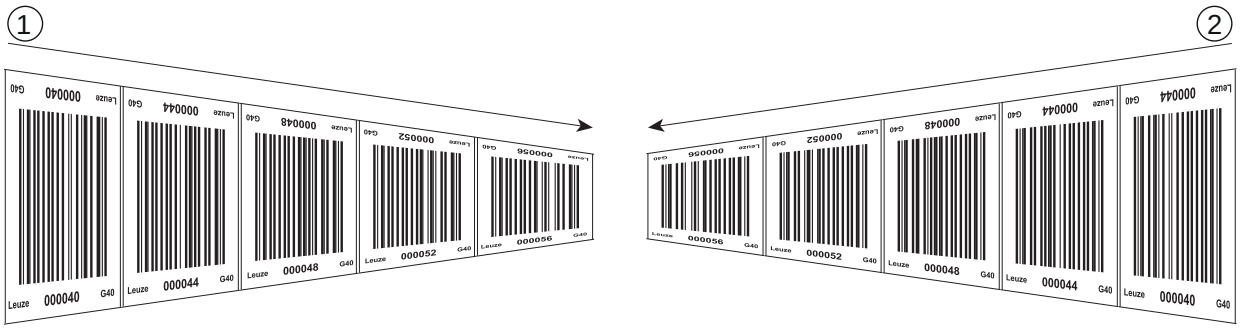


Fig. 6.5: Preparing the bar code tape for use in vertical curves

Mounting twin tapes

If two bar code 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.



1 Twin bar code tape 1
2 Twin bar code tape 2

Fig. 6.6: Mounting twin bar code tapes

NOTICE

A twin tape always consists of two bar code tapes.

- When ordering twin tapes, two bar code tapes are always included with an order.
- The two twin bar code tapes have the exact same length tolerances relative to each other.
- 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.

Mounting two bar code tapes with the same value range

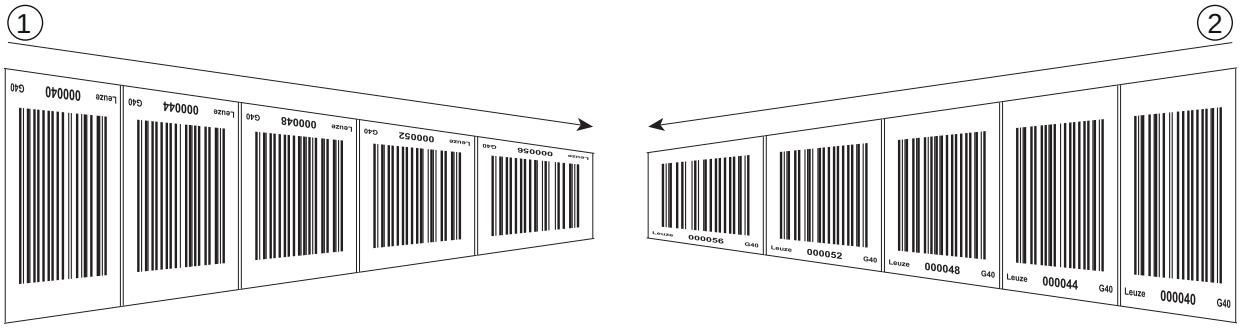
For crane systems or elevators, two bar code tapes with the same value range are used for positioning.

NOTICE

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

If a twin tape is not used: To have the same values at the same position, one bar code tape must be affixed with numbers upside down while the other is affixed normally.

If twin bar code tapes are not used, the two bar code tapes may deviate +/- 1 mm per meter relative to one another.



1 BCB affixed upside down
2 BCB affixed normally

Fig. 6.7: Affixing two bar code tapes with the same value range

6.2 Mounting the bar code positioning system

The BPS can be mounted in the following ways:

- Mounting using a mounting device on the fastening grooves
  - BTU 0300M-W: Wall mounting
  - BT 56: Mounting on a rod
- Mounting using a mounting device on the M4 mounting threads on the rear of the device
  - BT 300 W: Mounting on a mounting bracket
  - BT 300-1: Mounting on a rod
- Mounting using four M4 mounting threads on the rear of the device

NOTICE

If the BTU 0300M-W mounting device is used to mount the device, the new device is automatically aligned correctly should it be necessary to exchange a device.

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 BPS and bar code tape is sufficiently large.
  The scanning beam of the BPS should cover three or more bar codes.
  The distance between BPS and bar code 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 BPS outdoors or with BPS with integrated heating:
  Mount the BPS in a way which provides maximum thermal isolation, e.g., using rubber-bonded metal.
  Mount the BPS so that it is protected from airflow, e.g., in a protective housing.
- Mounting the BPS in a protective housing:
  When installing the BPS in a protective housing, ensure that the scanning beam can exit the protective housing without obstruction.
- Make certain that the working 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 BPS must be incident on the BCB without interruption.
  For the best functionality, the BPS must be guided parallel to the BCB. It is not permitted to move outside of the approved working range of the BPS (50 … 170 mm) while the system is in motion.
- Make certain that there is only one control bar code (or marker label) in the scanning beam at a time.
  The minimum distance between two control bar codes is determined by the distance between the BPS and bar code 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 BPS next to or above one another.

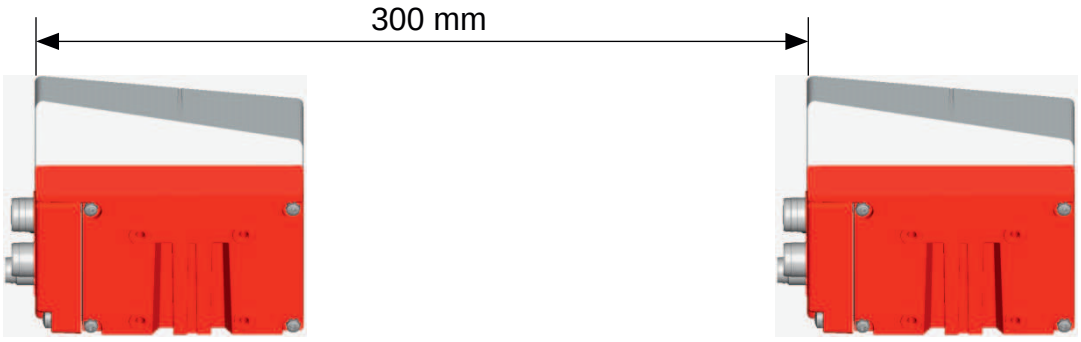


Fig. 6.8: Minimum distance for parallel mounting

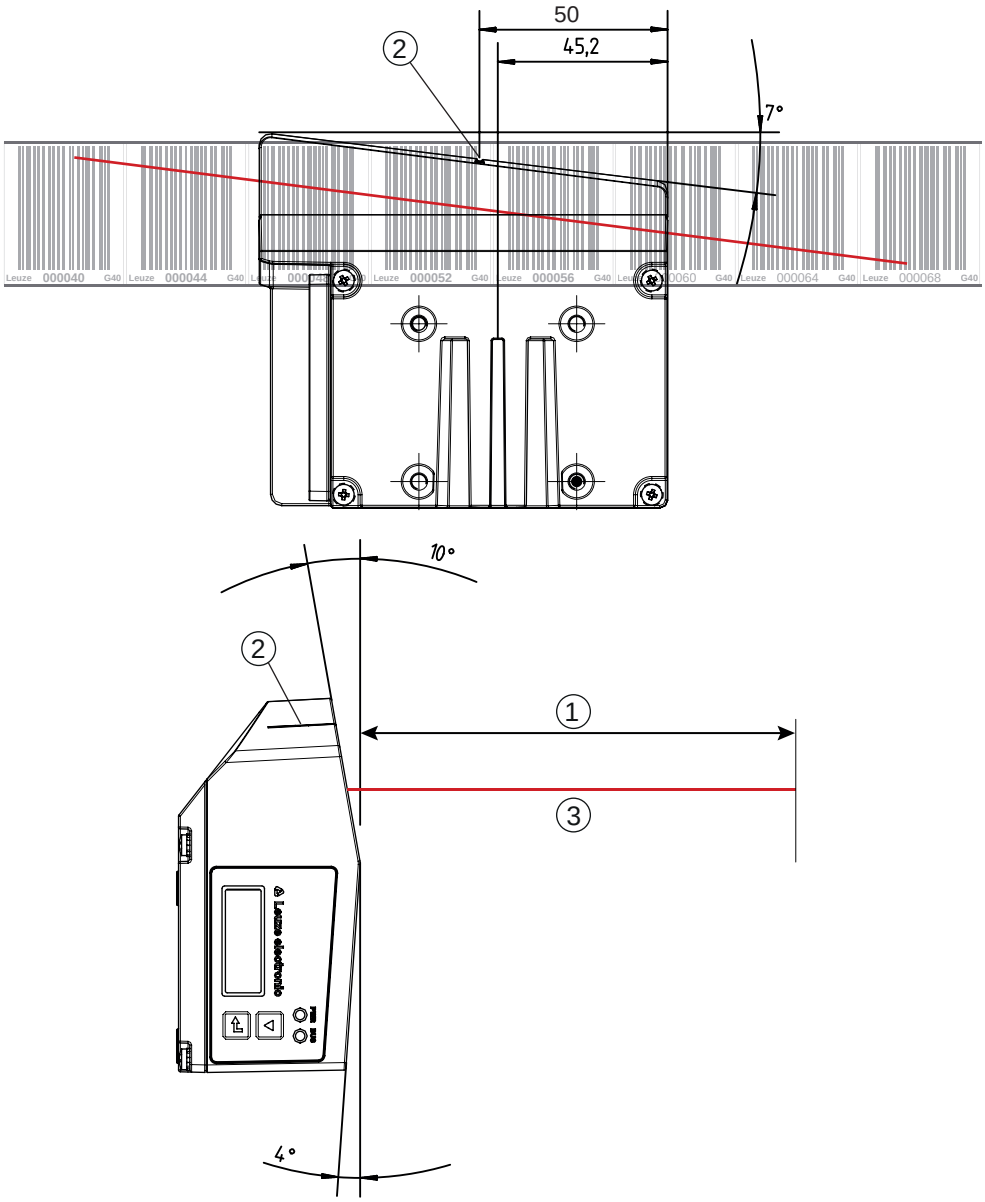
NOTICE

Install the connection hood before mounting the BPS!

- Screw the MS 358 or MK 358 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 BPS to the bar code tape

The beam of the BPS must be oriented at an incline of 7° to the bar code tape (see following figure). When positioning, make certain that the angle of radiation to the rear side of the housing is 90 ° and the reading distance to the bar code tape is maintained.



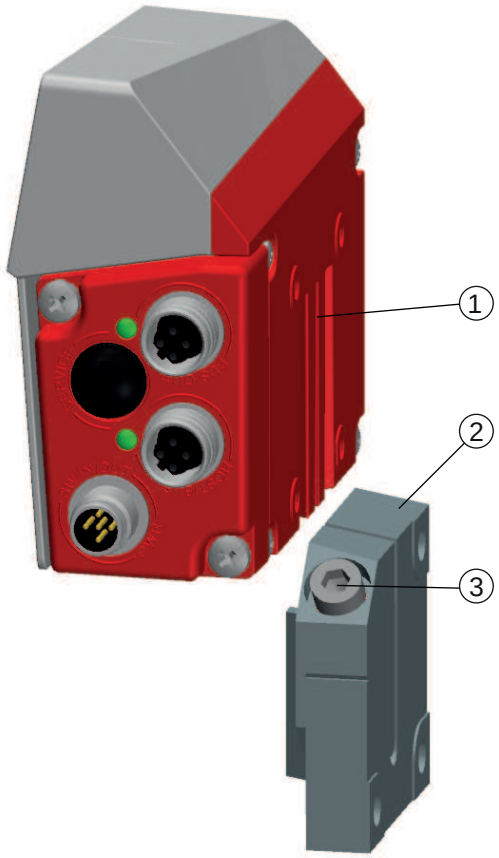
1 Reading distance
2 Reference point for the bar code position
3 Scanning beam

Fig. 6.9: Beam exit

6.2.3 Mounting with the BTU 0300M-W mounting device

Mounting the BPS with a BTU 0300M-W mounting device is intended for wall mounting.

For ordering information see chapter 15 "Order guide and accessories"; for dimensioned drawing see chapter 14.4 "Dimensioned drawings: Accessories".



1 Clamp profile
2 Clamping jaws
3 Screw terminal

Fig. 6.10: Mounting the BPS with the BTU 0300M-W mounting device

- Mount the BTU 0300M-W mounting device on the system side with M6 fastening screws (not included in delivery contents).
- Mount the BPS with the dovetail fastening grooves on the clamping jaws of the BTU 0300M-W mounting device with limit stop at the end.
- Secure the BPS with the M6 screw terminal.
  Maximum tightening torque for the M6 screw terminal: 8 Nm

6.2.4 Mounting with the BT 300 W mounting bracket

Mounting of the BPS with a BT 300 W mounting bracket is intended for wall mounting.

For ordering information see chapter 15 "Order guide and accessories"; for dimensioned drawing see chapter 14.4 "Dimensioned drawings: Accessories".

- Mount the BT 0300 W mounting bracket on the system side with M6 fastening screws (included in delivery contents).
- Mount the BPS on the mounting bracket with M4 fastening screws (included in delivery contents).
  Maximum tightening torque of the M4 fastening screws: 2 Nm

6.2.5 Mounting with BT 56 mounting device

Mounting of the BPS with a BT 56 mounting device is intended for rod mounting.

For ordering information see chapter 15 "Order guide and accessories"; for dimensioned drawing see chapter 14.4 "Dimensioned drawings: Accessories".

- Mount the BT 56 mounting device with the clamp profile on the rod (system-side).
- Mount the BPS with its fastening grooves on the clamping jaws of the BT 56 mounting device with limit stop at the end.
- Secure the BPS with the M6 screw terminal.
  Maximum tightening torque for the M6 screw terminal: 8 Nm

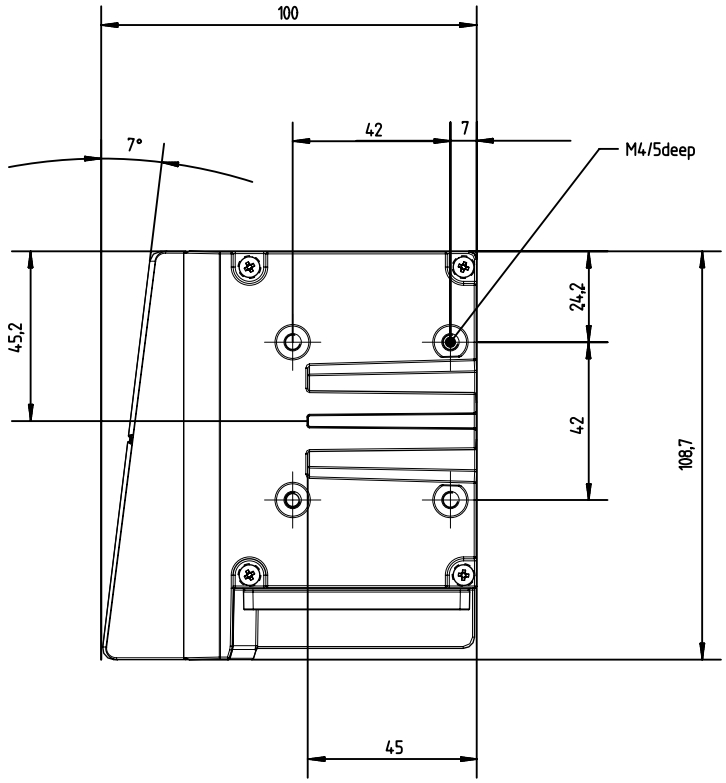
6.2.6 Mounting with BT 300-1 mounting device

Mounting of the BPS with a BT 300-1 mounting device is intended for rod mounting.

For ordering information see chapter 15 "Order guide and accessories"; for dimensioned drawing see chapter 14.4 "Dimensioned drawings: Accessories".

- Mount the BT 300-1 mounting device with the clamp profile on the rod (system-side).
- Mount the BPS on the mounting bracket of the BT 300-1 with M4 fastening screws (included in delivery contents).
  Maximum tightening torque of the M4 fastening screws: 2 Nm

6.2.7 Mounting with M4 fastening screws



all dimensions in mm

Fig. 6.11: Dimensioned drawing of rear of BPS

- Mount the BPS on the system with M4 fastening screws (not included in delivery contents).
  Maximum tightening torque of the fastening screws: 2 Nm

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 device is designed in accordance with protection 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 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 BPS.
- Degree of protection IP 65 is not fulfilled until connectors or cable bushings are screwed on and caps are installed.

NOTICE

For all connections (connection cable, interconnection cable, etc.), use only the cables listed in the accessories (see chapter 15 "Order guide and accessories").

7.1 External parameter memory in the connection hood

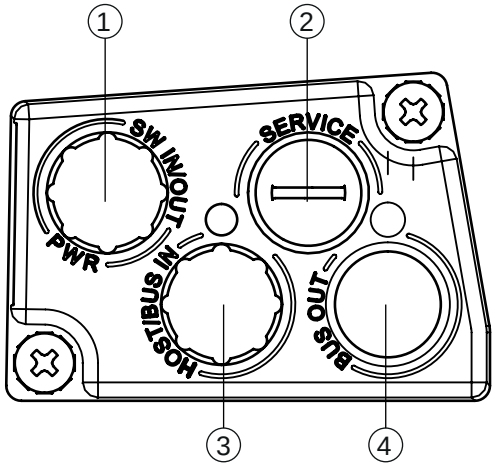
The parameter memory in the MS 358 or MK 358 connection hood stores the device name and holds a copy of the current BPS parameter set.

- If a BPS device exchange is performed on-site, the device name for the new BPS 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 BPS.

7.2 MS 358 connection hood with connectors

The MS 358 connection hood features three M12 connections and a Mini-B type USB port as a service interface.



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

Fig. 7.1: MS 358 connection hood, connections

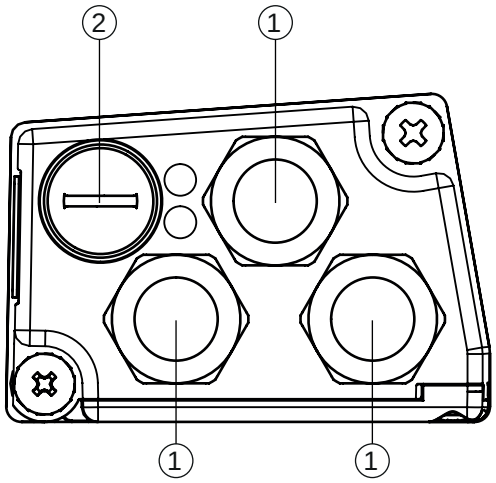
NOTICE
Shielding connection and functional earth connection! ↳ The shielding connection is done via the M12 connector housing. ↳ Ensure that the functional earth (FE) is connected correctly. Unimpaired operation is only guaranteed when the functional earth is connected properly. All electrical disturbances (EMC couplings) are discharged via the functional earth connection.

NOTICE
The integrated parameter memory for the simple replacement of the BPS 358i is located in the MS 358 connection hood. In the integrated parameter memory, both the settings and the network address are saved and transmitted to a new device.

7.3 MK 358 connection hood with spring-cage terminals

With the MK 358 connection hood, the BPS is connected directly and with no additional plug.

- The MK 358 connection hood has three cable bushings, which also contain the shield connection for the interface cable.
- A Mini-B USB port serves as a service interface.



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

Fig. 7.2: MK 358 connection hood, connections

NOTICE

Cable fabrication!

↳ We recommend against using 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.

NOTICE

The integrated parameter memory for the simple replacement of the BPS 358i is located in the MS 358 connection hood. In the integrated parameter memory, both the settings and the network address are saved and transmitted to a new device.

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.

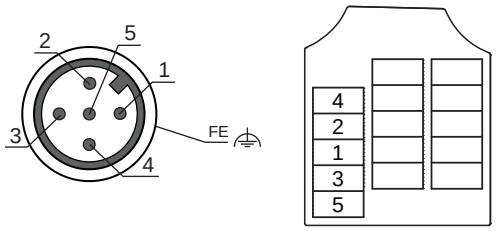


Fig. 7.3: PWR / SW IN/OUT connection

Tab. 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 connector) 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.

Connection cables: see chapter 15 "Order guide and accessories"

CAUTION

UL applications!

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

Switching input/output

The BPS 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 BPS (e.g., Measurement Stop/Start, Teach Preset, Reset Preset).
- The switching outputs can be used to signal the state of the BPS 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/Os.

  If no internal BPS 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.

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 BPS with more than 60 mA at + 18 … 30 VDC in normal operation.

↳ Each configured switching output is short-circuit proof.

NOTICE

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 BPS (SWIO1 and SWIO2), no switching outputs may be connected from external sensors/devices.
The switching output of the BPS may otherwise malfunction.

NOTICE

You can set the respective function as an input or output using the ‘webConfig’ configuration tool!

7.4.2 EtherNet/IP BUS IN

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

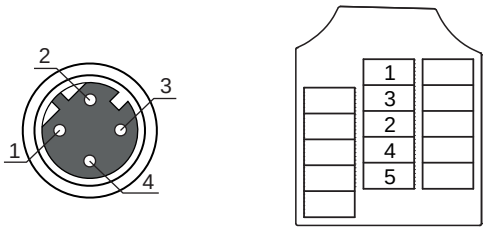


Fig. 7.4: EtherNet/IP / BUS IN connection

Tab. 7.2: EtherNet/IP / BUS IN pin assignment

Pin/terminal	Designation	Assignment
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -
FE via thread	FE via screw fitting	Functional earth (housing)

NOTICE

Use ready-made cables!

↳ If possible, use the ready-made cables from Leuze (see chapter 15.3 "Cables accessories").

7.4.3 EtherNet/IP BUS OUT

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

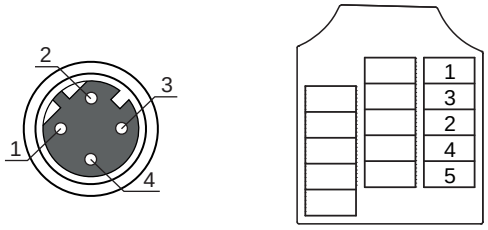


Fig. 7.5: EtherNet/IP / BUS OUT connection

Tab. 7.3: EtherNet/IP BUS OUT pin assignment

Pin/terminal	Designation	Assignment
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -
FE via thread	FE via screw fitting	Functional earth (housing)

NOTICE

Use ready-made cables!

- If possible, use the ready-made cables from Leuze (see chapter 15.3 "Cables accessories").

7.4.4 Service USB

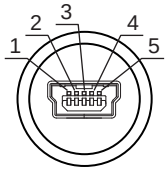
NOTICE

PC connection!

- The service USB interface of the BPS 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 specific USB service cable from Leuze (see chapter 15.3 "Cables accessories").

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

Tab. 7.4: Service USB pin assignment

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

NOTICE

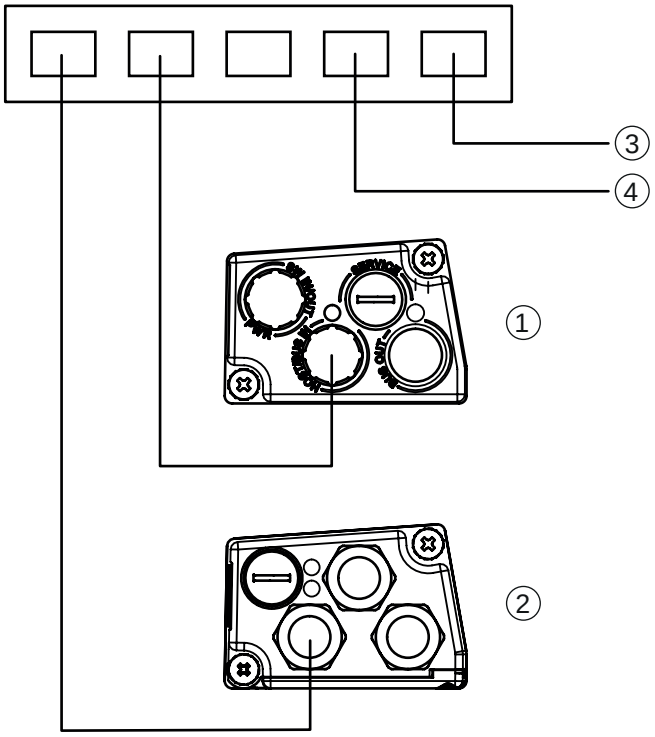
Self-configured cables!

- The entire USB interconnection cable must absolutely be shielded acc. to the USB specifications.
- The maximum cable length of 3 m must not be exceeded.

7.5 Ethernet topologies

The BPS 358i can be operated as a single device (stand-alone) in an Ethernet star topology with individual IP address.

The IP address can either be set manually and permanently via BootP/webConfig tool or assigned dynamically via a DHCP server.



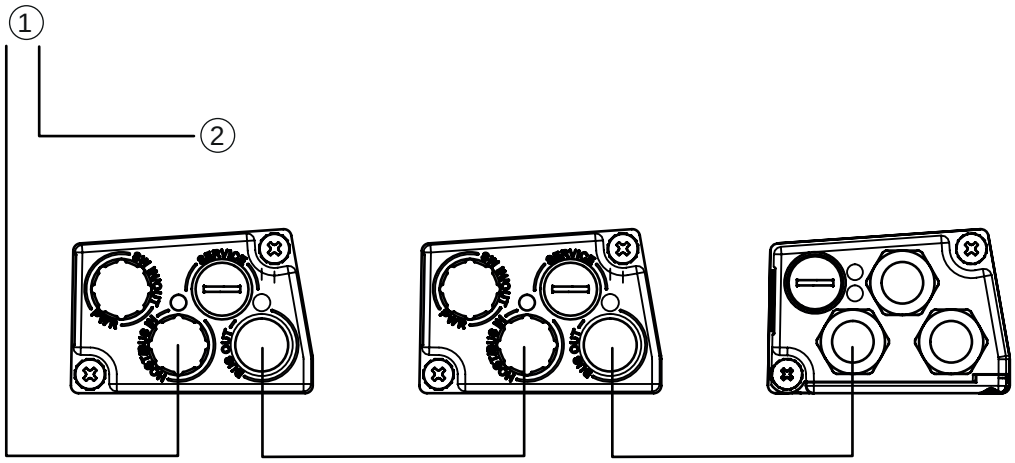
1 with MS 358 connection hood with M12 connectors
2 with MK 358 connection hood with spring-cage terminals
3 PC/control host interface
4 other network participants

Fig. 7.6: Star topology

The innovative further development of the BPS 358i with integrated switch functionality offers the option of networking multiple bar code readers of type BPS 358i with one another. In addition to the classic "star topology", a "linear topology" is thus also possible.

This makes wiring the network easy and inexpensive as slaves are looped through to one another in parallel.

The maximum length of a segment (connection between two switches/BPS 358i) is limited to 100 m.



1 PC/control host interface
2 other network participants

Fig. 7.7: Linear topology

Each participating BPS 358i is automatically assigned its address by a DHCP server.

Alternatively, each BPS 358i can be assigned the respective network address via the webConfig tool. This address must be specified by the network administrator.

7.5.1 Ethernet wiring

A Cat. 5 Ethernet connection cable should be used for wiring.

For the connection on the BPS 358i, a KDS ET M12 / RJ45 W-4P adapter is available into which the standard network cable can be plugged (see chapter 15 "Order guide and accessories").

If no standard network cables are to be used (e.g. due to a lack of protection class IP…), you can use the user-configurable cables on the BPS 358i (depending on the connection hood used).

	NOTICE
	The BPS 358i supports the DLR (Device Level Ring) ring structure determined by the ODVA.

7.6 Cable lengths and shielding

Observe the maximum cable lengths and the shielding types:

Connection	Interface	Max. cable length	Shielding
BPS service	USB	3 m	Shielding absolutely necessary acc. to USB specifications
BPS host	Ethernet	100 m	Shielding absolutely necessary
Switching input		10 m	Not necessary
Switching output		10 m	Not necessary
BPS power supply unit		30 m	Not necessary

8 EtherNet/IP interface

8.1 EtherNet/IP

EtherNet/IP is an industrial communication network based on Ethernet and builds on the TCP/IP and UDP/IP protocols.

EtherNet/IP uses CIP (Common Industrial Protocol) as the application layer for the user. CIP distinguishes between real-time communication by means of “implicit messages”, and individual, acyclic services referred to as “explicit messages”.

Explicit messages

Explicit messages are sent based on TCP/IP. The receiver interprets the message as an instruction, executes this instruction and generates a corresponding answer. Explicit messages are used e.g. for device configuration, programming, and the diagnosis and communication of non-time-critical data, and do not have a real-time character.

Explicit messages are always sent after point-to-point communication.

All EDS objects of the BPS 358i that are described below can be called up via explicit services (e.g. Get Attribute Single, Set Attribute Single, etc.).

Implicit messages

Implicit messages are used to send real-time I/O data. For this purpose, EtherNet/IP does not use TCP, but rather UDP (User Datagram Protocol) via IP (Internet Protocol). This protocol is much more compact and supports multicast and unicast messages.

Implicit message telegrams are sent cyclically at short intervals with current data and I/O signals. The cycle can be configured via the control. The telegram overhead here is minimal so that these messages can be processed extremely quickly and in a prioritized manner.

Within the BPS 358i, the input and output assemblies for transferring measurement values are transferred by means of UDP and are therefore available deterministically in a cycle configured via the control.

For implicit messages, EtherNet/IP uses the producer/consumer communication model for data exchange. A producer is a device that sends data; a consumer is a device that receives data. In multicast mode, multiple consumers can receive and evaluate a producer message at the same time.

Generally speaking, it should be noted that if multicast is used, the messages are sent to all participants as a broadcast. This significantly increases the data traffic on the network. If the data is to be exchanged only between the BPS and PLC, we recommend that the unicast mode be set at the control for these participants.

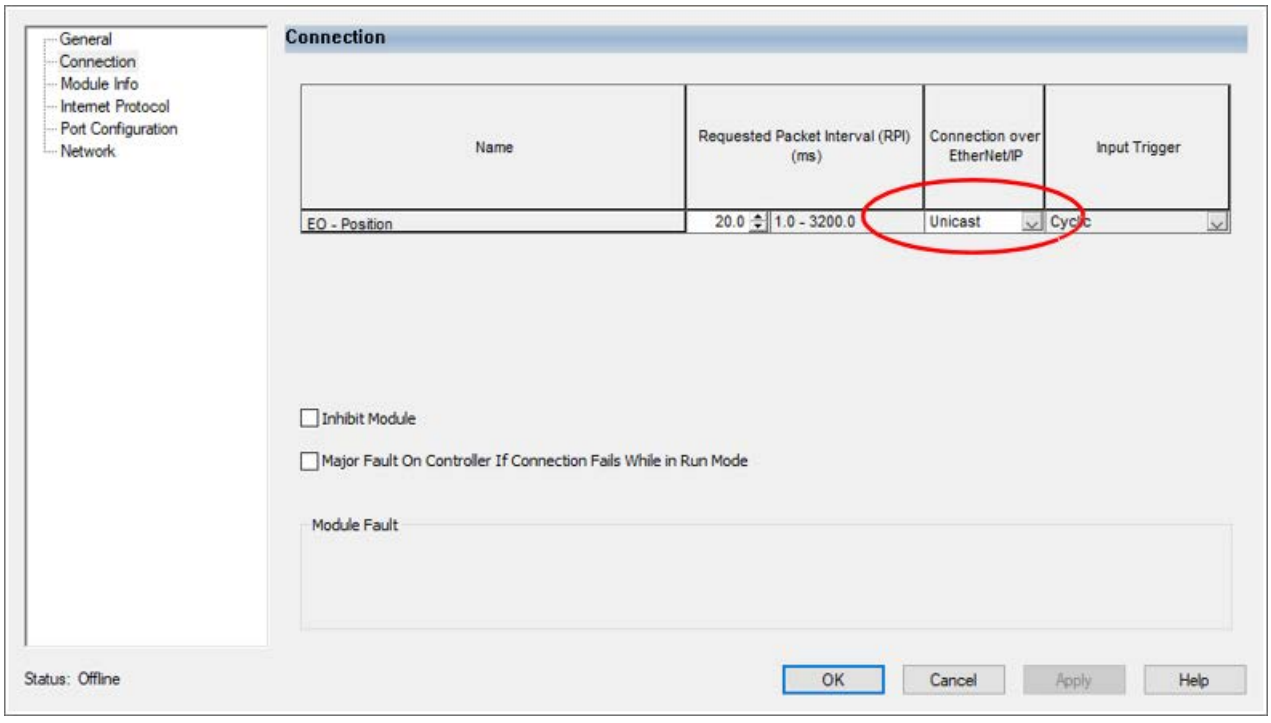


Fig. 8.1: Setting unicast mode

EtherNet/IP therefore combines TCP/IP and UDP/IP data telegrams for transferring explicit and implicit messages. As a result, EtherNet/IP can use both real-time I/O data for time-critical control tasks (UDP) as well as information data (TCP) simultaneously on the same network.

All BPS 358i data is displayed in an object-orientated manner via CIP and is accessible to the user via the explicit or implicit message services described above.

The common basis for configuration within CIP is the **EDS file** (**E**lectronic **D**ata **S**heet). The EDS file of the BPS 358i contains predefined input and output assemblies for the UDP-based real-time transfer as well as all configuration and diagnostic data for the TCP/IP-based services.

	NOTICE
	The BPS 358i communicates via the Common Industrial Protocol (CIP). CIP Safety, CIP Sync and CIP Motion are not supported by the BPS 358i.

The EDS file for the BPS 358i can be found on the product page of the Leuze website **www.leuze.com** under Downloads.

8.2 Topology

The BPS 358i can be used in all topologies defined by EtherNet/IP. The M12 connections for BUS IN and BUS OUT are coupled to each other via an integrated switch. The BPS 358i can thus be used for further branching of EtherNet/IP based on the standard CIP.

If parameter enabling of the BPS 358i is activated via the display, the BPS 358i is deactivated as a participant. This avoids parameter access conflicts. In this case, it is still possible to communicate with the participant connected via BUS OUT.

	NOTICE
	The BPS 358i supports the DLR (Device Level Ring) ring structure determined by the ODVA.

8.3 Addressing

Each participant connected to EtherNet/IP must be assigned an IP address. Addressing can be performed manually or automatically via DHCP or BootP.

By default, DHCP is set to "ON", BootP is set to "OFF". Both settings can be changed via the display.

	NOTICE
	Basic operation of the display is described in see chapter 3.3.2 "Display indicators" To set the network addresses manually (not DHCP), parameter enable must be activated. The display is inverted when parameter enable is active.

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

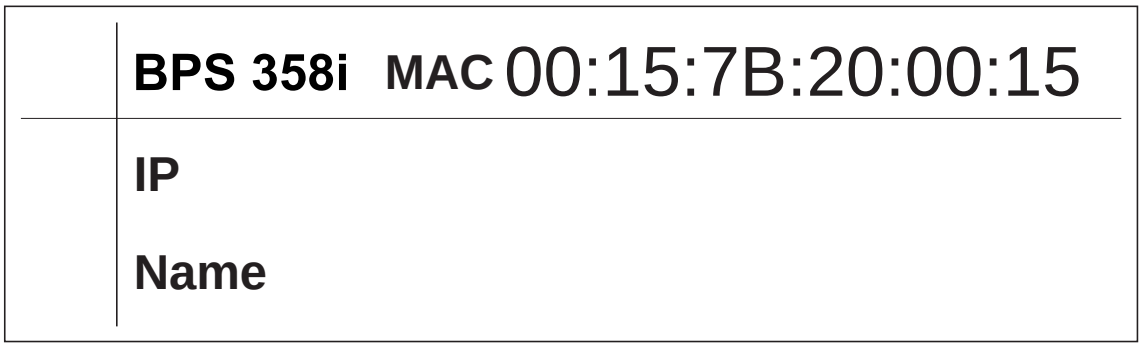


Fig. 8.2: Example of an Address Link Label

- 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 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.

	NOTICE
	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

8.4 Entering the network address via the display

To do this proceed as follows:

↳ Activate Parameter enable.

↳ Select the submenu *EtherNet/IP*.

↳ Select the menu item *IP address*.

9 EDS file – general info

The EDS file is named “BPS358i.eds”; the corresponding icon is named “BPS358i.ico”. Both files can be downloaded from the Leuze website **www.leuze.com** . The EDS file contains all identification and communication parameters of the device, as well as the available objects.

The BPS 358i is uniquely classified via a class 1 identity object (component of the BPS358i.eds file) for the EtherNet/IP scanner (master). The identity object contains, among other things, a manufacturer-specific Vendor ID, as well as an ID that describes the principle function of the participant.

The BPS 358i has the following identity object (class 1):

Vendor ID: $524_{Dec.}$ / $20C_{H}$

Device type: $34_{Dec.}$ / 22_{H} (identifies the BPS 358i as an “encoder”)

Position sensor type: $8_{Dec.}$ / 8_{H} (specifies the BPS 358i as an “absolute encoder”)

If accepting the objects without change, all parameters are set to default values. The default settings are shown in the objects described in detail in the “Default” column.

An assembly is activated by default in the EDS file. The assembly automatically communicates its inputs and outputs to the control. Further information on the assemblies see chapter 9.3 "Class 4: Assembly".

	NOTICE
	In the following tables, all attributes marked in the “Access” column with “Get” in the individual objects are to be understood as inputs of the scanner (control). Attributes marked in the “Access” column with “Set” represent outputs or parameters.

The EDS file is described in detail in the following chapter. The access addresses to the individual objects as well as the default settings of the individual attributes are given in this description.

Furthermore, assemblies with predefined inputs and outputs are provided for implicit (real-time) communication. A detailed description of the assemblies see chapter 9.1 "EDS file – classes and instances".

The EDS file also contains a configuration assembly. The BPS 358i parameters can be stored in the control through the configuration assembly.

For this purpose, a separate storage place for each participant must be provided in the control.

If a “generic module” is used in the control for the configuration assembly, then all memory locations are preset with parameter values 0 (zero). When using the generic module, it is therefore essential to manually transfer the individual parameters from the manual.

9.1 EDS file – classes and instances

Tab. 9.1: Classes and instances

Class ID	Class name	Class version	Instance ID	Instance name
1	Class1 Identity object	1.2	1	Instance 1
4	Class 4 Assembly	1.2	1	Instance 1 Position
4	Class 4 Assembly	1.2	3	Instance 3 Position + Velocity
4	Class 4 Assembly	1.2	100	Instance 100 Position + Status
4	Class 4 Assembly	1.2	101	Instance 101 Position + Velocity + Status
4	Class 4 Assembly	1.2	102	Instance 102 Fully Featured
4	Class 4 Assembly	1.2	120	Instance 120 Control
4	Class 4 Assembly	1.2	190	Instance 190 Configuration
35	Class 35 Position sensor object	1.2	1	Instance 1
104	Class 104 Error handling procedures	1.2	1	Instance 1
106	Class 106 Activation	1.2	1	Instance 1

Class ID	Class name	Class version	Instance ID	Instance name
109	Class 109 Device status and control	1.2	1	Instance 1
110	Class 110 Device application status and control	1.2	1	Instance 1
112	Class 112 Marker barcode	1.2	1	Instance 1
114	Class 114 Reading quality	1.2	1	Instance 1

9.2 Class 1: Identity object

Class ID: 1 (0x0001)

Instance ID: 1 (0x0001) Name: Instance 1

Service:

- Get_Attribute_Single

	NOTICE
	If the device is replaced in the application, the main revision number must not be transferred. The main revision number describes the firmware version of the BPS 358i software within the EDS file/class 1. This may have changed if the device has been replaced. Otherwise the positioning system may issue an error message after a device replacement.

Tab. 9.2: Class 1 Assembly signals

Path			Name	Size in bit	Data type	Standard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
1	1	1	Vendor ID	16	UINT	524	0	0	Get
		2	Device type	16	UINT	34	0	0	Get
		3	Product Code	16	UINT	7	0	0	Get
		4	Revision		Tbd	0	0	0	Get
		5	Status	16	WORD	0	0	0	Get
		6	Serial number	32	UINT	0	1	0	Get
		7	Product name	8	SHORT_ STRING	0	0	0	Get
		8	Status	8	USINT	0	0	0	Get
		9	Configuration consistency value	16	UINT	0	0	0	Get

Attribute 1: VendorID

The Vendor ID is assigned by the ODVA and is **524**for Leuze electronic Gmbh + Co. KG.

Attribute 2: Device type

The BPS 358i is defined by Leuze as an encoder. According to ODVA, the BPS 358i receives the number:

34 = 0x22 = BPS 358i

Attribute 3: Product code

The product code is an identifier assigned by Leuze that has no further impact on other objects.

7 = BPS 358i

Attribute 4: Revision

Version number of the identity object

STRUCT from {USINT major, USINT minor}

Remark from the ODVA specification:

The *Revision* attribute, which consists of major and minor revisions, identifies the revision (attribute no. 4) of the object that the identity object represents. The value zero is not valid for either the major and minor revision field.

The major and minor revisions are usually displayed as Major, Minor. Minor revisions are displayed as three digits with leading zeros if necessary. The major revision is limited to values between 1 and 127. The eighth bit (which, when set to one, represents values from 128 to 255) is reserved by CIP and must have the value zero.

Tab. 9.3: Attribute 4

Path			Desig-nation	Size in bit	Data type	Stan-dard (dec)	Min. value	Max. value	Access
Cl.	Inst.	Attr.							
1	1	4	Major	8	USINT	1	1	127	Get
			Minor	8	USINT	1	1	255	Get

Attribute 5: Status

Basic and higher-level monitoring of the device, network and configuration. The entries are described by the scanner.

Remark from the ODVA specification:

This attribute represents the current status of the entire device. Its value changes when the device's status changes.

The *Status* attribute has the file type WORD.

Tab. 9.4: Attribute 5

Path			Designation	Size in bit	Data type	Standard (dec)	Min. value	Max. value	Access
Cl.	Inst.	Attr.							
1	**1**	**5**	Owned	1	BOOL	0	0	1	Get
			Configured	1	BOOL	0	0	1	Get
			Extended device status	4x1	BOOL	0	0	15	Get
			Minor recoverable fault	1	BOOL	0	1	1	Get
			Minor unrecoverable fault	1	BOOL	0	1	1	Get
			Major recoverable fault	1	BOOL	0	1	1	Get
			Major unrecoverable fault	1	BOOL	0	1	1	Get

Attribute 6: Serial number

For use in Ethernet/IP, the serial number receives a serial number converted according to CIP. CIP describes a special format for the serial number. After conversion to a CIP code, the serial number is still unique, but its resolution no longer corresponds to the serial number on the name plate.

Attribute 7: Product name

This attribute contains the product's short designation. Devices with the same product code may have different product names.

Attribute 8: Status

This attribute contains information about the current status of the BPS 358i.

Attribute 9: Configuration consistency value

The function is not supported by the BPS 358i. The default entry 0 (zero) does not change.

9.3 Class 4: Assembly

Object class ID: 4 (0x0004)

Class 4 offers several instances for input and output data as well as for configuration parameters.

Instances 1 and 3 are prescribed by the ODVA for position sensor devices. The other instances are manufacturer-specific for the BPS 358i device.

Each instance has an attribute 3, which is defined as a byte array and consists of its own structure of attributes from other classes.

9.4 Class 4: Instance 1: Position

Assembly instance ID: 1 (0x0001)

- Attribute ID: 3 Name: Data
- Assembly data record length: 4 bytes

Tab. 9.5: Class 4 Instance 1 Assembly signals

Path			Desig-nation	Size in bit	Data type	Stan-dard (dec)	Min. value	Max. value	Cross refer-ence
Cl.	Inst.	Attr.							
4	1	3	Position value	32	DINT	0	-2000000000	2000000000	35 / 1 / 10

Data

Instance 1, attribute 3

Assembly data record length: 4 bytes

Assembly to read out the position value. According to the definition from the ODVA, the assembly with instance 1 is a mandatory assembly in the encoder profile.

Tab. 9.6: Instance 1: Position value

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	Position value (low byte)							
	1	Position value							
	2	Position value							
	3	Position value (high byte)							

9.5 Class 4: Instance 3: Position + Velocity Value

Assembly instance ID: 3 (0x0003)

Attribute ID: 3 Name: Data

Assembly data record length: 8 bytes

Tab. 9.7: Instance 3 Assembly signals

Path			Desig-nation	Size in bit	Data type	Stan-dard (dec)	Min. value	Max. value	Cross refer-ence
Cl.	Inst.	Attr.							
4	3	3	Position value	32	DINT	0	-2000000000	2000000000	35 / 1 / 10
			Velocity value	32	DINT	0	-1000000	1000000	35 / 1 / 24

Data

Instance 3, attribute 3:

Assembly data record length: 8 bytes

Assembly for reading out the position and speed value. The assembly with instance 3 complies with the definition of the ODVA encoder profile.

Tab. 9.8: Instance 3: Position and speed value

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
3	0	Position value (low byte)							
	1	Position value							
	2	Position value							
	3	Position value (high byte)							
	4	Velocity value (low byte)							
	5	Velocity value							
	6	Velocity value							
	7	Velocity value (high byte)							

9.6 Class 4: Instance 100: Position Value + Status

Assembly instance ID: 100 (0x0064)

Attribute ID: 3 Name: Data

Assembly data record length: 10 bytes

Tab. 9.9: Assembly signals

Path			Designation	Size in bit	Data type	Standard (dec)	Min. value	Max. value	Cross reference
Cl.	Inst.	Attr.							
4	100	3	Position value	32	DINT	0	-2000000000	2000000000	35 / 1 / 10
			Device status	8	USINT	0	-0	255	109 / 1 / 1
			Movement/direction status	8	USINT	0	0	2	35 / 1 / 113
			Alarms	16	WORD	0	0	65535	35 / 1 / 44
			Warnings	16	WORD	0	0	65535	35 / 1 / 47

Data

Instance 100, attribute 3

Assembly data record length: 10 bytes

Assembly for reading out the position value and the selected status attributes.

Tab. 9.10: Instance 100: Position value and status attributes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100	0	Position value (low byte)							
	1	Position value							
	2	Position value							
	3	Position value (high byte)							
	4	Device status							
	5	Movement/direction status							
	6	Alarms (low byte)							
	7	Alarms (high byte)							
	8	Warnings (low byte)							
	9	Warnings (high byte)							

9.7 Class 4: Instance 101: Postion + Velocity + Status

Assembly instance ID: 101 (0x0065)

Attribute ID: 3 Name: Data

Assembly data record length: 14 bytes

Tab. 9.11: Assembly signals

Path			Designation	Size in bit	Data type	Standard (dec)	Min. value	Max. value	Cross reference
Cl.	Inst.	Attr.							
4	101	3	Position value	32	DINT	0	-2000000000	2000000000	35 / 1 / 10
			Velocity value	32	DINT	0	-1000000	1000000	35 / 1 / 24
			Device status	8	USINT	0	-0	255	109 / 1 / 1
			Movement/direction status	8	USINT	0	0	2	35 / 1 / 113
			Alarms	16	WORD	0	0	65535	35 / 1 / 44
			Warnings	16	WORD	0	0	65535	35 / 1 / 47

Data

Instance 101, attribute 3

Assembly data record length: 14 bytes

Assembly for reading out the position and speed values and status attributes

Tab. 9.12: Instance 101: Position and speed values and status attributes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
101	0	Position value (low byte)							
	1	Position value							
	2	Position value							
	3	Position value (high byte)							
	4	Velocity value (low byte)							
	5	Velocity value							
	6	Velocity value							
	7	Velocity value (high byte)							
	8	Device status							
	9	Movement/direction status							
	10	Alarms (low byte)							
	11	Alarms (high byte)							
	12	Warnings (low byte)							
	13	Warnings (high byte)							

9.8 Class 4: Instance 102: Fully featured

Assembly instance ID: 102 (0x0066)

Attribute ID: 3 Name: Data

Assembly data record length: 18 bytes

Tab. 9.13: Assembly signals

Path			Designation	Size in bit	Data type	Standard (dec)	Min. value	Max. value	Cross reference
Cl.	Inst.	Attr.							
4	102	3	Position value	32	DINT	0	-2000000000	2000000000	35 / 1 / 10
			Velocity value	32	DINT	0	-1000000	1000000	35 / 1 / 24
			Device status	8	US	0	0	255	109 / 1 / 1
			Measurement not active	1	BOOL	0	0	1	106 / 1 / 6
			Control or marker	1	BOOL	0	0	1	112 / 1 / 4
			Control or marker toggle	1	BOOL	0	0	1	112 / 1 / 5
			Movement/direction status	2x1	BOOL	0	0	2	35 / 1 / 113
			Reserve	3x1	BOOL	0	0	0	N/A
			Reading quality	8	USINT	0	0	255	114 / 1 / 1
			Alarms	16	WORD	0	0	65535	35 / 1 / 44
			Warnings	16	WORD	0	0	65535	35 / 1 / 47
			Detected barcode	3x8	USINT	0	0	255	112 / 1 / 6

Data

Instance 102, attribute 3

Assembly data record length: 18 bytes

Assembly for reading out specific input data and status attributes

Tab. 9.14: Instance 102: Input data and status attributes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
102	0	Position value (low byte)							
	1	Position value							
	2	Position value							
	3	Position value (high byte)							
	4	Velocity value (low byte)							
	5	Velocity value							
	6	Velocity value							
	7	Velocity value (high byte)							
	8	Device status							
	9	Reserve			Movement/direction status		Control or marker toggle	Control or marker	Measurement not active
	10	Reading quality							
	11	Alarms (low byte)							
	12	Alarms (high byte)							
	13	Warnings (low byte)							
	14	Warnings (high byte)							
	15	Detected barcode (low byte)							
	16	Detected barcode							
	17	Detected barcode (high byte)							

9.9 Class 4: Instance 120: Control

Assembly Instance ID: 120 (0x0078)

Attribute ID: 3 Name: Data

Assembly data record length: 1 byte

Tab. 9.15: Assembly signals

Path			Designation	Size in bit	Data type	Standard (dec)	Min. value	Max. value	Cross reference
Cl.	Inst.	Attr.							
4	120	3	Stop/ start measurement	1	BOOL	0	0	1	106 / 1 / 3
			Activate / deactivate standby	1	BOOL	0	1	1	109 / 1 / 3
			Acknowledge control or marker	1	BOOL	0	0	1	112 / 1 / 3
			Reserve	5 x 1	BOOL	0	0	0	N/A

Data

Instance 120, attribute 3

Assembly data record length: 1 byte

Assembly for setting the control attributes

Tab. 9.16: Instance 120: Control attributes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
120	0	Reserve					Acknowledge control or marker	Activate / deactivate standby	Stop / start measurement

9.10 Class 4: Instance 190: Configuration

Assembly instance ID: 190 (0x00BE)

Attribute ID: 3 Name: Data

Assembly data record length: 24 bytes

Tab. 9.17: Assembly signals

Path			Designation	Size in bit	Data type	Stan-dard (dec)	Min. value	Max. value	Cross refer-ence
Cl.	Inst.	Attr.							
4	190	3	Direction count-ing toggle	1	BOOL	0	0	0	35 / 1 / 12
			Reserve B0	7 x 1	BOOL	0	0	0	N/A
			Position format	16	ENGU-NIT	8707	0	0	35 / 1 / 15
			Position low limit	32	DINT	0	-2000000000	2000000000	35 / 1 / 22
			Position high limit	32	DINT	0	-2000000000	2000000000	35 / 1 / 23
			Velocity format	16	ENGU-NIT	2064	0	0	35 / 1 / 25
			Velocity resolu-tion	32	UDINT	1000	1	50000	35 / 1 / 26
			Position value in case of error	2x1	BOOL	1	0	1	104 / 1 / 1
			Speed value in case of error	2x1	BOOL	1	0	1	104 / 1 / 2
			Reserve B17	4x1	BOOL	0	0	0	N/A
			Integration depth	5x1	BOOL	8	2	16	110 / 1 / 20
			Tape selection	12x1	BOOL	2	1	2	110 / 1 / 21
			Reserve B18	12	BOOL	0	0	0	N/A
			Velocity averag-ing	3x1	BOOL	2	0	5	110 / 1 / 22
			Reserve B19	5x1	BOOL	0	0	0	N/A
			Reload	1	BOOL	0	0	1	112 / 1 / 1
			Transmission	2x1	BOOL	0	0	2	112 / 1 / 2
			Reserve B20	5x1	BOOL	0	0	0	N/A
			Warning thresh-old reading qual-ity	8	USINT	60	30	90	114 / 1 / 2
			Error threshold reading quality	8	USINT	30	10	7	114 / 1 / 3
			Reading quality smoothing	8	USINT	5	0	100	114 / 1 / 4

Data

Instance 190, attribute 3

Assembly data record length: 24 bytes

Assembly for setting the configuration attributes

The configuration assembly is completely preset to the value 0 (zero) when it is transferred to the scanner.

The entries listed in the “Default” column must always be transferred manually to the scanner if the configuration assembly is used. Automatic transfer of the default settings is not possible.

All other system-specific parameters that are set by the respective programmer must also be transferred to the configuration assembly.

Tab. 9.18: Instance 190: Configuration attributes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
190	0	Reserve B0							Direction counting toggle
	1	Position format (low byte)							
	2	Position format (high byte)							
	3	Position low limit (low byte)							
	4	Position low limit							
	5	Position low limit							
	6	Position low limit (high byte)							
	7	Position high limit (low byte)							
	8	Position high limit							
	9	Position high limit							
	10	Position high limit (high byte)							
	11	Velocity format (low byte)							
	12	Velocity format (high byte)							
	13	Velocity resolution (low byte)							
	14	Velocity resolution							
	15	Velocity resolution							
	16	Velocity resolution (high byte)							
	17	Reserve B17				Speed value in case of error		Position value in case of error	
	18	Reserve B18			Integration depth				
	19	Reserve B19					Velocity averaging		
	20	Reserve B20					Transmission		Reload
	21	Warning threshold reading quality							
	22	Error threshold reading quality							
	23	Reading quality smoothing							

Comment:

Strictly speaking, offset values and their activation are not permanent parameters, as in some cases they have to be changed depending on the system status. Offset values are therefore not saved in the configuration assembly.

It is essential to ensure that parameters that are set in the BPS 358i via the scanner are also transferred to the configuration assembly.

Only parameters that are also entered in the configuration assembly can be taken into account in all BPS 358i operating situations.

Parameters that are set by explicit calls but are not entered in the configuration assembly can therefore only have a temporary effect. The next time the configuration file is automatically downloaded to the BPS 358i, these explicitly transferred parameters will be overwritten again.

9.11 Class 35: Position sensor object

Object class ID: 35 (0x0023)

Service:

- Get_attribute_Single
- Set_Attribute_Single

In the CIP network specifications, the function of object class 35 (23H) is defined as a “position sensor object”. The position sensor object describes the functions of an absolute measuring encoder. As defined in the CIP specification, the attributes with addresses 1 to 99 are functionally predetermined. The BPS 358i only uses attributes from this address range that are functionally mapped in the BPS. The address range ≥100 is manufacturer-specific.

Tab. 9.19: Class 35 Assembly signals

Path			Designation	Size in bit	Data type	Standard (dec)	Min. (dec)	Max. (dec)	Access
Cl.	Inst.	Attr.							
35	1	10	Position value	32	DINT	0	-2000000000	2000000000	Get

Path			Designation	Size in bit	Data type	Standard (dec)	Min. (dec)	Max. (dec)	Access
Cl.	Inst.	Attr.							
		11	Sensor type	16	UINT	8	8	8	Get
		12	Direction counting toggle	1	BOOL	0	0	1	Set
		15	Position format	16	ENGUNIT	8707	0	0	Set
		21	Position state register	8	BYTE	0	0	0	Get
		22	Position low limit	32	DINT	0	-1000000000	100000000	Set
		23	Position high limit	32	DINT	0	-1000000000	100000000	Set
		24	Velocity value	32	DINT	0	-100000000	10000000	Get
		25	Velocity format	16	UINT	2064	2064	11009	Set
		26	Velocity resolution	32	UDINT	1000	1	50000	Set
		44	Alarms	16	WORD	0	0	0	Get
		45	Supported alarms	16	WORD	24579	0	0	Get
		46	Alarm flag	1	BOOL	0	0	1	Get
		47	Warnings	16	WORD	0	0	0	Get
		48	Supported warnings	16	WORD	25600	0	0	Get
		49	Warning flag	1	BOOL	0	0	1	Get
		50	Operating time	32	UDINT	0	0	0	Get
		108	Position offset value	32	DINT	0	-100000000	10000000	Set
		112	Auto zero	1	BOOL	0	0	1	Set
		113	Movement / direction status	8	USINT	0	0	2	Get

Position value

Instance 1, attribute 10

Reading out the position value

Comment:

Negative values are shown in two's complement.

Sensor type

Instance 1, attribute 11

Specifies the measuring device with the CIP-defined identifier 8 as an absolute length measuring device.

Direction counting toggle

Instance 1, attribute 12

Determines whether the measured distance value decreases with increasing distance (positive counting direction) or with decreasing distance (negative counting direction).

0 = Positive counting direction (FORWARD)

1 = Negative counting direction (REVERSE)

Position format

Instance 1, attribute 15

The ENGUNIT data type configures the position format and the resolution. The EDS file contains the following parameters:

Tab. 9.20: Attribute 15: Position format

Dec.	Hex.	Unit
8706	0x2202	Centimeter [cm]
8707	0x2203	Millimeter [mm]
2049	0x0801	Tenth of a millimeter [1/10 mm]
2050	0x0802	Hundredth of a millimeter [1/100 mm]
2051	0x0803	Hundredth of an inch [1/100 in]

Comment:

If the position format is changed from metric to inches, the speed format is automatically changed internally to hundredths of an inch per second [1/100 in/s]. If the position format is changed from inches to metric, the speed format is automatically changed internally to millimeters per second [mm/s].

Position state register

Instance 1, attribute 21

Attribute 21 indicates the position status in relation to the defined limits.

- If the position is outside the range, a bit 0 is set in attribute 21 Position state register.
- If the position is lower than the position value set in Position low limit (attribute 22), the undershoot is marked with bit 2.
- If the position is higher than the position value set in Position high limit (attribute 23), bit 1 marks the overflow.

Tab. 9.21: Class 35 Assembly signals

Path			Desig-nation	Size in bit	Data type	Stan-dard (dec)	Min. value	Max. value	Access
Cl.	Inst.	Attr.							
35	1	21	Position out of range	1	BOOL	0	0	1	Get
			Position High Limit Ex-ceeded	1	BOOL	0	0	1	Get
			Position low limit ex-ceeded	1	BOOL	0	0	1	Get

Position low limit

Instance 1, attribute 22

The attribute 22 Position low limit configures the current working range. Attribute 21 Position state register contains the current range status of the position value (attribute 10).

The position limits define a configurable working range within the measurement range. This function enables the replacement of external proximity switches.

After changing the position format (attribute 15), this value must be updated manually to correspond to the newly selected position units.

Position high limit

Instance 1, attribute 23

Attribute 23 Position high limit configures the current working range. The position state register (attribute 21) contains the current range status of the position value (attribute 10).

The position limits define a configurable working range within the measurement range. This function enables the replacement of external proximity switches.

After changing the position format (attribute 15), this value must be updated manually to correspond to the newly selected position units.

Velocity value

Instance 1, attribute 24

Reading out the speed value

Comment:

Negative values are shown in two’s complement.

Velocity format

Instance 1, attribute 25

Configures the speed format and resolution. The EDS file contains the following parameters:

Tab. 9.22: Attribute 25: Speed format

Dec.	Hex.	Unit
11008	0x2B00	Meter per second [m/s]
11009	0x2B01	Centimeter per second [cm/s]
2064	0x0810	Millimeter per second [mm/s]
2065	0x0811	Decimeter per second [dm/s]
2066	0x0812	Hundredths of an inch per second [in/100/s]

Comment:

If the speed format is changed from metric to inches, the position format is automatically changed internally to hundredths of an inch [in/100]. If the speed format is changed from inches to metric, the position format is automatically changed internally to millimeters [mm].

Velocity resolution

Instance 1, attribute 26

As it is not possible to freely select the resolution in attribute 25 of the speed format, this attribute corresponds to the selected format and returns the resolution value in mm/100/s or inches/1000/s. Writing this attribute has no particular effect; it only saves the value and returns it when it is read. The written value is overwritten by selecting a new attribute value for the speed format.

Alarms

Instance 1, attribute 44

The status messages generated by the BPS 358i, **PLB** – plausibility and **ERR** – hardware errors, are entered in bit 0 and bit 1. The manufacturer-specific alarm messages **TEMP** – temperature error and **QUAL** – reading quality error threshold are entered in bit 13 or bit 14.

The alarms entered here lead to incorrect measurement values on the BPS 358i. The CIP specification distinguishes between alarms and warnings.

The following applies to the alarms' bit values:

0 = no alarm

1 = alarm

Tab. 9.23: Class 35 Assembly signals

Path			Designation	Size in bit	Data type	Standard (dec)	Min. value	Max. value	Access
Cl.	Inst.	Attr.							
35	1	44	Position error (position and velocity)	1	BOOL	0	0	1	Get
			Diagnostic error (hardware defect)	1	BOOL	0	0	1	Get
			Reserved	1	tbd	0	0	0	Get
			Temperature error	1	BOOL	0	0	1	Get
			Error threshold reading quality	1	BOOL	0	0	1	Get

Remark from the ODVA specification:

An alarm is triggered when a fault bit (in the application) is set to true (high). The alarm remains active until the alarm is cancelled and the device is able to provide an accurate position value.

Supported alarms

Instance 1, attribute 45

Attribute 45 indicates which alarms specified by the position sensor object are supported by the BPS 358i.

The following alarms are supported by the BPS 358i:

Bit 0 = 1 – PLB

Bit 1 = 1 – ERR

Bit 2 to 11 = 0 - Reserved by ODVA

Bit 13 = 1 – TEMP

Bit 14 = 1 – QUAL

Bit 15 = 0 - not used/supported

BPS 358i default value: 24579 (0x6003)

Remark from the ODVA specification:

This attribute contains information about the alarms supported by the position sensor unit. This attribute is required if attribute 44 Alarms is implemented.

Alarm flag

Instance 1, attribute 46

The attribute evaluates the alarms specified in attribute 44 in an OR function in order to compile a collective alarm.

Alarm indicator = PLB | ERR | TEMP | QUAL

Remark from the ODVA specification:

Indicates that an alarm error has occurred. This attribute is the logical OR of all alarm bits in attribute 44 Alarms. This attribute is required if attribute 44 Alarms is implemented.

Warnings

Instance 1, attribute 47

According to the CIP specification, warning messages are messages that signal that internal limit values have been exceeded, but do not lead to incorrect measurement values.

An area is reserved in the CIP specification for device-specific data (bits 13 to 15).

The BPS 358i supports POSLIM – Position limits exceeded (bit 10) as warnings.

The TEMP – temperature warning and QUAL – reading quality threshold value warning status messages in bit 13 and bit 14 are also specified as manufacturer-specific warnings.

The following applies to the warnings' bit values:

0 = no warning

1 = Warning

Tab. 9.24: Class 35 Assembly signals

Path			Desig-nation	Size in bit	Data type	Stan-dard (dec)	Min. value	Max. value	Access
Cl.	Inst.	Attr.							
35	1	47	Position limits ex-ceeded	1	BOOL	0	0	1	Get
			Re-served	1	tbd	0	0	0	Get
			Temper-ature warning	1	BOOL	0	0	1	Get
			Warning threshold reading quality	1	BOOL	0	0	1	Get

Note from the ODVA specification:

The Warnings attribute indicates that the tolerance for certain internal device parameters has been exceeded. In contrast to alarms, warnings do not imply incorrect position values. All warnings are deleted when the tolerances are back within normal parameters. The warning message attribute indicates whether one of the defined warnings is active.

Supported warnings

Instance 1, attribute 48

Attribute 48 indicates which warnings specified by the position sensor object are supported by the BPS 358i.

The following alarms are supported by the BPS 358i:

Bit 10 = 1 POSLIM – Position limit values exceeded

Bit 11 to 12 = 0 – Reserved by ODVA CIP

Bit 13 = 1 TEMP – Temperature warning

Bit 14 = 1 QUAL – Reading quality warning threshold

BPS 358i default value: 25600 (0x6400)

Remark from the ODVA specification

This attribute contains information about supported warnings by the position sensor device. This attribute is required if the Warnings attribute is implemented.

Warning flag

Instance 1, attribute 49

The attribute evaluates the warnings specified in attribute 47 in an OR function to compile a collective alarm.

Warning = POSLIM | TEMP | QUAL

Remark from the ODVA specification:

Indicates that a warning error has occurred. This attribute is the logical OR of all warning bits in attribute 47 Warnings.

This attribute is required if the Warnings attribute is implemented.

Operating time

Instance 1, attribute 50

The value is incremented in 1/10 hours as long as the BPS 358i is connected to the power supply.

The value cannot be reset.

Position offset value

Instance 1, attribute 108

The attribute sets an offset relative to the measured position value in the BPS 358i.

Position value (attribute 10) = Measured position value + Position offset value (attribute 108)

Comment:

The offset is effective immediately after the command “set attribute single class 1 instance 1 attribute 108”.

If the preset value is activated via the preset value attribute (attribute 19), this has priority over the offset. Preset and offset do not cancel each other out.

Auto zero

Instance 1, attribute 112

This attribute controls the position sensor’s auto-zero function.

0 > 1 = Set the position offset value (attribute 108) = - (measured value)

An increasing value (transition from 0 to 1) on this attribute sets the attribute 108 Position offset value to a value that results in the attribute 10 Position value being zero. In this case, a negative value of the internal measurement value is saved in attribute 108 Position offset value.

Remark from the ODVA specification:

If the zero offset attribute (position offset value #108) is implemented as non-persistent, the auto zero command must save the new zero offset value.

Movement / direction status

Instance 1, attribute 113

The attribute indicates whether a movement is registered based on the velocity value (attribute 24) absolute value >100 mm/s and in which direction.

0 = no movement = speed value (attribute 10) <100 mm/s

1 = Movement in positive direction

2 = Movement in negative direction

9.12 Class 104: Error handling procedures

Object class ID: 104 (0x0068)

Service:

- Get_Attribute_Single
- Set_Attribute_Single

This class provides parameters to handle any errors. If there is a brief disruption to the position value or the speed calculation in the device, the BPS sends the last valid measured value for a certain time (50 ms). If the BPS can calculate valid measurement values again within the error delay time, these are output. The fault is only noticeable by a slight increase in the output measurement value. If the calculation problem lasts longer, the attributes can be used to configure how the BPS should behave in these cases.

Tab. 9.25: Class 104 Assembly signals

Path			Name	Size in bit	Data type	Stan-dard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
104	1	1	Position value in case of error	8	USINT	1	0	1	Set
		2	Speed value in case of error	8	USINT	1	0	1	Set

Position value in case of error

Instance 1, attribute 1

Position value in the event of an error after the error delay time has elapsed

0 = Last valid value

1 = Zero

Speed value in case of error

Instance 1, attribute 2

Speed value in the event of an error after the error delay time has elapsed

0 = Last valid value

1 = Zero

9.13 Class 106: Activation

Object Class ID: 106 (0x006A)

Service:

- Get_Attribute_Single
- Set_Attribute_Single

This class defines control and status signals for activating the BPS 358i.

Tab. 9.26: Class 106 Assembly signals

Path			Name	Size in bit	Data type	Stan-dard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
106	1	3	Stop / start mea-sure-ment	1	BOOL	0	0	1	Set
		6	Mea-sure-ment not active	1	BOOL	0	0	1	Get

Stop / start measurement

Instance 1, attribute 3

This bit can be used to stop and restart the measurement.

If the measurement is stopped, the BPS only switches off the laser beam.

When the measurement is restarted, the measurement values are available again after a few milliseconds.

0 = Measurement active

1 = Stop measurement

Measurement not active

Instance 1, attribute 6

The attribute signals an inactive measurement.

0 = Measurement active

1 = Measurement not active

9.14 Class 109: Device status and control

Object class ID: 109 (0x006D)

Service:

- Get_Attribute_Single
- Set_Attribute_Single

This class contains the device status display, as well as control bits for cancelling an error or for setting the BPS 358i to standby mode.

Tab. 9.27: Class 109 Assembly signals

Path			Name	Size in bit	Data type	Stan-dard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
109	1	1	Device status	8	USINT	0	0	255	Get
		2	Acknowl-edge event log	1	BOOL	0	0	1	Set
		3	Activate / deacti-vate standby	1	BOOL	0	0	1	Set
		4	Standby active	1	BOOL	0	0	1	Get

Device status

Instance 1, attribute 1

This attribute represents the current device status.

0 = Initial value

1 = Initialization

10 = Standby

11 = Service

12 = Diagnosis

15 = Device is ready

128 = Error

129 = Warning

The following event messages can be acknowledged via attribute 2 Acknowledge event log:

128 = Error

129 = Warning

Acknowledge event log

Instance 1, attribute 2

This attribute deletes the event memory from attribute 1 Device status.

128 = Error

129 = Warning

Activate / deactivate standby

Instance 1, attribute 3

This bit can be used to switch the BPS to standby mode. The BPS switches off the laser beam and the motor. If the standby mode is then deactivated, the motor must first reach its rated speed. It therefore takes a few seconds until measurement values are available again.

0 = Inactive

1 = Activate

Standby active

Instance 1, attribute 4

This attribute signals an active standby mode of the BPS.

0 = No standby

1 = Standby active

9.15 Class 110: Device application status and control

Object class ID: 110 (0x006E)

Service:

- Get_Attribute_Single
- Set_Attribute_Single

The class contains specific status and control information for the application. It generally provides the WORD bit field attributes Device application status (attribute 1) and Device application control (attribute 2) for status and control signals.

Tab. 9.28: Class 110 Assembly signals

Path			Name	Size in bit	Data type	Standard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
110	1	1	Device application status	16	WORD	0	0	0	Get
		2	Device application control	16	WORD	0	0	0	Set
		20	Integration depth	8	USINT	8	2	16	Set
		21	Tape selection	8	USINT	2	1	2	Set
		22	Velocity averaging	8	USINT	2	0	5	Set

Device application status

Instance 1, attribute 1

This attribute indicates the application-specific status of the device.

It is not used for BPS 358i, but is reserved for future use.

Device application control

Instance 1, attribute 2

This attribute specifies the application-specific control of the device.

It is not used for BPS 358i, but is reserved for future use.

Integration depth

Instance 1, attribute 20

This attribute defines the number of consecutive measurements that the BPS 358i uses to determine the position.

Tape selection

Instance 1, attribute 21

This attribute is used to switch between bar code tape with 30 mm grid (BCB G30 ...) and 40 mm grid (BCB G40 ...).

1 = 30 mm (BCB G30 ...)

2 = 40 mm (BCB G40:…)

Velocity averaging

Instance 1, attribute 22

This attribute defines the period for averaging the speed.

The measurement value preparation averages all speed values calculated during the selected time period (averaging) to obtain an initial speed value.

The attribute value defines the averaging period:

000b = **0** = no averaging

001b = **1** = 2 ms

010b = **2** = 4 ms

011b = **3** = 8 ms

100b = **4** = 16 ms

101b = **5** = 32 ms

9.16 Class 112: Marker bar code

Object class ID: 112 (0x0070)

Service:

- Get_Attribute_Single
- Set_Attribute_Single

The class enables the transmission of control and marking information to the scanner and the setting of the corresponding parameters.

Tab. 9.29: Class 112 Assembly signals

Path			Name	Size in bit	Data type	Stan-dard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
112	1	1	Reload	1	BOOL	0	0	1	Set
		2	Trans-mission	8	USINT	0	0	2	Set
		3	Acknowl-edge control or marker	1	BOOL	0	0	1	Set
		4	Control or marker detected	1	BOOL	0	0	1	Get
		5	Control or marker toggle	1	BOOL	0	0	1	Get
		6	Detected barcode	3x8	USINT	0	255	0	Get

Reload

Instance 1, attribute 1

This attribute defines the configuration for the input data:

0 = Immediate overwriting of the input data

1 = Overwrite input data after acknowledgement

Transmission

Instance 1, attribute 2

This attribute is used to specify which information is transferred in the input data:

0 = Control and marker bar codes

1 = Marker bar codes only

2 = Control bar codes only

Acknowledge control or marker

Instance 1, attribute 3

This attribute can be used to confirm to the scanner that the recognized control or marker bar code has been accepted.

Transition 0 → 1 = Acknowledgment

Control or marker detected

Instance 1, attribute 4

This attribute indicates a recognized control or marker bar code.

0 = No marking

1 = Marking recognized

Control or marker toggle

Instance 1, attribute 5

This attribute changes its status each time a control or marking bar code is recognized.

0 > 1 = New marking

1 > 0 = New marking

Detected barcode

Instance 1, attribute 6

This attribute is used to transfer the content (3 ASCII characters) of the recognized control or marking bar code.

9.17 Class 114: Reading quality

Object class ID: 112 (0x0072)

Service:

- Get_Attribute_Single
- Set_Attribute_Single

This class enables the reading quality functionality for transmitting the BPS reading quality and for configuring the parameters for the warning threshold, error threshold and smoothing of the reading quality value.

Continuous monitoring is possible by transmitting the reading quality. The operator can immediately see when the reading quality deteriorates due to wear or soiling.

The reading quality signaling is also in the QUAL bits of the Class 35 Alarms (attribute 44) and Warnings (attribute 47) properties.

Tab. 9.30: Class 114 Assembly signals

Path			Name	Size in bit	Data type	Stan-dard (dec)	Min.	Max.	Access
Cl.	Inst.	Attr.							
114	1	1	Reading quality	8	USINT	0	0	100	Get
		2	Warning threshold reading quality	8	USINT	60	30	90	Set
		3	Error threshold reading quality	8	USINT	30	10	70	Set
		4	Reading quality smooth-ing	8	USINT	5	0	100	Set

Reading quality

Instance 1, attribute 1

This attribute indicates the current smoothed value as a percentage of the reading quality assessed by the BPS 358i. Smoothing is based on the settings of attribute 4 Reading quality smoothing.

Notes:

Corresponding alarm and warning flags are signaled in the attributes class 35 (attribute 44) Alarms and Warnings (attribute 47).

Warning threshold reading quality

Instance 1, attribute 2

The attribute defines the warning threshold. Below this threshold of attribute 1 Reading quality, the BPS 358i generates a warning event, which is signaled by the corresponding QUAL warning flag in attribute 47 Class 35 Warnings.

Error threshold reading quality

Instance 1, attribute 3

The attribute defines the error threshold. Below this threshold of attribute 1 Reading quality, the BPS 358i generates an error event, which is signaled by the corresponding QUAL alarm flag in attribute 44 Class 35 Alarms.

Reading quality smoothing

Instance 1, attribute 4

The attribute defines the smoothing of the reading quality value (attribute 1) as insensitivity to changes in quality.

The higher this value is, the less a change affects the reading quality value (attribute 1).

10 Starting up the device – webConfig tool

With the Leuze webConfig tool, a web-technology based, graphical user interface is available for configuring the BPS.

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.

NOTICE

The webConfig tool is offered in the following languages:

German, English, French, Italian, Spanish

NOTICE

BPS configuration via the webConfig tool

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

10.1 Installing software

In order for the BPS 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.

NOTICE

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

10.1.1 System requirements

NOTICE

Regularly update the operating system and the Internet browser.

Install the current Windows Service Packs.

Tab. 10.1: webConfig system requirements

Operating system	Windows 10 (recommended) Windows 8, 8.1 Windows 7
Computer	PC, laptop or tablet with USB interface, version 1.1 or higher
Graphics card	Min. resolution: 1280 x 800 pixels
Required disk space for USB driver	10 MB
Internet browser	Recommended is a current version of Mozilla Firefox Google Chrome Microsoft Edge Note: Other Internet browsers are possible but have not been tested with the current device firmware.

10.1.2 Install USB driver

- Start your PC with administrator privileges and log on.
- Download the setup program from the Internet:
  www.leuze.com > Products > Measuring sensors > Bar code positioning systems > BPS 300i > (BPS name) > Tab **Downloads > Software/Driver**.
- Start the setup program and follow the instructions.

NOTICE

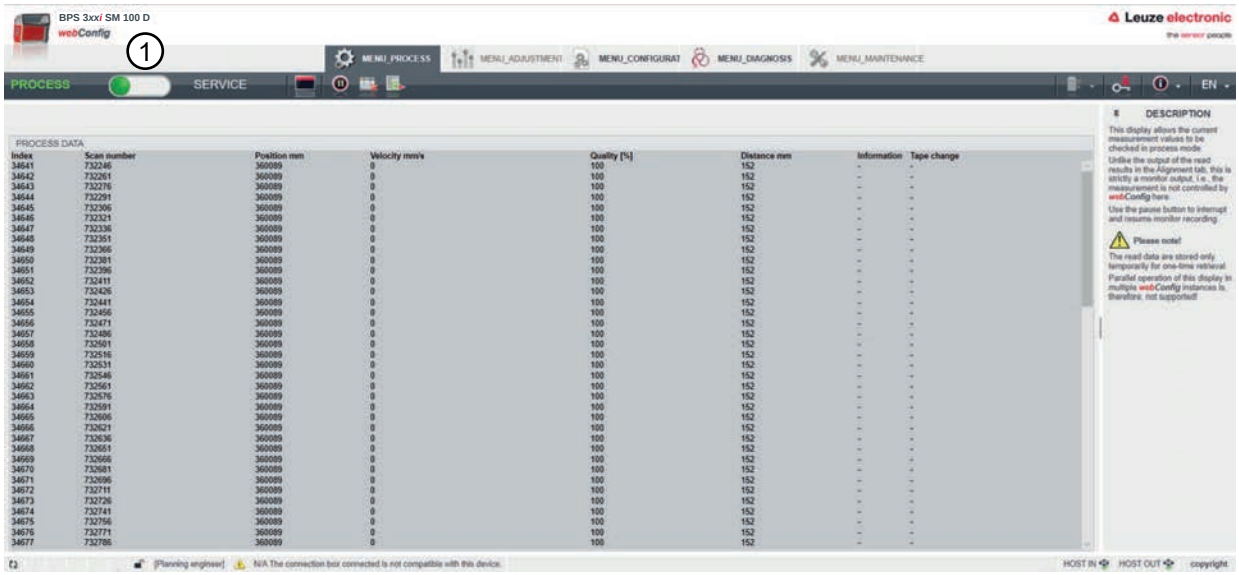
Alternatively, you can install the USB driver **LEO_RNDIS.inf** manually.

- Contact your network administrator if the installation fails.

10.2 Start webConfig tool

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

- Connect the supply voltage to the BPS.
- Connect the SERVICE USB interface of the BPS to the PC.
  The connection to the SERVICE USB interface of the BPS 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**
  This is the default Leuze service address for communication with the BPS 300i series' bar code positioning systems.
- ⇨ The webConfig start page appears on your PC.



1 Switching operating mode **Process** – **Service** (top left)

Fig. 10.1: The start page of the webConfig tool

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

NOTICE

The webConfig tool is completely contained in the firmware of the BPS.

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

Clear browser history

The cache of the Internet browser is to be cleared if different device types or devices with different firmware were connected to the webConfig tool.

↳ Delete cookies and temporary Internet and website data from browser history before starting the web-Config 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 BPS via the webConfig tool.

↳ Do **not** use the Internet browser's refresh functions:
[Shift] [F5] or [Shift] + mouse click

10.3 Short description of the webConfig tool

10.3.1 Operating modes

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

- **Process**

  The BPS is connected to the control.
  - The process communication to the control is activated.
  - The switching inputs/outputs are activated.
  - Configuration and diagnostics functions available, cannot be changed.
  - *PROCESS* function available.
  - Alignment and maintenance functions 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.PROCESS
  - Alignment, configuration, diagnostics and maintenance functions available.

Process operating mode

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

- *PROCESS*

  Check and save the current read data in the process mode (see chapter 10.3.2 "PROCESS function").
  - Tabular display of the following values:

    Scan number, position, speed, reading quality, distance from BCB, info on the control label
- *CONFIGURATION* (see chapter 10.3.4 "CONFIGURATION function")

Information on the current BPS configuration – no change to the configuration:

- Display of the interface parameters
- Selection of the used bar code 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 reading quality

Service operating mode

In the *Service* operating mode, the webConfig tool also has the following main menus and functions:

- *ALIGNMENT* (see chapter 10.3.3 "ALIGNMENT function")
  - 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
- *CONFIGURATION* (CONFIGURATION function)
  - Configuration of the interface parameters
  - Configuration of device components (switching inputs/outputs, display)
  - Selection of the used bar code tape
  - Configuration of the data processing (position/speed detection or monitoring, data preparation)
  - Configuration of the warning threshold and the error threshold for the reading quality
- *DIAGNOSIS* (see chapter 10.3.5 "DIAGNOSIS function")
  - Event logging of warnings and errors
- *MAINTENANCE* (see chapter 10.3.6 "MAINTENANCE function")
  - Firmware update
  - User management
  - Backup/Restore

10.3.2 PROCESS function

The *PROCESS* function is used to check 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 pause and resume monitor recording.

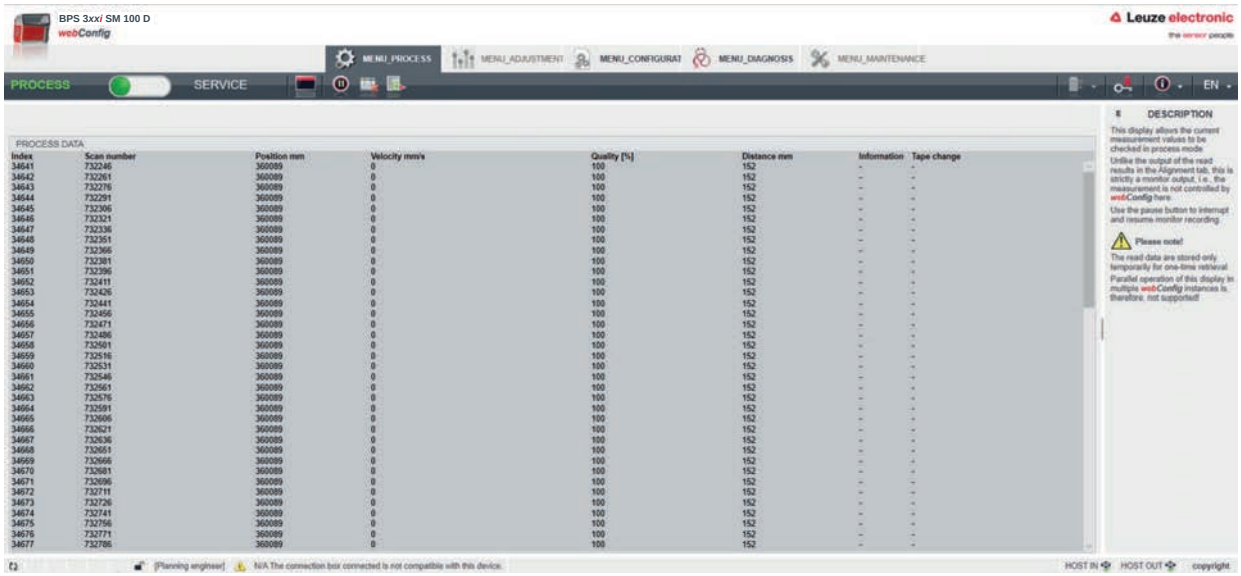


Fig. 10.2: *PROCESS* webConfig function

10.3.3 ALIGNMENT function

NOTICE

***ALIGNMENT* function only in *Service*operating mode!**

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

The *ALIGNMENT* function simplifies mounting and alignment of the BPS. The laser must 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 BPS is aligned with the BCB.

NOTICE

During output of the measurement results, the BPS is controlled by the webConfig tool.

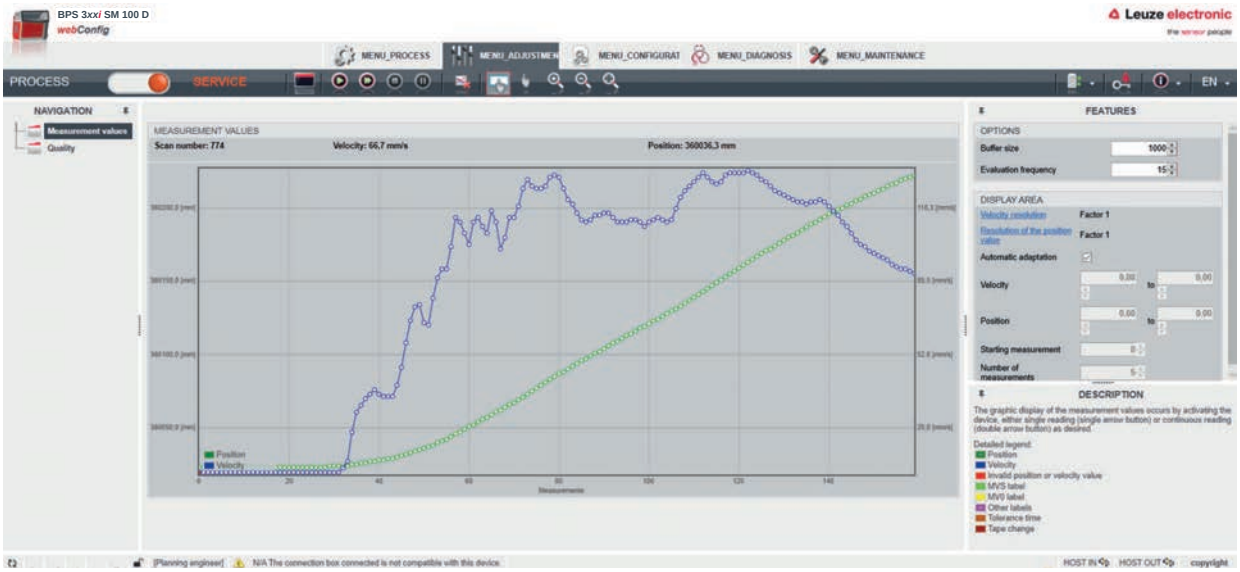


Fig. 10.3: *ALIGNMENT* webConfig function

10.3.4 CONFIGURATION function

NOTICE

Configuration changes only in *Service*operating mode!

Changes via the *CONFIGURATION* function can only be made in the *Service* operating mode.

Overview of the webConfig configuration functions

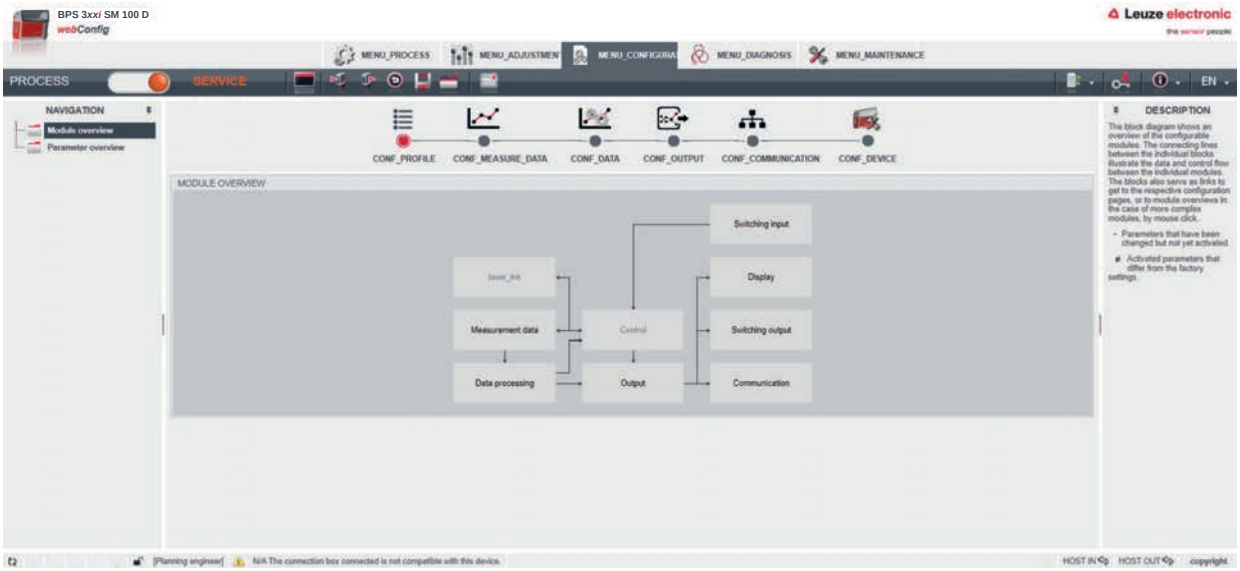


Fig. 10.4: *CONFIGURATION* webConfig function

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

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

	NOTICE
	Configuration parameters *: Ethernet parameters (see chapter 9.1 "EDS file – classes and instances") **: Parameters can only be configured via the webConfig tool

Time behavior functions of the switching inputs/outputs

The time behavior functions (e.g. switch-on delay) can **only** be configured with the webConfig tool.

- Switch-on 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 switch-on delay lapses, only a brief pulse appears at the output following the switch-on delay.

Fig. 10.5: Switch-on delay > 0 and switch-on time > 0

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

- 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 for which the input signal must be stable.

- Switch-off delay

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

Configuration of bar code tape selection and tape value correction (*MEASUREMENT DATA*tab, bar code tape)

- Bar code 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*
- Count direction *
- Output mode sign *

Configuration of reading quality monitoring (*DATA PROCESSING*tab, Reading quality)

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

Configuration of the communication data (*COMMUNICATION*tab)

- Configuration of the SERVICE USB interface

Ethernet interface parameters

The Ethernet parameters are displayed for viewing purposes only.

See also

EDS file – classes and instances [❝ 55]

10.3.5 DIAGNOSIS function

The *DIAGNOSIS* function is available in the *Process* and *Service* operating modes.

The device event log is displayed via the *DIAGNOSIS* function.

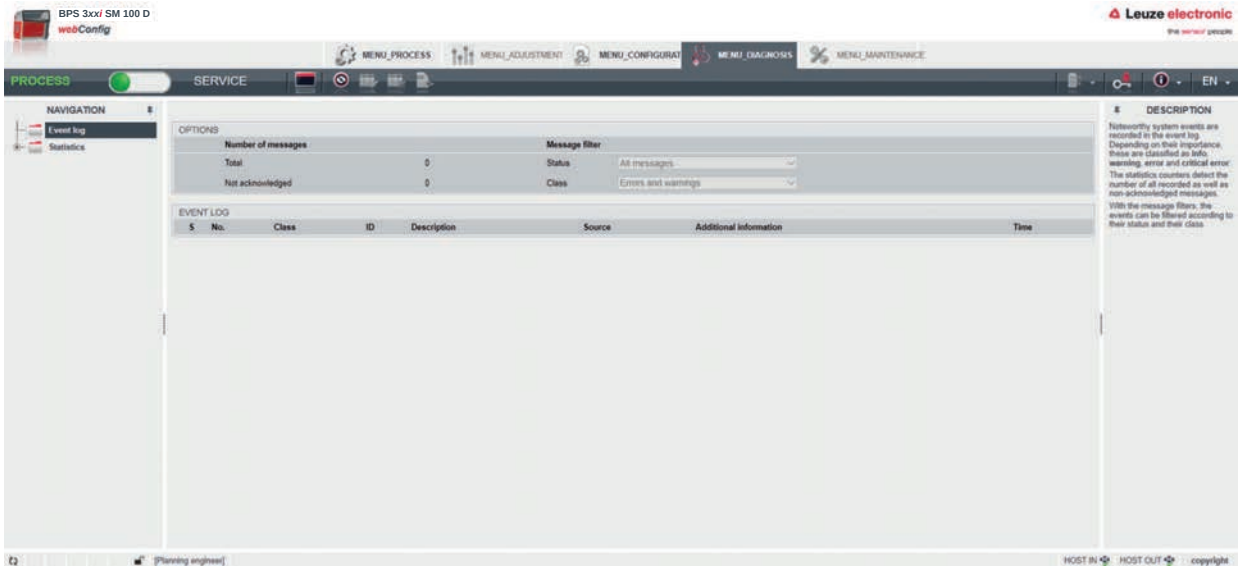


Fig. 10.6: *DIAGNOSIS* webConfig function

10.3.6 MAINTENANCE function

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

Functionalities:

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

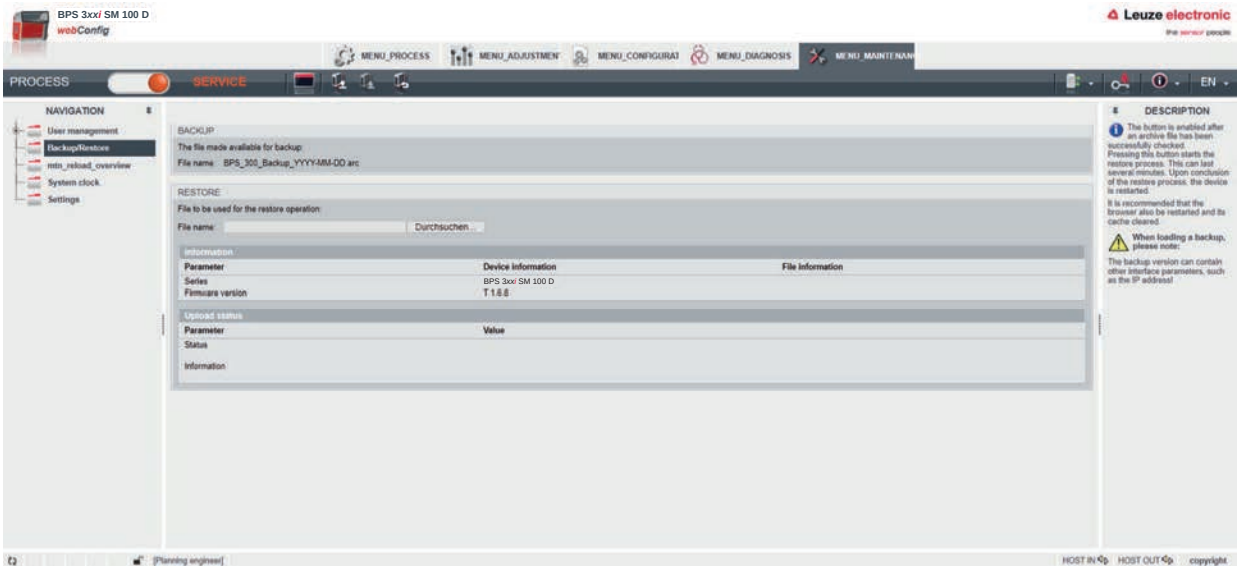


Fig. 10.7: *MAINTENANCE* webConfig function

11 Diagnosis and troubleshooting

11.1 What to do in case of failure?

Once the BPS has been switched on, the display elements (see chapter 3.3 "Display elements") make it easier to check that it is working properly and to locate errors.

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 operating displays, the error messages and the diagnostic tool (also using the webConfig tool, *DIAGNOSI*Stab) and rectify the error.

NOTICE

Contact Leuze subsidiary/customer service.

- If you are unable to rectify a fault, contact the relevant Leuze branch or call Leuze customer service (see chapter 13 "Service and support").

Tab. 11.1: BPS alarm and diagnostic messages

Diagnosis	Description	BPS category	API/ Slot/ Subslot	Type	Coming / going
Parameter error	Error in an EDS file's configuration	Error	0/nn = module number/0	Diagnostics alarm Only diagnostics or process alarms actually trigger the transmission of an alarm. All other types (preventive maintenance and status messages) only lead to an entry into the diagnostics buffer and are thus part of the state-based diagnostics.	Coming
Configuration error	Error in an EDS file's configuration	Error	0/n/0	Diagnostics alarm	Coming

11.1.1 Diagnosis with webConfig tool

System events are displayed in the webConfig tool via the *DIAGNOSIS* 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.

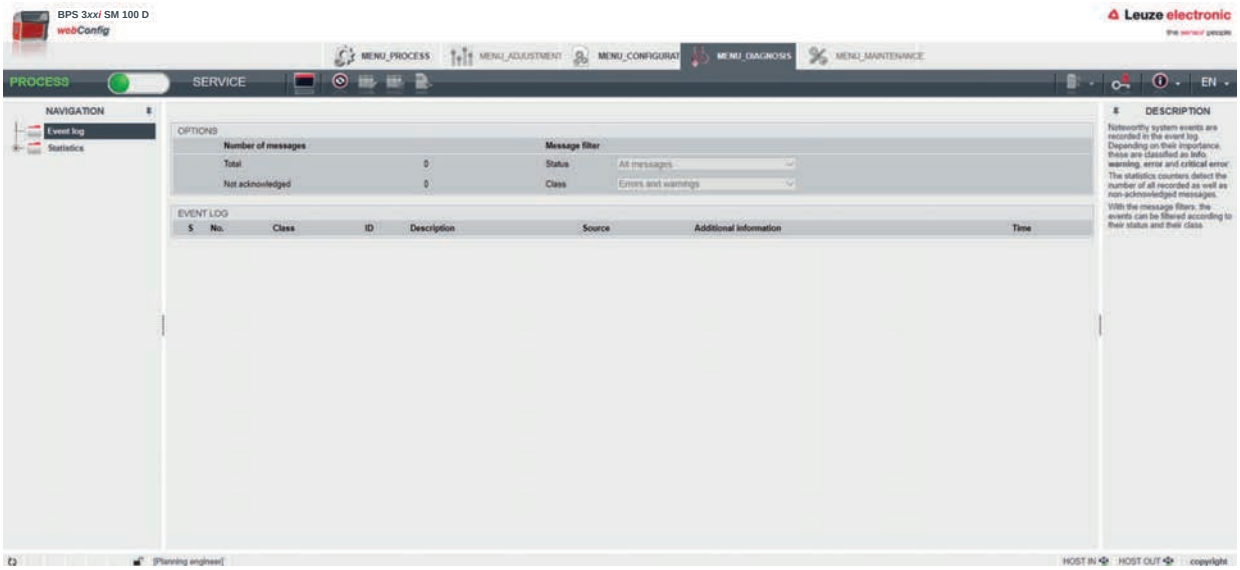


Fig. 11.1: *DIAGNOSIS* webConfig function

11.2 Operating indicators of the LEDs

You can use the PWR and NET status LEDs (see chapter 3.3.1 "LED indicators") to determine the general causes of errors.

Tab. 11.2: PWR LED displays – causes and measures

Error	Possible cause	Measures
Off	No supply voltage connected to the device Hardware error	Check supply voltage Contact Leuze customer service (Service and support)
Green, flashing	Device is being initialized	
Red, flashing	No bar code in the scanning beam No valid measurement value	Query BCB diagnostic data and carry out the resulting measures (see chapter 11.4 "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 Leuze customer service (Service and support)
Orange, continuous light	Device in *Service* mode	Reset the device to *Process* mode using the webConfig tool

See also

Display elements [❝ 14]

11.3 Error messages on the display

The device outputs the following possible error status information in the *BPS Info* device status via the BPS's optional display:

- *System OK*

  BPS operating error-free.
- *Warning*

  Warning message. Query device status.
- *Error*

  Device function is not ensured.

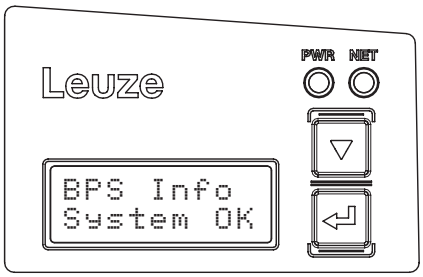


Fig. 11.2: Example: Device status/error status information on the display

11.4 Checklist for causes of errors

Tab. 11.3: Service interface errors – causes and measures

Error	Possible cause	Measures
webConfig does not start	Incorrectly connected interconnection cable Connected BPS 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

Tab. 11.4: Process interface errors – causes and measures

Error	Possible cause	Measures
Sporadic network errors	Check wiring for proper contacting	Check wiring: • Enter correct IP address in browser. Default IP address see chapter 10.2 "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

Tab. 11.5: LED indicators - interface errors – causes and measures

Error	Possible cause	Measures
NET LED “off”	No supply voltage connected to the device	Check supply voltage
	No IP address assigned	Check wiring
	Service operation	Exiting service operation
NET LED “flashing red”	Incorrect wiring	Check wiring
	Communication error: Configuration failed IO Error: no data exchange	Check configuration, especially with regard to address assignment (device names/IP address/ MAC ID) Carry out a reset on the control
	Time-out in BUS communication No communication established to the IO controller (“no data exchange”)	Check protocol settings Check configuration, especially with regard to address assignment (device names/IP address/ MAC ID)
	Wrong device name set	Check configuration, especially with regard to address assignment (device names/IP address/ MAC ID)
	Incorrect configuration	Check configuration, especially with regard to address assignment (device names/IP address/ MAC ID)
NET LED “red continuous light”	Serious network error (duplicate IP address detected)	Check network configuration

Tab. 11.6: Position measurement errors – causes and measures

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

12 Care, maintenance and disposal

12.1 Cleaning

If there is dust on the device:

↳ Clean the 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 device.

12.2 Servicing

The device does not normally require any maintenance by the operator.

Repairs to the device must only be carried out by the manufacturer.

↳ For repairs, contact your responsible Leuze subsidiary or Leuze customer service (see chapter 13 "Service and support").

12.2.1 Firmware update

A firmware update can only be performed by Leuze Service on-site or at the company headquarters.

↳ For firmware updates, contact your responsible Leuze subsidiary or Leuze customer service (see chapter 13 "Service and support").

12.2.2 BCB repair with repair kit

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

www.leuze.com > Products > Measuring sensors > Bar code positioning systems > BPS 300i > (BPS name) > Downloads tab **> Repair kit**

NOTICE
Do not use the BCB repair kit on a permanent basis! ↳ Use the bar code tape created with the repair kit only temporarily as an emergency solution. The optical and mechanical properties of the self-printed bar code tape do not correspond to those of the original bar code tape. Self-printed bar code tape should not remain in the system on a permanent basis. ↳ Original repair tapes (BCB G30 … RK or BCB G40 … RK) with custom tape start value, tape end value, custom length in standard heights of 25 mm and 47 mm can be found on the Leuze website in the accessories for the BPS 300 devices. An entry wizard is available for repair tapes on the Leuze website under devices BPS 300 – Accessories. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form for the desired repair tape. ↳ Repair tapes are available up to a maximum length of 5 m per repair tape. Repair tapes longer than 5 must be ordered as special tapes in the entry wizard.

NOTICE
In the repair kit files, you will find all position values with 30 mm grid (BCB G30 …) and 40 mm grid (BCB G40 …).

Layout:

- BCB G30: 0.9 m of bar code tape is provided on each A4 sheet.
  - Five lines of 18 cm with six code-information segments of 30 mm each
  - Tape lengths: from 0 to 9999.99 m in various files; each 500 m
- BCB G40: 1 m of bar code tape is provided on each A4 sheet.
  - Five lines of 20 cm with five code-information sections of 40 mm each
  - Tape lengths: from 0 to 9999.99 m in various files; each 500 m

Replacing a section of defective bar code 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 bar code tape.

NOTICE

Printing coding

↳ Select only those pages that are actually required.

↳ Change the printer settings so that the bar code is not distorted.

↳ Check the print results and measure the distance between two bar codes: BCB G40 …: 40 mm and BCB G30 …: 30 mm. See graphics below.

↳ 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 (BCB G30 …) or 4 (BCB G40 …).

Fig. 12.1: Checking the print result – BCB G40 …-repair kit (40 mm gird)

Fig. 12.2: Checking the print result – BCB G30 …-repair kit (30 mm gird)

12.3 Disposal

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

13 Service and support

Service hotline

You can find the contact information for the hotline in your country on our website **www.leuze.com** under **Contact & Support**.

Repair service and returns

Defective devices are repaired in our service centers competently and quickly. We offer you an extensive service packet to keep any system downtimes to a minimum. Our service center requires the following information:

- Your customer number
- Product description or part description
- Serial number or batch number
- Reason for requesting support together with a description

Please register the merchandise concerned. Simply register return of the merchandise on our website **www.leuze.com** under **Contact & Support > Repair Service & Returns**.

To ensure quick and easy processing of your request, we will send you a returns order with the returns address in digital form.

What to do should servicing be required?

	NOTICE
	**Please use this chapter as a master copy should servicing be required!** ↳ Enter the contact information and fax this form together with your service order to the fax number given below.

Customer data (please complete)

Device type:	
Serial number:	
Firmware:	
Display messages	
Status of LEDs:	
Error description:	
Company:	
Contact person/department:	
Phone (direct dial):	
Fax:	
Street/No:	
ZIP code/City:	
Country:	

Leuze Service fax number:

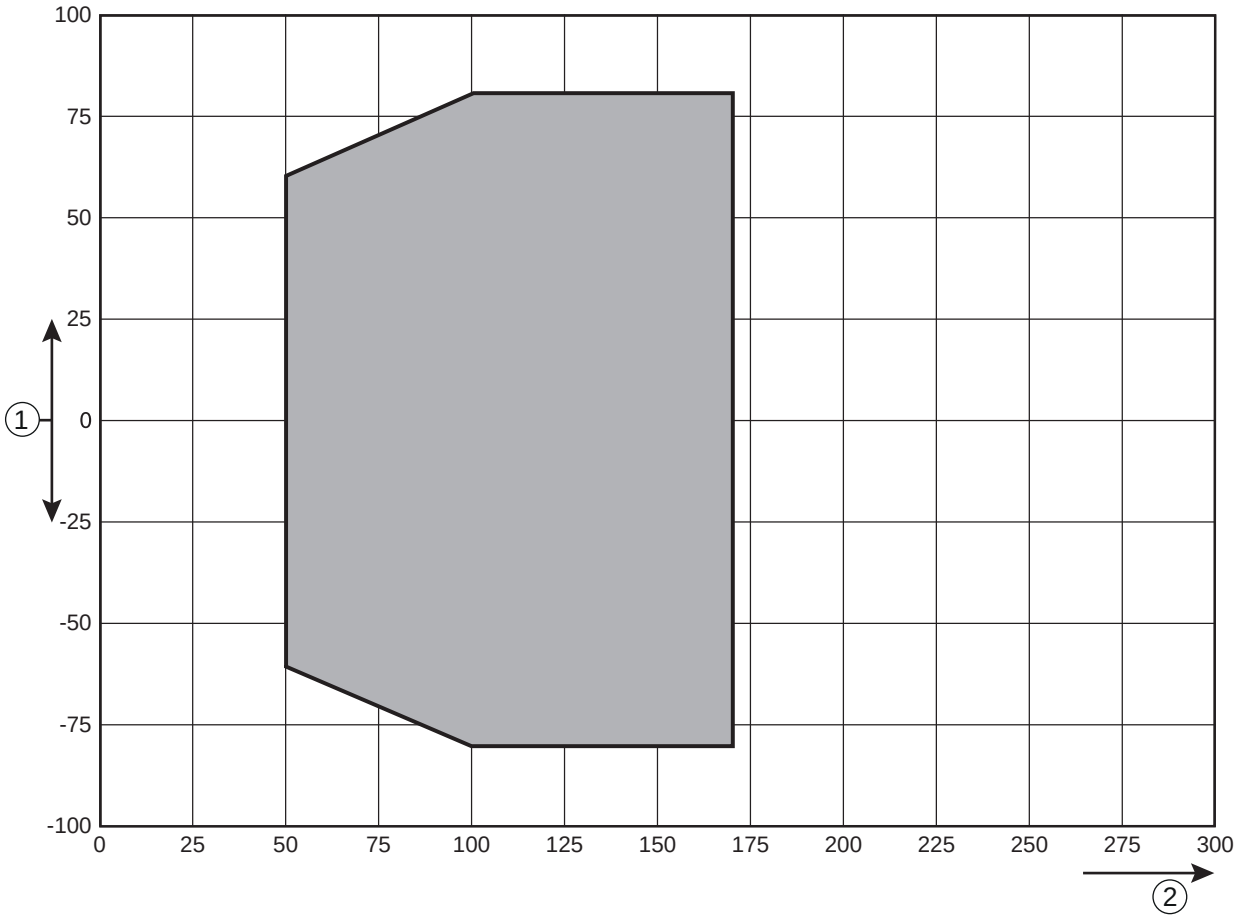
+49 7021 573-199

14 Technical data

14.1 General specifications

Tab. 14.1: Optics

Light source	Laser diode
Wavelength	655 nm
Impulse duration	< 150 µs
Max. output power	1.8 mW
Average life expectancy laser diode	100,000 h (typ. at +25 °C)
Beam deflection	Via rotating polygon wheel
Exit window	Glass
Laser class	1 acc. to IEC 60825-1:2014 / EN 60825-1:2014+A11:2021
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 BPS reading field curve).



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

Fig. 14.1: BPS reading field curve

Tab. 14.2: Measurement data

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

Tab. 14.3: Operating and display elements

Display (optional – only in device models with "D")	Monochromatic graphical display, 128 x 32 pixels, With background lighting
Keyboard (optional – only in device models with "D")	Two buttons
LEDs	Two LEDs for power (PWR) and bus state (NET), two-colored (red/green)

Tab. 14.4: Mechanical data

Housing	Diecast aluminum
Connection technology	• BPS with MS 358: M12 connectors • BPS with MK 358: Terminal blocks with spring-cage terminals (5-pin)

Degree of protection	IP 65
Weight	Approx. 580 g (without connection hood)
BPS 358i dimensions without connection hood	(H x W x D) 108.7 mm x 100.0 mm x 48.3 mm
Dimensions (with MS 358 connection hood)	(H x W x D) 108.7 mm x 100.0 mm x 48.3 mm
Dimensions (with MK 358 connection hood)	(H x W x D) 147.4 mm x 100.0 mm x 48.3 mm
MS 358 connection hood dimensions	(H x W x D) 64.0 mm x 43.5 mm x 33.5 mm
MK 358 connection hood dimensions	(H x W x D) 64.0 mm x 43.5 mm x 83.5 mm

Tab. 14.5: 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)

Tab. 14.6: 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).

14.1.1 BPS without heating

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

Tab. 14.7: Electrical equipment

Data specification	Values/description
Interface type	Protocol: EtherNet/IP
Interface type	2x Ethernet on 2x M 12 (D-coded) Protocol: EtherNet/IP
Service USB interface	USB 2.0 type Mini-B port
Switching input / switching output	Two switching inputs/outputs Freely programmable functions 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)
Supply voltage U_B	18 … 30 VDC (Class 2, protection class III)
Power consumption	Max. 3.7 W

Tab. 14.8: Ambient temperature

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

14.1.2 BPS with heating

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

Tab. 14.9: Electrical equipment

Supply voltage U_B	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 preassembled cable not usable (insufficient conductor cross section).

Tab. 14.10: Ambient temperature

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

14.2 Bar code tape

Tab. 14.11: 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 encodings: see chapter 15 "Order guide and accessories"	0 … 5 m, 0 … 10 m, 0 … 20 m, …, 0 … 150 m; Special lengths and special encodings: see chapter 15 "Order guide and accessories"
Tape tolerance	±1 mm per meter	±1 mm per meter

NOTICE

Twin tapes on request

An entry wizard for twin tapes with custom tape start value, tape end value, custom length and height is available on the Leuze website under devices BPS 300 – Accessories. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form for the desired twin tape.

Tab. 14.12: BCB structure

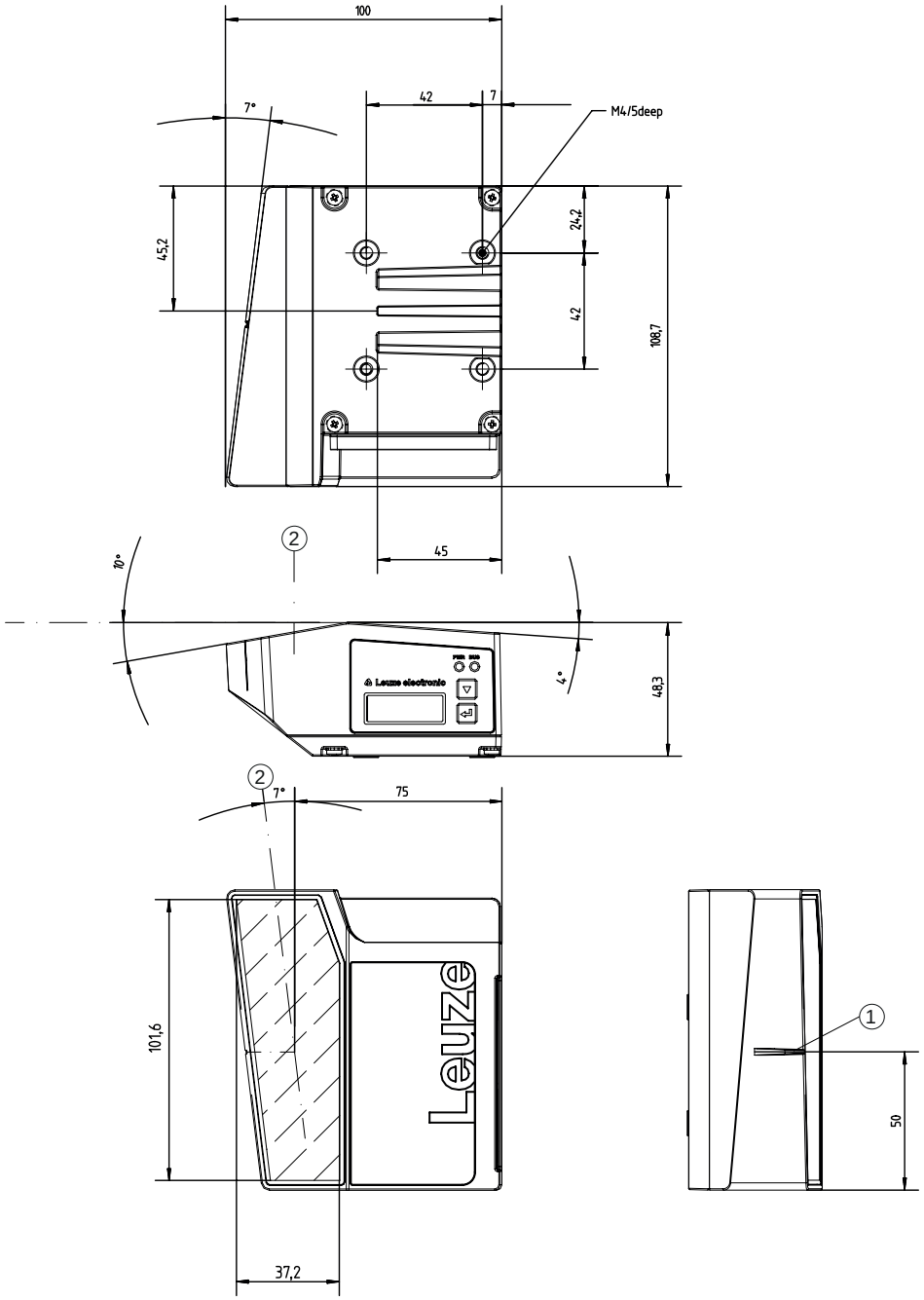
Manufacturing process	Filmsetting
Surface protection	Polyester, matt
Base material	Polyester film, affixed without silicone
Adhesive	Acrylate adhesive
Strength of adhesive	0.1 mm
Adhesive strength (average values)	On aluminum: 25 N/25 mm On steel: 25 N/25 mm On polycarbonate: 22 N/25 mm On polypropylene: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

Tab. 14.13: BCB environmental data

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 BPS 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 (checked at 23 °C over 24 h)	Transformer oil, diesel oil, white spirit, heptane, ethylene glycol (1:1)
Behavior in fire	Self-extinguishing after 15 s, does not drip
Surface	Grease-free, dry, clean, smooth
Mechanical properties	Scratch and wipe resistant, UV resistant, moisture resistant, partly chemical resistant

14.3 Dimensioned drawings

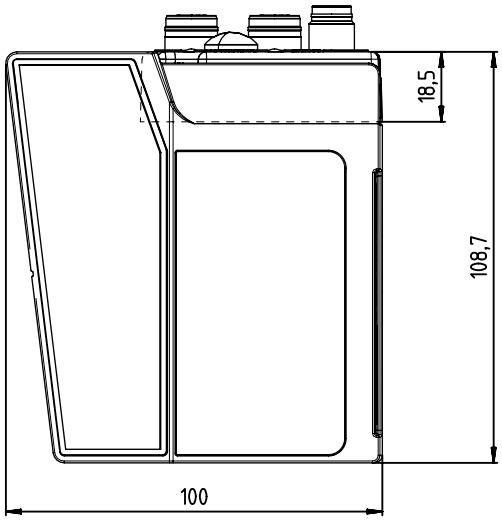


all dimensions in mm

1 Reference point for the bar code position

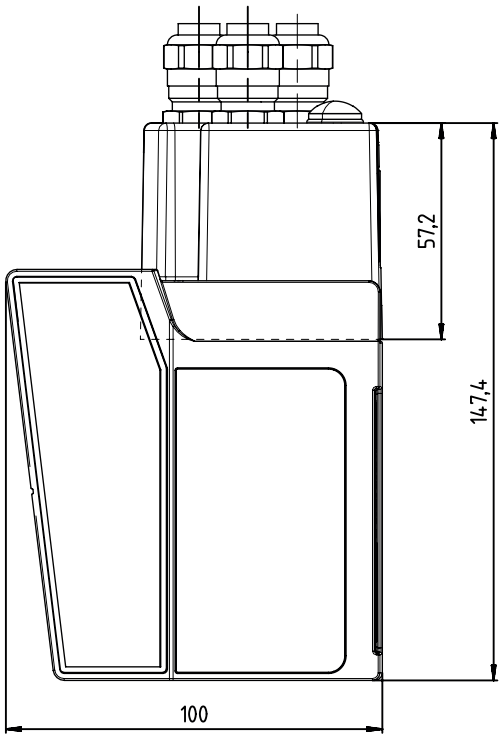
2 Optical axis

Fig. 14.2: Dimensioned drawing BPS without connection hood



all dimensions in mm

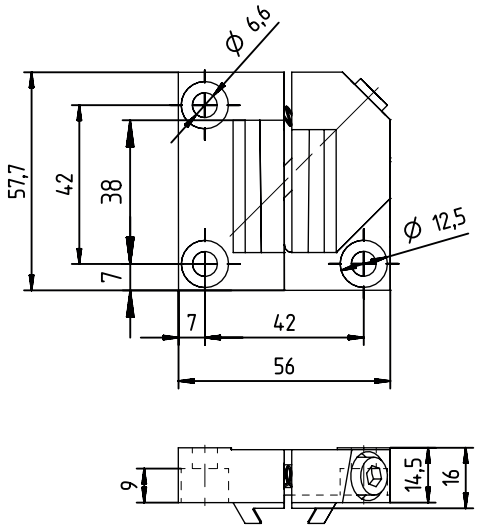
Fig. 14.3: BPS dimensioned drawing with MS 358 connection hood



all dimensions in mm

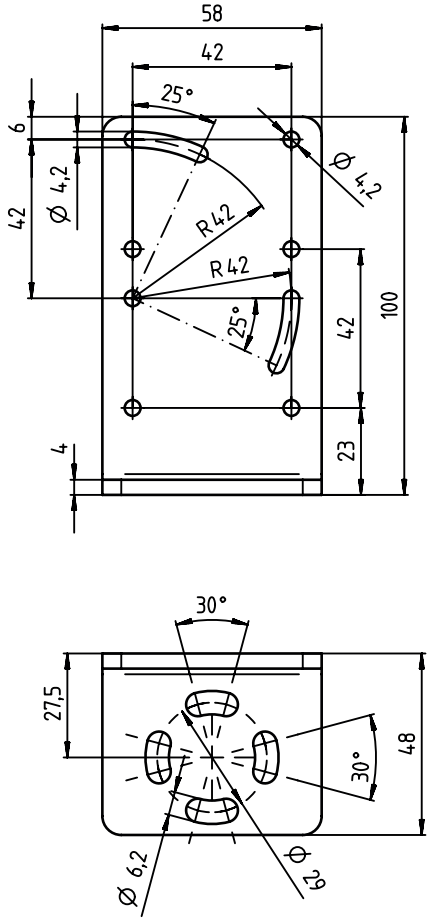
Fig. 14.4: BPS dimensioned drawing with MK 358 connection hood

14.4 Dimensioned drawings: Accessories



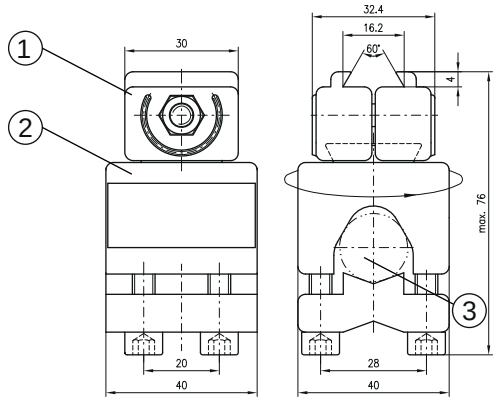
all dimensions in mm

Fig. 14.5: Dimensioned drawing BTU 0300M-W mounting device



all dimensions in mm

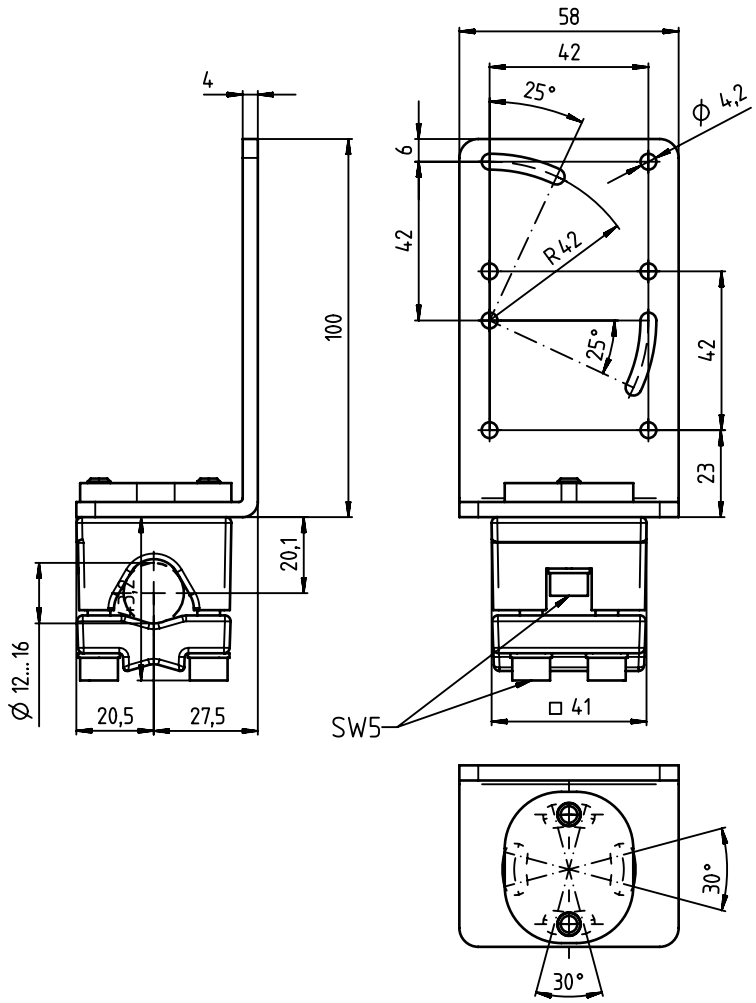
Fig. 14.6: Dimensioned drawing BT 300-W mounting bracket



all dimensions in mm

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

Fig. 14.7: Dimensioned drawing BT 56 mounting device



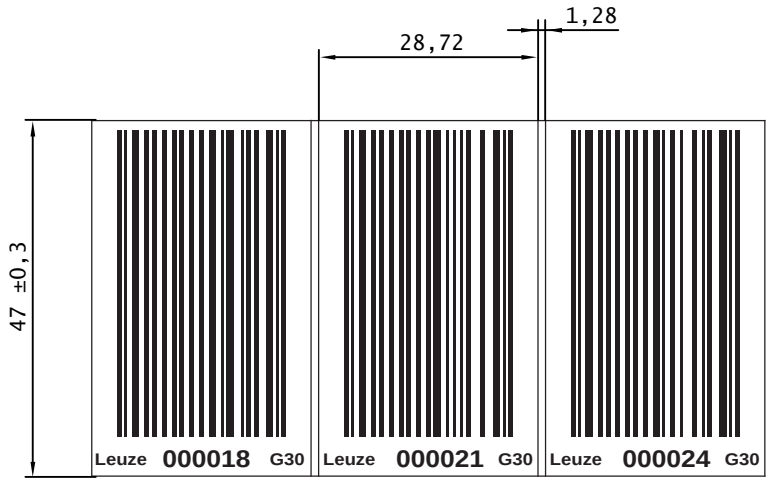
all dimensions in mm

Fig. 14.8: Dimensioned drawing BT 300-1 mounting device

14.5 Dimensioned drawing bar code tape

all dimensions in mm

Fig. 14.9: Dimensioned drawing BCB G40 … bar code tape with 40 mm grid



all dimensions in mm

Fig. 14.10: Dimensioned drawing BCB G30 … bar code tape with 30 mm grid

15 Order guide and accessories

15.1 BPS 358i type overview

Tab. 15.1: BPS 358i type overview

Part no.	Part designation	Description
50152290	BPS 358i SM 100	BPS with EtherNet/IP interface
50152291	BPS 358i SM 100 D	BPS with EtherNet/IP interface and display
50152292	BPS 358i SM 100 H	BPS with EtherNet/IP interface and heating

15.2 Connection hoods

Tab. 15.2: BPS connection hoods

Part no.	Part designation	Description
50120796	MK 358	Connection hood with spring-cage terminals
50120797	MS 358	Connection hood with M12 connectors

15.3 Cables accessories

Tab. 15.3: Accessories – PWR connection cable (voltage supply)

Part no.	Part designation	Description
50132079	KD U-M12-5A-V1-050	PWR connection cable, M12 socket for PWR, axial plug outlet, open cable end, cable length 5 m, not shielded
50132080	KD U-M12-5A-V1-100	PWR connection cable, M12 socket for PWR, axial plug outlet, open cable end, cable length 10 m, not shielded

Tab. 15.4: Accessories – BUS IN connection cable (open cable end)

Part no.	Part designation	Description
M12 plug for BUS IN, axial connector, open line end		
50135073	KS ET-M12-4A-P7-020	BUS IN connection cable, length 2 m
50135074	KS ET-M12-4A-P7-050	BUS IN connection cable, length 5 m
50135075	KS ET-M12-4A-P7-100	BUS IN connection cable, length 10 m
50135076	KS ET-M12-4A-P7-150	BUS IN connection cable, length 15 m
50135077	KS ET-M12-4A-P7-300	BUS IN connection cable, length 30 m

Tab. 15.5: Accessories – BUS IN interconnection cable (on RJ-45)

Part no.	Part designation	Description
M12 connector for BUS IN to RJ-45 connector		
50135080	KSS ET-M12-4A-RJ45-A-P7-020	BUS IN interconnection cable (on RJ-45), length 2 m
50135081	KSS ET-M12-4A-RJ45-A-P7-050	BUS IN interconnection cable (on RJ-45), length 5 m
50135082	KSS ET-M12-4A-RJ45-A-P7-100	BUS IN interconnection cable (on RJ-45), length 10 m

Part no.	Part designation	Description
50135083	KSS ET-M12-4A-RJ45-A-P7-150	BUS IN interconnection cable (on RJ-45), length 15 m
50135084	KSS ET-M12-4A-RJ45-A-P7-300	BUS IN interconnection cable (on RJ-45), length 30 m

Tab. 15.6: Accessories – BUS OUT interconnection cable (on M12)

Part no.	Part designation	Description
M12 connector + M12 connector for BUS OUT to BUS IN		
50137077	KSS ET-M12-4A-M12-4A-P7-020	BUS OUT interconnection cable, length 2 m
50137078	KSS ET-M12-4A-M12-4A-P7-050	BUS OUT interconnection cable, length 5 m
50137079	KSS ET-M12-4A-M12-4A-P7-100	BUS OUT interconnection cable, length 10 m
50137080	KSS ET-M12-4A-M12-4A-P7-150	BUS OUT interconnection cable, length 15 m
50137081	KSS ET-M12-4A-M12-4A-P7-300	BUS OUT interconnection cable, length 30 m

Tab. 15.7: Accessory USB cable

Part no.	Part designation	Description
50117011	KB USB A – USB miniB	USB service cable, 1 Type A and Mini-B type connector, length 1 m

15.4 Other accessories

Tab. 15.8: Accessories – BPS connectors

Part no.	Part designation	Description
50020501	KD 095-5A	M12 axial socket for voltage supply, shielded
50108991	D-ET1	RJ45 connector for user-configuration
50112155	S-M12A-ET	Axial M12 connector, D-coded, for self-assembly
50109832	KDS ET M12 / RJ45 W-4P	Converter from M12, D-coded, to RJ-45 socket

Tab. 15.9: Mounting device accessories

Part no.	Part designation	Description
50124941	BTU 0300M-W	Mounting device for wall mounting – precise alignment of the BPS without adjustment (easy-mount).
50121433	BT 300 W	Mounting bracket for wall mounting
50027375	BT 56	Mounting device for rod
50121434	BT 300-1	Mounting device for rod

15.5 Bar code tapes

15.5.1 Standard bar code tapes

Leuze offers a wide selection of standardized bar code tapes.

Tab. 15.10: Data for standard bar code tapes

Feature	Value
Grid dimensions	30 mm (BCB G30 …) 40 mm (BCB G40 …)
Height	47 mm 25 mm
Length	5 m 10 m, 20 m … in 10 m increments up to 150 m 200 m
Length graduation	10 m
Tape start value	0

- Standard bar code tapes are printed below the bar code with the corresponding position value.
- The bar code tapes are wound and delivered on a core.

All available standard tapes are listed on the Leuze website under the currently selected BPS device in the *Accessories* tab.

15.5.2 Special bar code tapes

Special tapes are produced according to customer specifications.

Tab. 15.11: Data for special bar code tapes

Feature	Value
Grid dimensions	30 mm (BCB G30 …) 40 mm (BCB G40 …)
Height	20 mm – 140 mm in millimeter increments
Length	According to customer specifications, maximum 10,000 m
Tape start value	According to customer specifications, dependent on grid dimension
Tape end value	According to customer specifications, dependent on grid dimension, maximum tape end value at 10,000 m

- Special bar code tapes are printed below the bar code with the corresponding position value.
- Special bar code tapes over 300 m in length are wound and delivered on multiple rolls.

An entry wizard is available for special bar code tapes on the Leuze website under devices BPS 300 - *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

15.5.3 Twin tapes

Twin tapes are special bar code tapes and are produced according to customer specifications.

Tab. 15.12: Data for Twin tapes

Feature	Value
Grid dimensions	30 mm (BCB G30 …) 40 mm (BCB G40 …)

Feature	Value
Height	20 mm – 140 mm in millimeter increments
Length	According to customer specifications, maximum 10,000 m
Tape start value	According to customer specifications, dependent on grid dimension
Tape end value	According to customer specifications, dependent on grid dimension, maximum tape end value at 10,000 m

- Two identical tapes are delivered in one package. The tape values as well as the tape tolerances are identical on both tapes. The tapes are printed with the position value in plain text below and above the bar code.
- Twin tapes over 300 m in length are wound and delivered on multiple rolls.

An entry wizard for twin tapes with custom tape start value, tape end value, custom length and height is available on the Leuze website under devices BPS 300 - *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

15.5.4 Repair tapes

Repair tapes are produced according to customer specifications.

Tab. 15.13: Data for repair tapes

Feature	Value
Grid dimensions	30 mm (BCB G30 …) 40 mm (BCB G40 …)
Height	47 mm 25 mm
Length	According to customer specifications, maximum 5 m
Tape start value	According to customer specifications, dependent on grid dimension
Tape end value	According to customer specifications, dependent on grid dimension

- Repair tapes longer than 5 m must be ordered as special tapes.
- Repair tapes are printed below the bar code with the corresponding position value.
- Repair tapes are usually delivered wound on a roll.

An entry wizard is available for repair tapes on the Leuze website under devices BPS 300 - *Accessories* tab. The entry wizard provides support when entering the individual pieces of tape data and creates a query or order form with the correct part number and type designation.

15.5.5 Marker labels and control labels

Leuze offers a selection of standardized marker and control labels.

Tab. 15.14: Data for marker labels and control labels

Feature	Value
Grid dimensions	30 mm (BCB G30 …) 40 mm (BCB G40 …)
Height	47 mm
Base color of control label BCB … MVS	Red
Base color of control label BCB … MV0	Yellow
Base color of marker label BCB … ML	Red

- Marker labels and control labels are individual labels that are delivered in a packaging unit containing 10 pieces.

All available marker and control labels are listed on the Leuze website for the currently selected BPS device in the *Accessories* tab.

16 EC Declaration of Conformity

The bar code positioning systems of the BPS 300 series have been developed and manufactured in accordance with the applicable European standards and directives.

	NOTICE
	You can download the EC Declaration of Conformity from the Leuze website. ↳ Call up the Leuze website: *www.leuze.com*. ↳ Enter the type designation or part number of the device as the search term. The article number can be found on the name plate of the device under the entry “Part. No.”. ↳ The documents can be found on the product page for the device under the *Downloads* tab.

17 Appendix

17.1 Bar code sample

BCB G40 … bar code tape with 40 mm grid

Fig. 17.1: Continuous, 40 mm grid

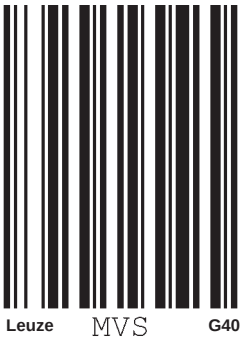


Fig. 17.2: Single label MVS, 40 mm grid

Fig. 17.3: Single label MV0, 40 mm grid

Fig. 17.4: Single marker label, 40 mm grid

BCB G30 … bar code tape with 30 mm grid

Fig. 17.5: Continuous, 30 mm grid

Fig. 17.6: Single label MVS, 30 mm grid

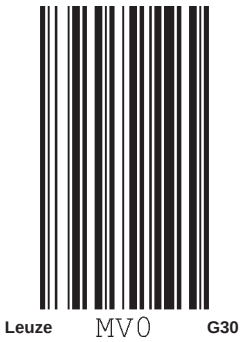


Fig. 17.7: Single label MV0, 30 mm grid

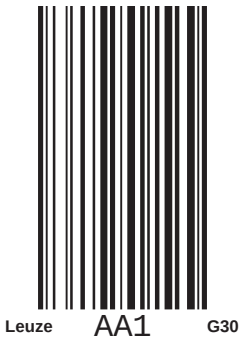


Fig. 17.8: Single marker label, 30 mm grid