Leuze

Translation of original operating instructions

IPS 458i

Camera-based positioning sensor

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 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.

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

ACD	Address Conflict Detection
Big endian	Specifies the byte sequence. Here, the highest-value byte is stored first, i.e., at the smallest memory address.
CMOS	Semiconductor process for implementing integrated circuits (Complementary Metal-Oxide-Semiconductor)
DHCP	Process for automatically assigning the IP address (Dynamic Host Configuration Protocol)
EDS	Standardized electronic data sheet (Electronic Data Sheet)
EMC	Electromagnetic compatibility
EN	European standard
FE	Functional earth
FOV	Field of view of the sensor
ICMP	Process for exchanging information and error messages (Internet Control Message Protocol)
IGMP	Process for organizing multicast groups (Internet Group Management Protocol)
IO or I/O	Input/Output
IO controller	Control that initiates the IO data communication

IP address	Network address, which is based on the Internet Protocol (IP)
IPS	Camera-based positioning sensor (Imaging Positioning Sensor)
Actual position	Actual position of the marker (center point)
LED	LED (Light Emitting Diode)
MAC address	Hardware address of a device in the network (Media Access Control address)
Offset	Shift of the nominal position in the X/Y direction
Marker	Marking on which the sensor determines the position (hole or reflector)
ODVA	User organization (Open DeviceNet Vendor Association)
PELV	Protective extra low voltage with reliable disconnection (Protective Extra Low Voltage)
HBS	High-bay storage device
Bar	Material on which the marker is located, e.g., steel beam
ROI	Region of interest of the sensor in which a marker is detected (Region of Interest)
Nominal position	Position of the region of interest (coordinate center)
PLC	Programmable Logic Control (corresponds to Programmable Logic Controller (PLC))
SWI	Digital switching input (Switching Input)
SWO	Digital switching output (Switching Output)
TCP/IP	Internet protocol family (Transmission Control Protocol/Internet Protocol)
Tolerance range	Symmetrical area in X/Y direction around the nominal position in which the four switching outputs (+X/-X/+Y/-Y) switch.
UDP	Network transmission protocol (User Datagram Protocol)
UL	Underwriters Laboratories

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 camera-based positioning sensors of the IPS 400i series are designed for optical, contactless fine positioning relative to a marker for use in steel construction, e.g. on high-bay storage devices in conveyor and storage systems.

Areas of application

The camera-based positioning sensors of the IPS 400i series are especially designed for the following areas of application:

- Compartment fine positioning in single-depth and double-depth pallet high-bay warehouses

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

Integrated illumination!

The camera-based positioning sensors of the IPS 400i series correspond to the following classification with respect to the integrated lighting:

- **Infrared** illumination: Exempt group in acc. with EN 62471

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
- in circuits which are relevant to safety
- In food processing
- for medical purposes

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 device may only be opened for exchanging the housing hood.
- There are no user-serviceable parts inside the device.
- 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.

3 Device description

3.1 Device overview

3.1.1 IPS 400i positioning sensor

The camera-based positioning sensors of the IPS 400i series enable fast and simple positioning of stacker cranes in conveyor and storage systems.

- Positioning is designed for single-depth or double-depth pallet high-bay warehouses.
- Positioning in various compartment positions, e.g., *rack near* or *rack far*, is implemented with the help of programs in the positioning sensor.
- The positioning sensor detects holes or reflectors in bars in the rack construction and determines the position deviation in the X and Y direction relative to the nominal position.
- The position deviation is output to the control via four digital outputs or via the interface.
- Operation and configuration of the positioning sensor:
  - Via the Ethernet service interface by means of the integrated webConfig tool.
  - Via printed configuration codes.

The positioning sensors of the IPS 400i series are operated as a "stand-alone" single device with individual IP address in an Ethernet topology.

The positioning sensor is optionally available with integrated heating.

Information on technical data and characteristics: see chapter 15 "Technical data".

Markings

The positioning sensor detects the following markers:

- Hole: Dark, round marking on light background
- Reflector: Light, round marking on dark background

3.1.2 Performance characteristics

The most important performance characteristics of the camera-based positioning sensor:

- Working distances 250 mm to 2400 mm (dependent on type/marker)
- Marker diameter 13 mm to 15 mm
- Typical reproducibility: 0.5 mm at a working distance of up to 1900 mm (1 sigma)
- Integrated IR illumination (infrared LED, 850 nm) offers high interference rejection against ambient light.
- Intuitive alignment via four feedback LEDs and webConfig tool
- Two control buttons for intuitive operation without PC
- webConfig, a web-based configuration tool for configuration of all device parameters.
  No additional configuration software necessary
- Installation wizard for simple configuration in just a few steps
- Integrated teach functions:
  - Automatic adjustment of the exposure time and hole geometry
  - Electronic position teach for fine adjustment
- Reading in of configuration codes
- Multiple programs
- Measurement value output: Four digital switching outputs or Ethernet
- Diagnostics in process mode through image transfer via FTP
- Diagnostics using the output of quality scores and detection status
- Optional model with heating for use to -30 °C
- Variously coded M12 connections for unique assignment of the connections:
  - Voltage supply, switching inputs/outputs
  - Ethernet connection

3.1.3 Accessories

Special accessories are available for the positioning sensor (see chapter 16 "Order guide and accessories").

3.1.4 Device model with heating

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

Features of the integrated heating:

- Extension of the application range -30 °C … +45 °C
- Supply voltage: 18 V … 30 V DC
- Average power consumption: 12 W

	NOTICE
	The mounting location is to be selected such that the it does not expose the sensor with heating directly to a cold air stream. To achieve an optimal heating effect, the sensor should be mounted so that it is thermally isolated.

3.1.5 Combination with external illumination

For reflective surfaces behind the hole in the bar, we recommend using external illumination (see chapter 5.2 "Combination with external illumination"). As an alternative to external illumination, reflectors can also be used.

3.2 Device construction

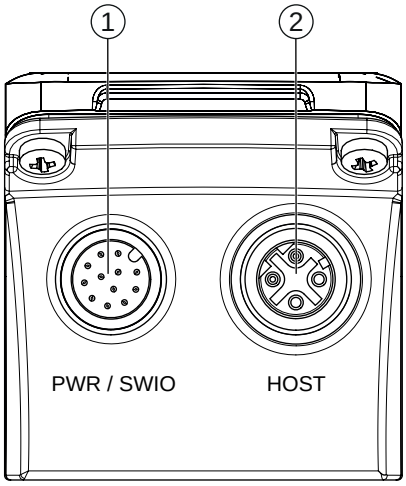
1 Lens
2 Control panel with indicator LEDs, control buttons and function/program selection display
3 LEDs for illumination (infrared light)
4 M4 mounting thread
5 Device housing
6 Housing hood
7 M12 connection technology
8 Feedback LEDs (4x green, +X -X +Y -Y)

Fig. 3.1: Device construction

3.3 Connection technology

The device is connected using variously coded M12 connectors:

- A-coded, 12-pin, M12 connection for operating voltage, switching inputs/outputs
- D-coded, 4-pin, M12 connection for the Ethernet connection



1 PWR / SWIO, M12 plug, 12-pin, A-coded
2 HOST, M12 socket, 4-pin, D-coded

Fig. 3.2: Electrical connections

NOTICE

Ready-made cables are available for all connections (see chapter 16.3 "Cables accessories").

NOTICE

Shielding connection!

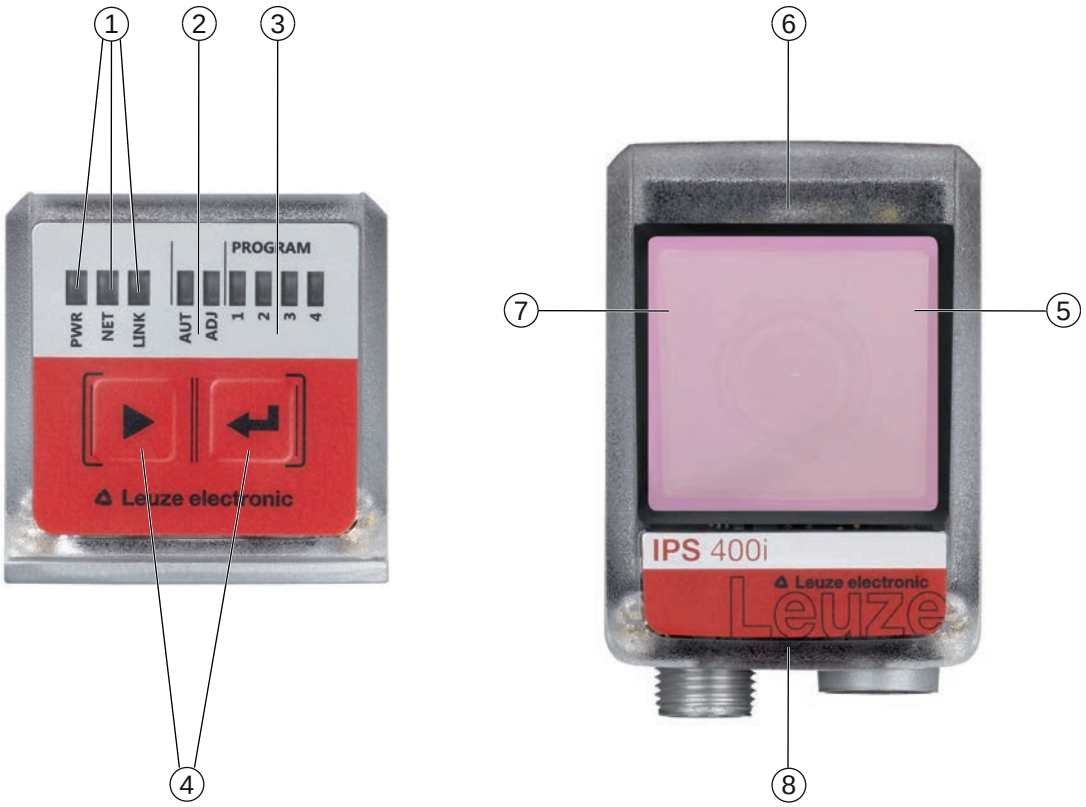
↳ The shielding is connected via the M12 connector housing.

3.4 Indicators and operational controls

The device is equipped with the following indicators and operational controls:

- Three indicator LEDs (PWR, NET, LINK)
- Two control buttons
- Six indicator LEDs for function selection (AUTO, ADJ) and program selection
- Four green feedback LEDs for aligning the positioning sensor

  The positioning sensor depicts the deviations in the directions -X, +Y, +X, -Y using four green feedback LEDs. These LEDs are activated upon shipment of the device from the factory and can be deactivated via the webConfig tool.



1 LED indicators: PWR, NET, LINK
2 Function selection
3 Program selection
4 Control buttons
5 -X position; signals whether the positioning sensor is located in the tolerance range
6 +Y position; signals whether the positioning sensor is located in the tolerance range
7 +X position; signals whether the positioning sensor is located in the tolerance range
8 -Y position; signals whether the positioning sensor is located in the tolerance range

Fig. 3.3: Indicators and operational controls

	NOTICE
	The program selection LEDs correspond to the first four selection IDs in the webConfig tool.

3.4.1 LED indicators

PWR LED

Tab. 3.1: PWR indicators

Color	State	Description
---	OFF	Device off No operating voltage
Green	Flashing	Device ok • Initialization phase • Positioning not possible • Operating voltage applied • Self test running
	ON (continuous light)	Device ok • Positioning possible • Self test successfully finished • Device monitoring active
Orange	ON (continuous light)	Service mode • Positioning possible • No data on the host interface
	Flashing	Wave function (synchronous with NET LED) • Positioning possible
Red	Flashing	Device ok, warning set • Positioning possible • Temporary operating fault
	ON (continuous light)	Device error/parameter enable No positioning possible

NET LED

Tab. 3.2: NET indicators

Color	State	Description
---	OFF	No operating voltage • No communication possible • Ethernet protocols not released • Ethernet communication not initialized or inactive
Green	Flashing	Initialization of the device Establishing communication
	ON (continuous light)	Operation ok • Network mode ok • Connection and communication to Host established
Orange	Flashing	Topology error detected • Deviating target/actual topology
Red	Flashing	Communication error • Temporary connection error • If DHCP active: No IP address could be obtained.
	ON (continuous light)	Network error • No connection established • No communication possible

LINK LED

Tab. 3.3: LINK indicators

Color	State	Description
Green	ON (continuous light)	Ethernet connected (LINK)
Yellow	Flashing	Data communication (ACT)

Feedback LEDs

Tab. 3.4: Feedback LED indicators

Color	State	Description
---	OFF	Device off No operating voltage No positioning operation active No marker found or marker not in the corresponding quadrant
Green	Flashing	Flashing frequency signals the marker distance to the nominal position: • Low frequency: Large distance • High frequency: Short distance
	ON (continuous light)	Marker is in nominal position (coordinate origin). The positioning sensor is optimally positioned if all four feedback LEDs illuminate.

3.4.2 Function selection and program selection

Function selection

The following functions are selected and displayed via the bar graph display (see chapter 8.6 "Activating device functions"):

- *AUTO*: Auto setup function for determining the optimum exposure and marker settings. Additional teaching of printed configuration codes.
- *ADJ*: Adjustment function for aligning the device and for teaching-in the position in the current program

The individual functions are selected and activated with the control buttons.

- Select function with the navigation button ▶: The function LED flashes.
- Activate function with the enter button ↵: The function LED illuminates continuously.

NOTICE
If you activate the *AUTO* or *ADJ* function via the control buttons, the device accepts no commands via the process interface. Process mode is thereby interrupted.

Program selection

The control buttons and PROGRAM display can be used to select, activate and display the first four programs that are stored in the device.

3.4.3 Control buttons

Function selection and program selection are controlled via the control buttons.

NOTICE
In the *Service* operating mode (which is set using the webConfig tool), the positioning sensor cannot be operated using the control buttons.

- ▶ – navigation button: Scroll through the functions in the function and program selection display from left to right.
- ↵ – enter button: Scroll through the functions in the function and program selection display.

NOTICE
A preselected function (flashing LED) does not yet have any influence on the functionality. If no button is pressed for a longer period of time, flashing of the LED is ended automatically by the device.

NOTICE
The *AUTO* and *ADJ* functions always apply to the currently valid program. Both functions must be deactivated again by pressing the enter button ↵.

Exiting a function mode

When exiting a function mode (AUTO/ADJ), observe the following notes:

- Short press of the enter button ↵: The function mode is exited, the parameters are not accepted.
- Long press (3 seconds) of the enter button ↵ and teach not possible: The function mode is exited, the parameters are not accepted.
- Long press (3 seconds) of the enter button ↵ and teach possible: The function mode is exited, the parameters are stored permanently.

Upon exiting a function mode, the four feedback LEDs signal whether teaching was successful:

- Single, brief flash: Teaching successful
- Flashing fast (3 seconds): Teaching not successful

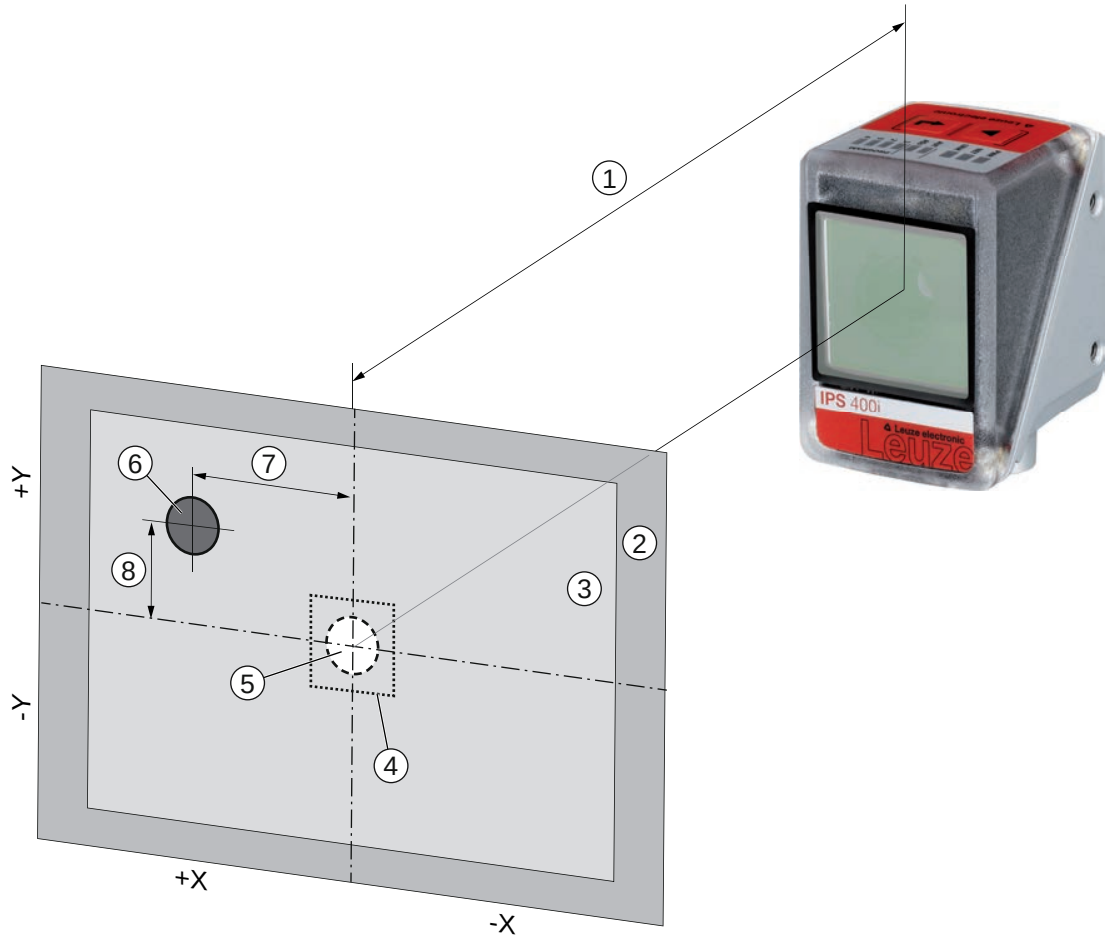
4 Functions

This chapter describes the functions of the positioning sensor:

- Programs (see chapter 4.1 "Programs")
- Camera operating modes (see chapter 4.2 "Camera operating modes")
- Quality score (see chapter 4.3 "Quality score")
- Offset (see chapter 4.4 "Offset")
- Teach position (see chapter 4.5 "Teach position")
- Detection status (see chapter 4.6 "Detection status")

The sensor operates in two dimensions, X and Y:

- X corresponds to the horizontal axis (default).
- Y corresponds to the vertical axis (default).



1 Working distance
2 Field of view (FOV)
3 Region of interest (ROI)
4 Tolerance range
5 Nominal position (marker)
6 Actual position (marker)
7 X deviation
8 Y deviation

Fig. 4.1: Mode of operation of the positioning sensor

4.1 Programs

There are eight programs stored in the positioning sensor. The programs can be used for the following functions:

- Positioning at short and distant range
- Loading and unloading positions with different offset values
- Compartments with different markers (hole or reflector)

Switch between or activate programs in the device as follows:

- Via the webConfig tool (see chapter 4.7 "Leuze webConfig tool")
- Via switching inputs SWI3 and SWI4 (only the first four programs – default setting)
- Via control buttons on the device (only the first four programs – default setting)

NOTICE

Changing the check program

The selection ID can be used to trigger an automatic change of check program:

- Via the SWI3 and SWI4 digital switching inputs
- Via an Ethernet online command

NOTICE

A program change should only be performed with closed reading gate (status "Ready").

4.2 Camera operating modes

The camera operating mode defines how the positioning sensor starts and ends a positioning operation.

4.2.1 Single trigger mode

In the "Single trigger mode" camera operating mode, the positioning sensor captures one image and attempts to determine the actual position of the marker relative to the nominal position.

4.2.2 Reading gate control

Upon activation, the reading gate control opens a time window in the device for the positioning operation. In this time window, the positioning sensor continuously determines the relative position and outputs the position. The reading gate control must be deactivated again via the trigger signal.

The "Reading gate control" camera operating mode is activated upon shipment from the factory.

Image acquisition and evaluation occur in parallel.

With the "Sequential reading gate control" camera operating mode, image acquisition and processing of the images occur one after another (sequentially).

4.2.3 Sequential reading gate control

With this camera operating mode, image acquisition, processing and output take place in succession. The time interval between image acquisition and output of the results decreases with every image.

4.3 Quality score

The quality score is a measure of the quality of the found marker and refers to the shape factor, the scaling factor and the contrast of the taught marker. The quality score is output in percent [%].

Limit values can be defined in the positioning sensor via the quality score:

- Limit value at which a switching output is set as a warning if the value is less than or exceeds the limit.
- Limit value at which images are transferred via Ethernet / interface (FTP).
- In addition, the determined quality score can be output via the interface.

4.4 Offset

Offset in the X/Y direction that is taken into account for the positioning, e.g., when moving goods in and out of storage. Here, the offset shifts the nominal position relative to the center point of the region of interest. The offset can be in the positive or negative direction.

	NOTICE
	You can set one offset value per program.

4.5 Teach position

For fine adjustment and as an alternative to precise mechanical alignment, you can teach-in the position of the device. When teaching-in the position, the coordinate system of the region of interest is placed in the center point of the detected marker.

You can activate the function in the device as follows:

- Via the webConfig tool (see chapter 4.7 "Leuze webConfig tool")
- Via control buttons on the device (via *ADJ* mode)
- Via an Ethernet online command

If the teaching-in of the position fails, it may be due to the following reasons:

- The marker is not located in the device's region of interest.
- The limits of the new region of interest determined by teaching-in are not completely in the field of view.

4.6 Detection status

The detection status signals the status of the current detection:

- `0`: Detection successful – one marker detected in region of interest
- `1`: Detection not successful – several markers detected in region of interest
- `2`: Detection not successful – no markers detected in region of interest

4.7 Leuze webConfig tool

The webConfig configuration tool offers a graphical user interface for the configuration of the positioning sensor via a PC (see chapter 9 "Starting up the device – Leuze webConfig tool").

The wizard of the webConfig tool can be used to easily configure the positioning sensor in just a few steps.

5 Applications

5.1 Compartment fine positioning

After performing rough positioning, the positioning sensor is used for the optical, contactless fine positioning in the X and Y direction.

Compartment fine positioning of stacker crane

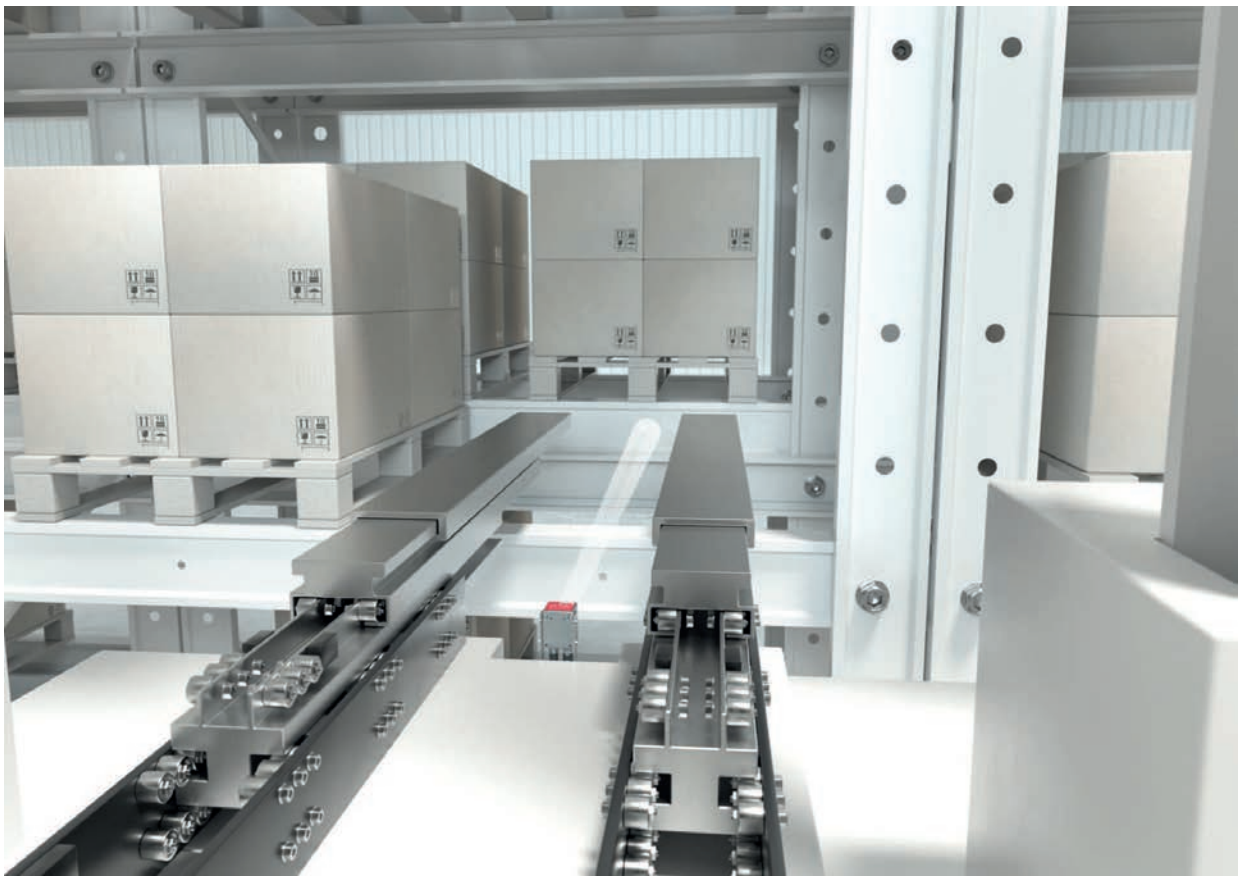


Fig. 5.1: Compartment fine positioning of a stacker crane in a double-deep pallet high-bay warehouse

5.2 Combination with external illumination

For reflective surfaces behind the hole in the bar, we recommend using external illumination.

NOTICE
↳ Observe the package insert of the external illumination.

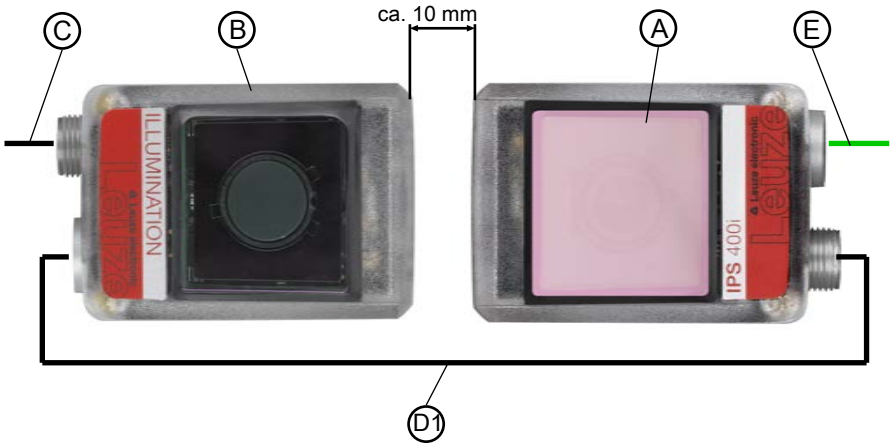
5.2.1 Mounting sensor and external illumination

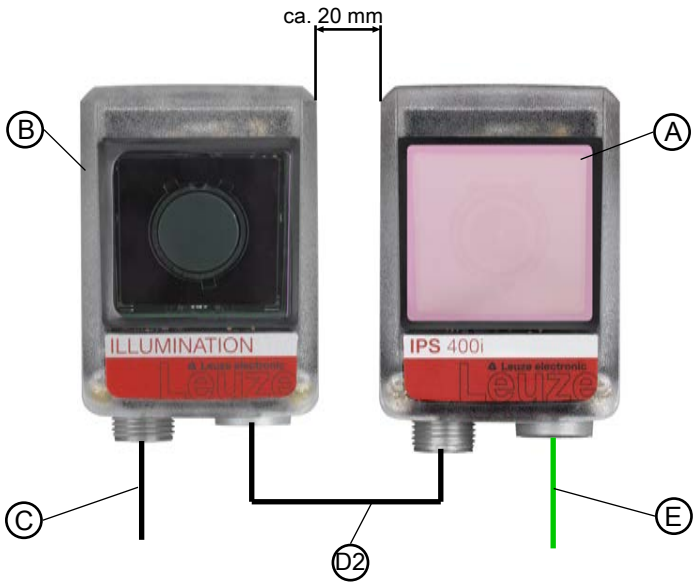
NOTICE
↳ Maintain the mounting distance between sensor and illumination. ↳ Mount the illumination to a metal mounting bracket on the rear side of the housing only (heat dissipation). ↳ Ensure that behind the hole there are no reflective materials within 500 mm.

5.2.2 Electrical connection

The sensor and the external illumination can be directly connected to one another. In this case, all signals (PWR/SWIO) are looped through the external illumination.

NOTICE	
	The integrated heating of the external illumination is activated at an ambient temperature of ≤ 10 °C.





A	Sensor, e.g. IPS 4xxi
B	External illumination, e.g., 50144030
C	Connection cable, e.g. 2 m – 50130281
D1	Interconnection cable, e.g. 2 m – 50130284
D2	Interconnection cable, e.g. 0.3 m – 50143811
E	Ethernet interconnection cable, e.g. 2 m – 50135080

Fig. 5.2: Electrical connection of sensor and external illumination – arrangement possibilities and mounting distances

5.2.3 Commissioning

The following parameters are to be set in the sensor via the webConfig tool if the external illumination is directly connected to the sensor (see see chapter 9 "Starting up the device – Leuze webConfig tool").

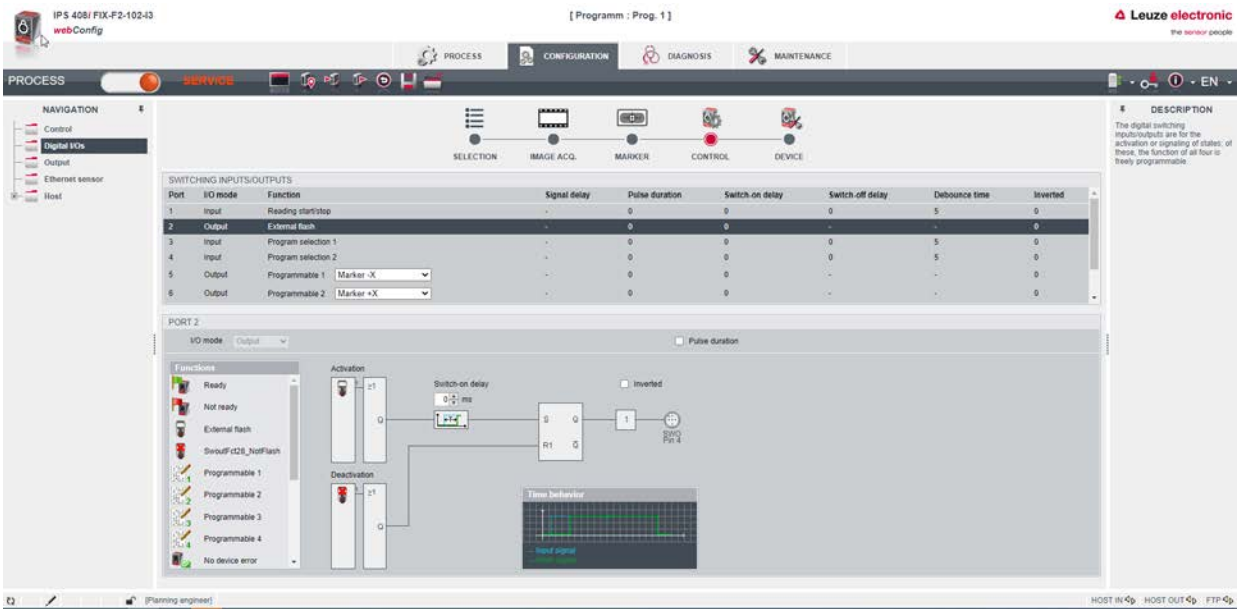


Fig. 5.3: Settings for operation with external illumination in the CONFIGURATION menu

- Configure switching output SWO2 as "external flash".
- The pulse duration of switching output SWO2 is automatically synchronized with the exposure time.
- Set the flash time to no longer than necessary.
  The maximum flash time of the external illumination is 4 ms.
- Only flash during the positioning process.
- The internal illumination of the sensor must be switched off.

6 Mounting

The positioning sensor can be mounted in the following ways:

- Mounting using four M4 mounting threads on the rear of the device
- Mounting using two M4 mounting threads on each of the side surfaces of the device
- Mounting on a 12 mm rod using the BTU 320M-D12 mounting system
- Mounting on the BT 320M mounting bracket

	NOTICE
	Devices without heating: - Mount the device without heating on a metal mounting bracket. Devices with integrated heating: - Mount the device in a way which provides maximum thermal isolation, e.g., using rubber-bonded metal. - Mount the device in such a way that it is protected from draft and wind. Provide additional protection if necessary.

6.1 Determining the mounting position of the positioning sensor

6.1.1 Selecting a mounting location

	NOTICE
	The size of the marker influences the maximum working distance. Therefore, when selecting a mounting location and/or the suitable marker, be certain to take into account the different positioning characteristics of the sensor with various markers.

	NOTICE
	**Observe when choosing the mounting location!** ↳ Make certain that the required environmental conditions (humidity, temperature) are maintained. ↳ Avoid possible soiling of the reading window due to liquids, abrasion by boxes, or packaging material residues. ↳ Ensure the lowest possible chance of damage to the sensor through mechanical collision or jammed parts. ↳ Avoid possible ambient light influence (no direct sunlight).

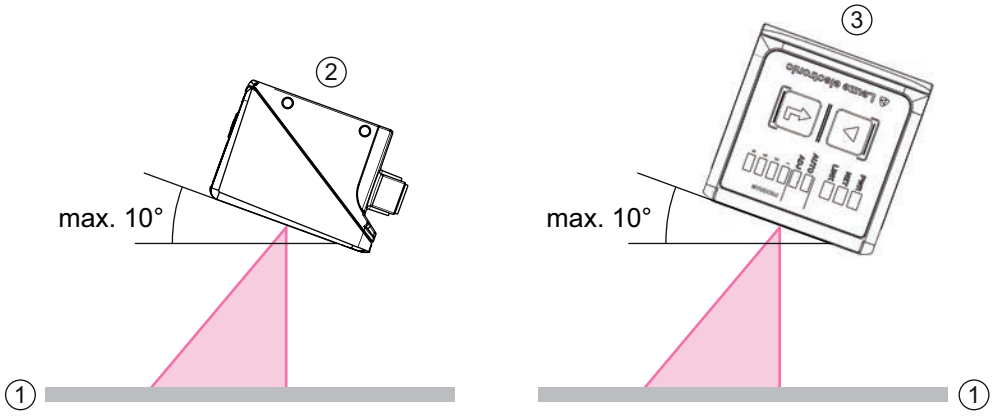
Take the following factors into account when selecting the correct mounting location:

- Size, orientation, and position tolerance of the markers on the objects to be scanned.
- Reading distance that results from the marker size (Determining the working distance).
- Time of data output.
- The permissible line lengths between sensor and host system depending on which interface is used.
- Visibility of the control panel and access to the control buttons.

	NOTICE
	In event of a device exchange (e.g., in case of servicing), the new sensor must be mechanically aligned and the position checked.

6.1.2 Mounting bracket

If the illumination light of the sensor is directly incident on the surface of the bar at an angle of 90°, total reflection occurs. The illumination light directly reflected may overload the sensor and thereby adversely affect positioning.



Recommended tilt angle or angle of inclination: maximum 10°

1 Bar
2 Mounting with tilt angle
3 Mounting with angle of inclination

Fig. 6.1: Mounting with tilt angle or angle of inclination

	NOTICE
	The optimum tilt angle or angle of inclination is dependent on the surface of the bar and the working distance. Normally, a tilt angle of 5° and an angle of inclination of 0° is recommended.

6.1.3 Determining the working distance

In general, the sensor's field of view increases as the working distance becomes larger. This also results in a decrease in the resolution, however.

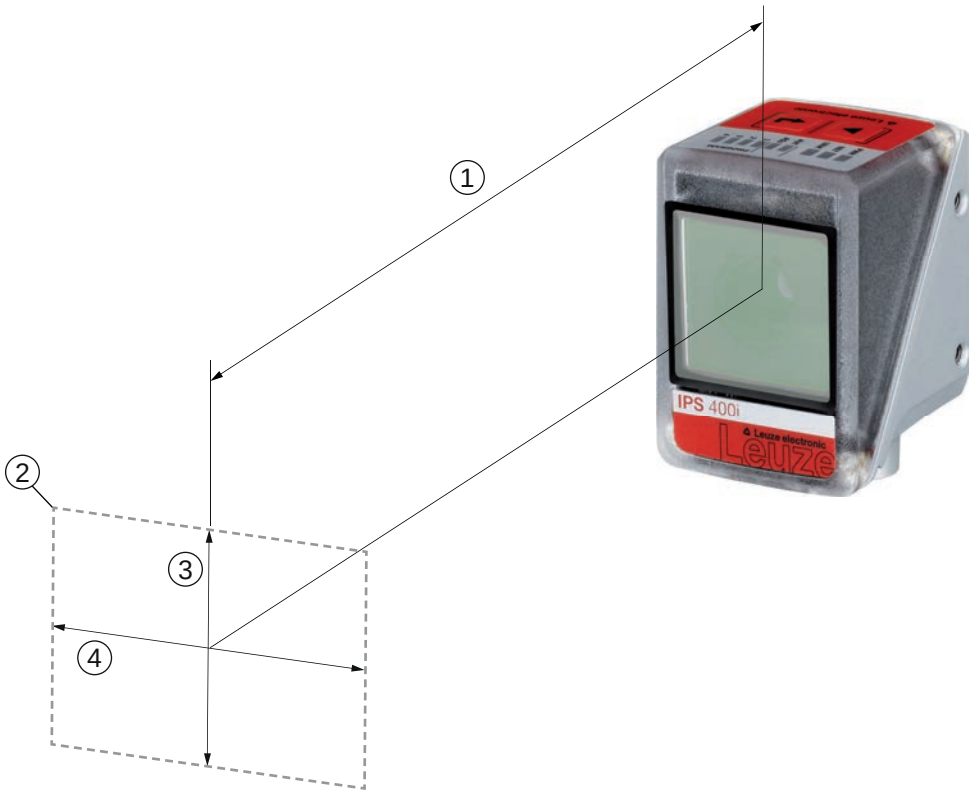
Working distances for the sensor with F2 or F4 optics

- F2 optics. 250 mm … 1900 mm
- F4 optics. 350 mm … 2400 mm
  A reflector is necessary for working distances greater than 1.9 m.

NOTICE	
	Note that the actual working distance is also influenced by factors such as marker geometry, mounting bracket, reflection properties of the bar, etc., and may therefore differ from the distances listed here.

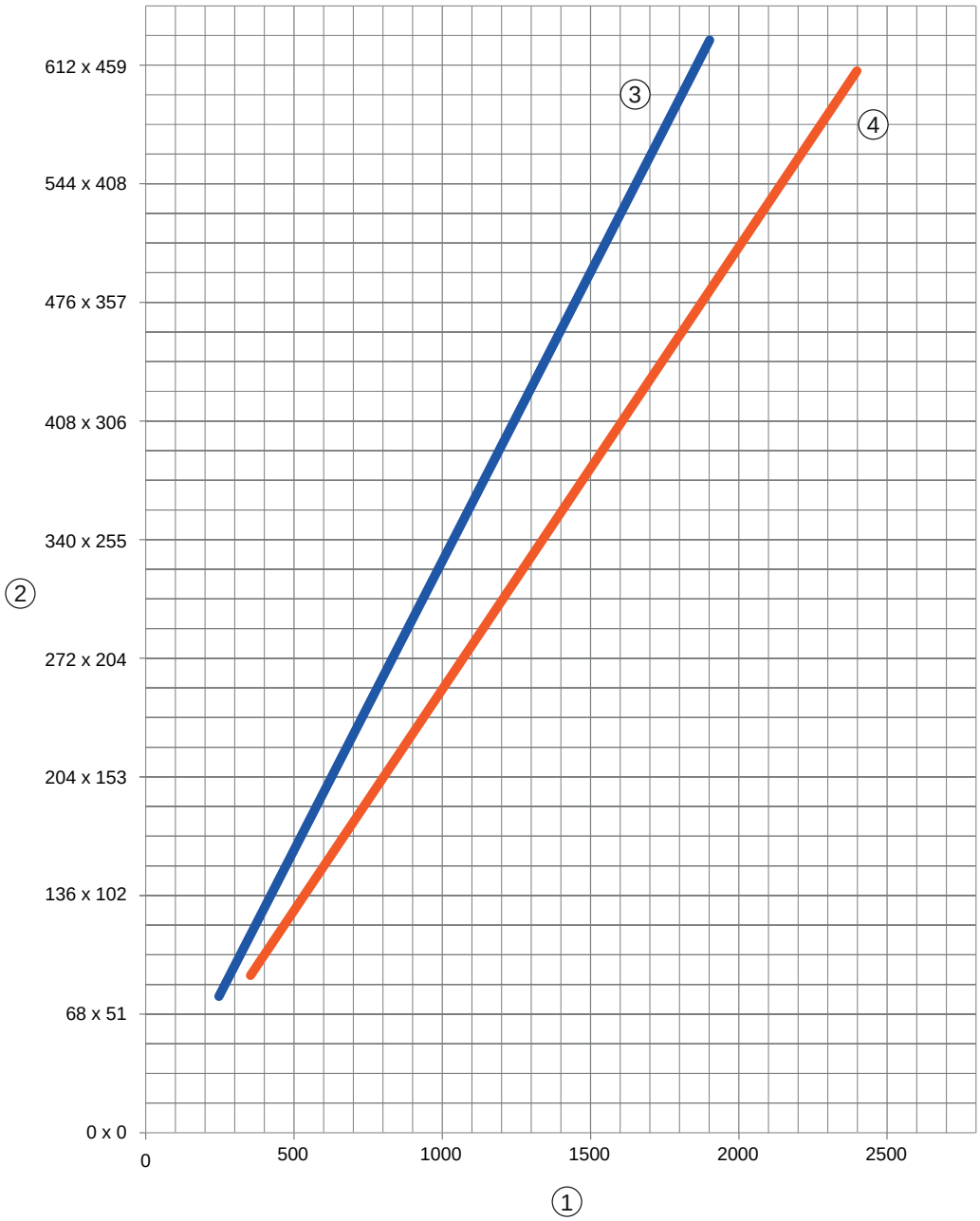
Relationship between working distance and field of view size

The following images show the relationship between the working distance and the resulting field of view for the optics models of the sensor. The working distance is the path from the front edge of the sensor to the marker.



1 Working distance
2 Field of view (FOV)
3 Height of the field of view
4 Width of the field of view

Fig. 6.2: Working distance and field of view



1 Working distance [mm]
2 Field of view: width x height [mm]
3 F2 optics
4 F4 optics

Fig. 6.3: Relationship between working distance and field of view size

6.1.4 Field of view size

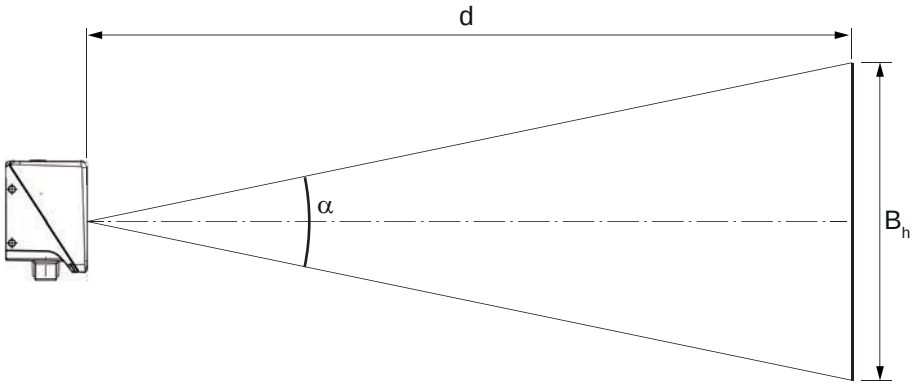
The following table shows the relationship between the working distance and the resulting field of view for the optics models of the sensor. The working distance is the path from the front edge of the sensor to the marker. Use the data to calculate the typical field of view (FOV) for your application.

Tab. 6.1: Field of view size

Model	Optics model	Lens	Typical opening angle, horizontal	Typical opening angle, vertical
IPS 200i	M3-optics	4.3 mm	37.5°	28.6°
IPS 400i	F2-optics	12 mm	18.7°	14.1°
	F4-optics	16 mm	14.0°	10.7°

Formula for the field of view calculation

Field of view$_x$ = 2 x [tan (α / 2) x d]



B_h Field of view, horizontal and vertical
α Opening angle, horizontal and vertical
d Camera distance from the lens cover to the marker

Fig. 6.4: Field of view

Example

IPS 200i with a camera distance of 300 mm:

- Field of view, horizontal = 2 x [tan (37.5 / 2) x 300 mm] = 204 mm
- Field of view, vertical = 2 x [tan (28.6 / 2) x 300 mm] = 153 mm

6.2 Mounting the positioning sensor

NOTICE

Observe during mounting!

- Make certain that there is only one marker in the sensor's region of interest.
- All markers that are to be detected must have the same diameter.
  Other objects with the same diameter (e.g., screw heads) must not be located in the sensor's region of interest.
- Make certain that the surface that surrounds a marker reflects diffusely.
- The steel beams/crossbeams must be of uniform quality (surface, color, corrosion).
- The area behind the marker (in the case of holes) should remain unbuilt within an area of 500 mm.
- For closed profiles, use only reflectors as markers.
- Avoid glossy, reflective surfaces and light sources behind the markers (in the case of holes).
- Avoid kinks or folded edges that pass through the center of the hole or that touch the hole.
- Make certain that the surface of the steel beam/crossbeam is not soiled (e.g., sludge), especially near the marker (hole) or the working range of the sensor.
- Align the sensor as parallel to the marker as possible.
- Make certain that the markers are located as close as possible to the center of the sensor's region of interest.
- The working distance set in the device must correspond to the actual working distance.

NOTICE

Observe when mounting reflectors!

- Make certain that the reflectors are kept clean before and during mounting.
- Make certain that the black edge and the reflective surface are not damaged.
- Avoid oil and grease on the reflector (e.g., from fingerprints). The reflective properties are thereby significantly reduced.
- To clean the reflectors, do not use any solvent-based cleaners or cleaning agents with abrasive effect.

6.2.1 Mounting with M4 fastening screws

- Mount the device on the system with M4 fastening screws (not included in delivery contents).
  - ⇨ Max. tightening torque of the fastening screws: 1.4 Nm
  - ⇨ Location and thread depth of the mounting thread: see chapter 15.5 "Dimensioned drawings"

6.2.2 Mounting with the BTU 320M-D12 mounting system

Mounting with a BTU 320M-D12 mounting system is intended for 12-mm rod mounting. For ordering information, see chapter 16.4 "Other accessories".

- Mount the mounting system on the rod with the clamp profile (system-side).
- Mount the device to the mounting system with M4 fastening screws.
  - ⇨ Max. tightening torque of the fastening screws: 1.4 Nm
  - ⇨ Location and thread depth of the mounting thread: see chapter 15.5 "Dimensioned drawings"

6.2.3 Mounting with the BT 320M mounting bracket

Mounting with a BT 320M mounting bracket is intended for wall mounting. For ordering information, see chapter 16.4 "Other accessories".

- Mount the mounting bracket on the system side with M4 fastening screws (included in delivery contents).
- Mount the device to the mounting bracket with M4 fastening screws.
  - ⇨ Max. tightening torque of the fastening screws: 1.4 Nm
  - ⇨ Location and thread depth of the mounting thread: see chapter 15.5 "Dimensioned drawings"

6.3 Replace housing hood

In individual cases, you can exchange the housing hood of the sensor, e.g., if the protective screen is scratched.

NOTICE

Only replace the housing hood while the device is in a de-energized state!

Only replace the housing hood if no voltage is being applied to the device.

- Disconnect the device from the voltage supply before replacing the device hood.

NOTICE

Check the seal before mounting!

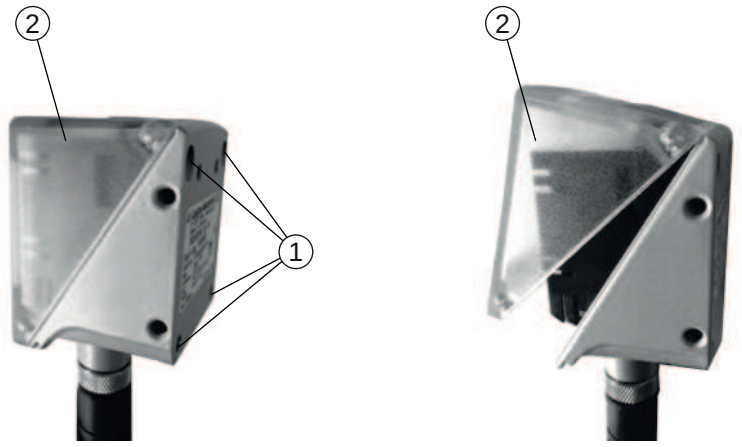
- Check the seal on the base of the device housing for cleanliness before mounting the new housing hood.

NOTICE

Clean the new housing hood before mounting!

- Clean the new housing hood with a soft cloth before mounting.

- Loosen the four fastening screws of the housing hood.
- First tip the housing hood downward and away from the housing base.
- Then lift the housing hood up and off of the housing base.
- Then mount the new housing hood in the reverse order. The tightening torque of the fastening screws is 0.25 Nm.



1 Fastening screws
2 Housing hood

Fig. 6.5: Replace housing hood

7 Electrical connection

CAUTION

Safety notices!

- Before connecting the device, please ensure that the operating voltage matches the value printed on the nameplate.
- 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

Shielding connection!

The shielding is connected via the M12 connector housing.

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

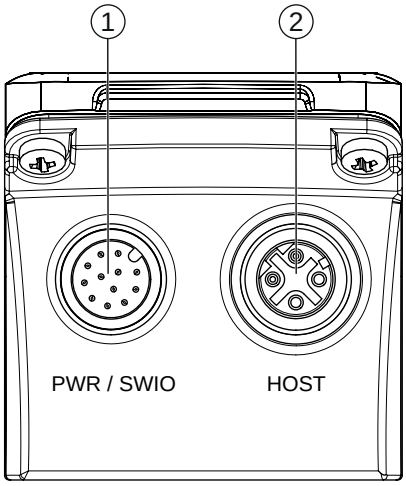
Degree of protection IP65!

Degree of protection IP65 is achieved only if the connectors and caps are screwed into place.

7.1 Overview

The sensor is provided with the following connections:

- PWR / SWIO: A-coded, 12-pin, M12 connection for operating voltage, switching inputs/outputs
- HOST: D-coded, 4-pin, M12 connection for the Ethernet connection



1 PWR / SWIO, M12 plug, 12-pin, A-coded
2 HOST, M12 socket, 4-pin, D-coded

Fig. 7.1: Electrical connections

NOTICE
Ready-made cables are available for all connections (see chapter 16.3 "Cables accessories").

Voltage supply and switching inputs/outputs

The voltage supply (18 V … 30 V DC) is connected at the PWR / SWIO M12 plug.

Eight freely programmable switching inputs/outputs for individual adaptation to the respective application are also available on the PWR / SWIO M12 plug.

Standalone operation in Ethernet network

The sensor is operated as a "stand-alone" single device in an Ethernet star topology with individual IP address. The host interface of the superior system is connected to the HOST M12 socket.

7.2 PWR/SWI/SWO – voltage supply and switching inputs/outputs

12-pin M12 connector (A-coded)

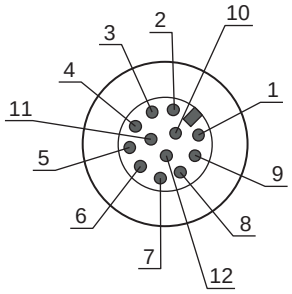


Fig. 7.2: PWR/SWI/SWO connection

Tab. 7.1: PWR/SWI/SWO pin assignment

Pin	Designation	Core color	Assignment
1	VIN	Brown	+18 … +30 V DC operating voltage
2	GND	Blue	Negative operating voltage (0 V DC)
3	SWI1	White	Digital switching input 1 (trigger)
4	SWO2	Green	Digital switching output 2 (READY)
5	FE	Pink	Functional earth
6	n.c.	Yellow	Not assigned
7	SWO5	Black	Digital switching output (default: +X)
8	SWO6	Gray	Digital switching output (default: -X)
9	SWO7	Red	Digital switching output (default: +Y)
10	SWO8	Violet	Digital switching output (default: -Y)
11	SWI3	Gray/pink	Digital switching input 3 (Program Selection 0)
12	SWI4	Red/blue	Digital switching input 4 (Program Selection 1)
Thread (M12 connector)	FE (functional earth)		Connection cable shield. The shield of the connection cable is on the thread of the M12 connector.

NOTICE

The core colors only apply if Leuze's original connection cables are used (see chapter 16.3 "Cables 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 sensor is provided with eight freely programmable switching inputs/outputs (SWI1, SWI3, SWI4, SWO2, SWO5 … SWO8).

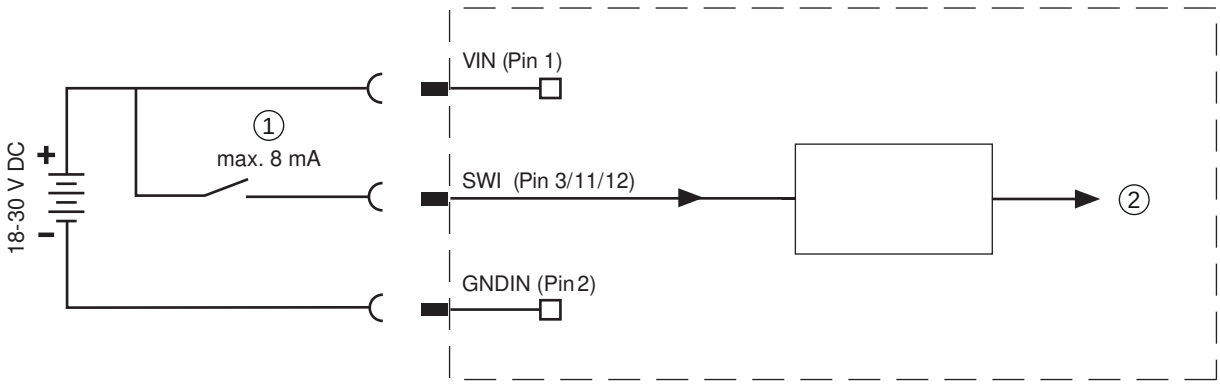
NOTICE

The function as switching input or switching output is set via the webConfig configuration tool (**CONFIGURATION > DEVICE > Switching inputs/outputs**, see chapter 9 "Starting up the device – Leuze webConfig tool").

The eight switching inputs/outputs are configured by default as follows:

- SWI1
  Switching input: Trigger (default)
- SWO2
  Switching output: device ready (default)
- SWI3
  Switching input: Program selection 0
- SWI4
  Switching input: Program selection 1
- SWO5
  Switching output +X position (default)
- SWO6
  Switching output –X position (default)
- SWO7
  Switching output +Y position (default)
- SWO8
  Switching output –Y position (default)

Function as switching input



1 Switching input
2 Switching input to controller

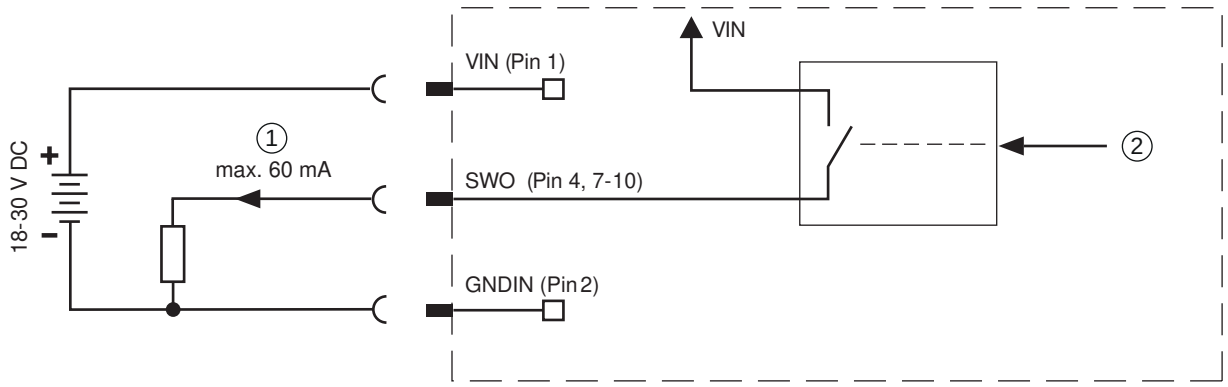
Fig. 7.3: Switching input SWI1, SWI3 and SWI4 connection

NOTICE

Maximum input current!

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

Function as switching output



1 Switching output
2 Switching output from controller

Fig. 7.4: Switching output SWO2, SWO5 … SWO8 connection

	NOTICE
	Maximum loading of the switching outputs! ↳ Do not load the respective switching output of the sensor with more than 60 mA at +18 V … +30 V DC in normal operation. ↳ Each configured switching output is short-circuit proof.

7.3 HOST - Host input / Ethernet

4-pin, M12 socket (D-coded) for connecting to HOST.

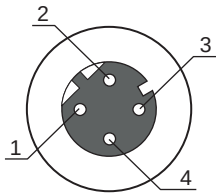


Fig. 7.5: HOST connection

Tab. 7.2: HOST pin assignment

Pin/terminal	Designation	Assignment
1	TD+	Transmit Data +
2	RD+	Receive Data +
3	TD-	Transmit Data -
4	RD-	Receive Data -
Thread (M12 socket)	FE (functional earth)	Connection cable shield. The shield of the connection cable is on the thread of the M12 socket.

NOTICE

Use ready-made cables!

If possible, use the ready-made cables from Leuze (see chapter 16.3 "Cables accessories").

7.4 Ethernet star topology

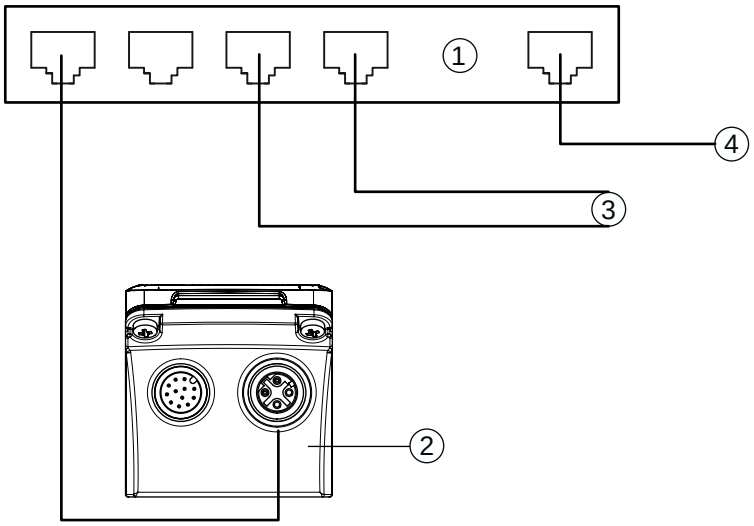
The sensor is operated as a "stand-alone" single device in an Ethernet star topology with individual IP address.

The address can be set either by means of DHCP or the webConfig tool.

- The sensor is designed as an Ethernet device with a standard baud rate of 10/100 Mbit.
- A fixed MAC address is assigned to each device by the manufacturer; this address cannot be changed.
- The device automatically supports the transmission rates of 10 Mbit/s (10BASE T) and 100 Mbit/s (10BASE TX), as well as auto-negotiation and auto-crossover.
- The device supports the following protocols and services:
  - TCP / IP (client/server)
  - UDP
  - DHCP
  - ARP
  - PING
  - EtherNet/IP
  - ICMP
  - IGMP
- For communication with the superior host system, the corresponding TCP/IP protocol (client/server mode) or UDP must be selected.

NOTICE

The IPS 458i does not support DLR (Device Level Ring).



1 Ethernet switch
2 Positioning sensor of the IPS 400i series
3 Other network participants
4 Host interface - PC/control

Fig. 7.6: Ethernet star topology

Ethernet cable assignment

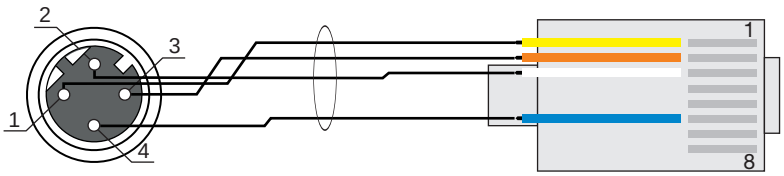


Fig. 7.7: HOST to RJ-45 cable assignments

Designed as shielded cable, max. 100 m.

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

NOTICE

Self-configured cables with Ethernet interface!

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

7.5 Cable lengths and shielding

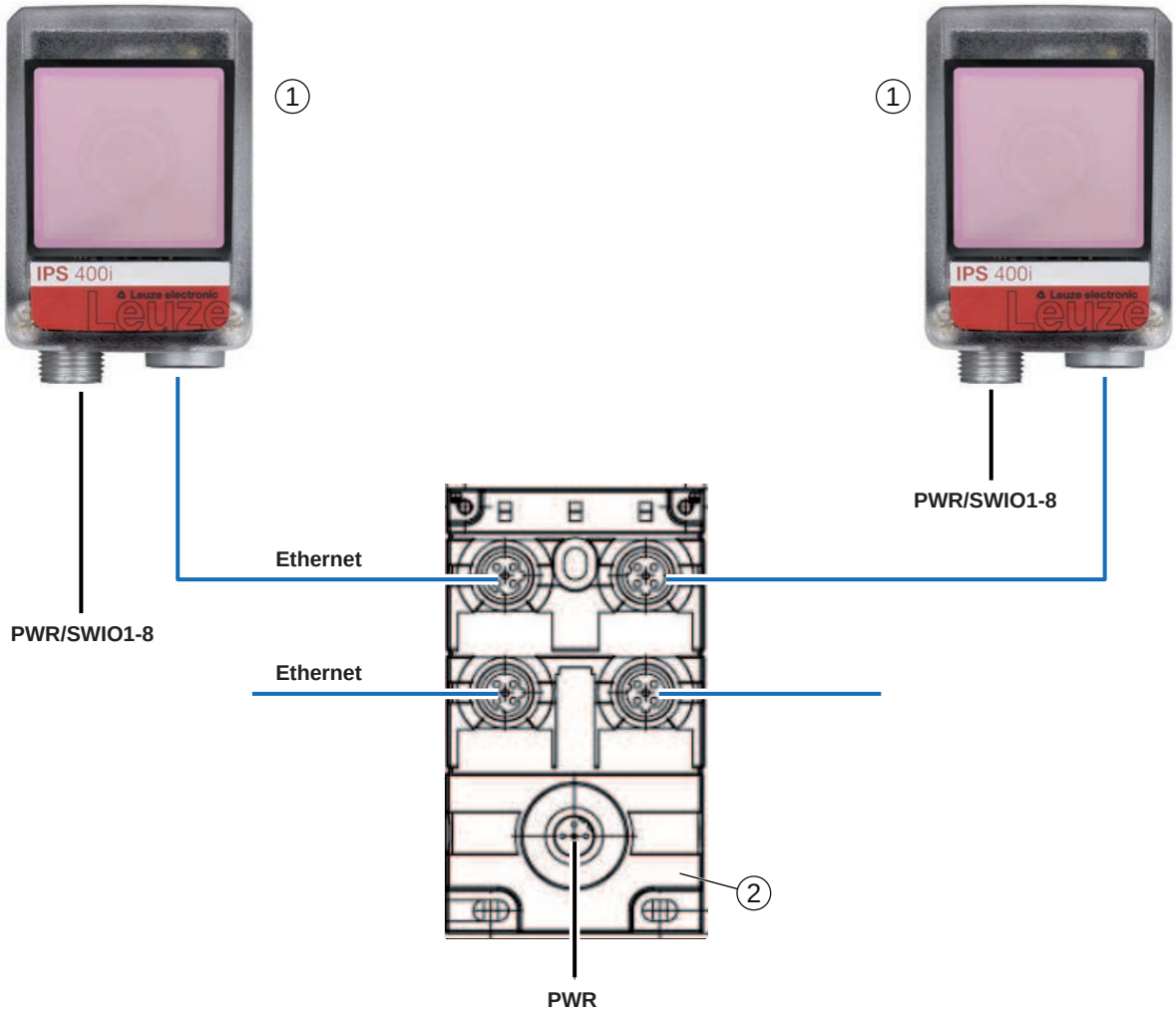
Observe the maximum cable lengths and the shielding types:

Connection	Interface	Max. cable length	Shielding
Network from the first IPS 400i to the last network participant	Ethernet	Max. segment length: 100 m for 100BASE-TX twisted pair (min. CAT 5)	Shielding absolutely necessary
Switching input		10 m	Not necessary
Switching output		10 m	Not necessary
IPS 400i power supply unit		30 m	Not necessary

7.6 Connecting positioning sensor to Ethernet switch

The Ethernet communication is decentrally distributed in the high-bay storage device via the Ethernet switch.

Circuit diagram example for the connection to an Ethernet switch



1 IPS 400i positioning sensor
2 Ethernet switch

Fig. 7.8: Circuit diagram example for connection to Ethernet switch

8 Starting up the device – Basic configuration

8.1 Measures to be performed prior to the initial commissioning

NOTICE
↳ Observe the notices for device arrangement (see chapter 6.1 "Determining the mounting position of the positioning sensor"). ↳ If possible, always trigger the positioning sensor with the aid of commands or an external signal transmitter (e.g. photoelectric sensor/diffuse sensor). ↳ Before commissioning, familiarize yourself with the operation and configuration of the device. ↳ Before connecting the operating voltage, recheck all connections and ensure that they have been properly made.

NOTICE
No additional configuration software is necessary for commissioning.

8.2 Starting the device

↳ Connect the 18 V … 30 V DC operating voltage.

⇨ After applying the operating voltage, the device operates with the factory settings.

- Activation of the desired program (default: program 1).
- Activation via SWI1 (default: reading gate control).
- If a marker is detected, the following is output:
  - Switching outputs: Position value via SWO5 … SWO8 (default)
  - Ethernet communication: Position value X/Y, status, quality score
  - Feedback LEDs: Status of the switching outputs SWO5 … SWO8

↳ Deactivate the reading gate once the positioning task has ended.

NOTICE
Deviations from these settings must be set via the webConfig tool (see chapter 9 "Starting up the device – Leuze webConfig tool").

↳ Using the online commands, important device functions can be checked, e.g. reading activation (see chapter 11.1 "Online commands").

NOTICE
For information on how to proceed in the event of problems during commissioning of the devices see chapter 13 "Diagnostics and troubleshooting". If a problem occurs that cannot be rectified even after checking all electrical connections and settings on the devices and on the host, contact your responsible Leuze subsidiary or Leuze customer service (see chapter 14 "Service and support").

8.3 Configuring and aligning the device via control buttons

Prerequisites:

- The positioning sensor is correctly mounted; in particular, at the correct working distance (see chapter 6 "Mounting").
- The positioning sensor is correctly connected (see chapter 7 "Electrical connection").
- The application data is set via the webConfig tool (see chapter 9 "Starting up the device – Leuze web-Config tool").
- The housing hood of the positioning sensor is aligned parallel to the marker.
- The marker is as close as possible to the center of the positioning sensor's region of interest.

NOTICE

The working distance set in the device must correspond to the actual working distance.

NOTICE

- Use the navigation button ▶ to move through the menu.
- Activate or deactivate the desired selection with the enter button ↵.
- First, the program is selected and confirmed. The *AUTO* or *ADJ* function is then activated or deactivated.

- Press the navigation button ▶ once.
  - ⇨ The PROGRAM 1 LED flashes; program 1 is preselected.
  - ⇨ Press the navigation button several times to preselect the desired program.
- Press the enter button ↵ to activate the desired program.
- Press the navigation button ▶ repeatedly until the AUTO LED flashes.
- Press the enter button ↵ to activate the *AUTO* function.
- Align the positioning sensor so that all four feedback LEDs permanently illuminate green.

NOTICE

The feedback LEDs signal the X/Y distance to the marker by means of the flashing frequency:

- Slow flashing: Large distance
- Fast flashing: Short distance
- Continuous illumination: Positioning sensor is optimally aligned

- If all four feedback LEDs illuminate green continuously, press the enter button ↵ for three second to apply the parameters.
- The positioning sensor is optimally aligned.
- The exposure time and the marker diameter are taught.
- The position is taught if the entire region of interest is still in the field of view after teaching-in.

Upon exiting a function mode, the four feedback LEDs signal whether teaching was successful:

- Single, brief flash: Teaching successful
- Flashing fast (3 seconds): Teaching not successful

8.4 Setting the communication parameters

With the communication parameters, you determine how data is exchanged between device and host system, monitor PCs etc.

NOTICE
For devices with integrated EtherNet/IP interface: see chapter 10 "EtherNet/IP"

8.4.1 Manually setting the IP address

Set the IP manually if your system does not include a DHCP server or if the IP addresses of the devices are to be set permanently.

NOTICE
On delivery, the automatic address assignment via DHCP server is defined as the standard setting of the IPS 458i and the IP address is set to 0.0.0.0.

NOTICE
The device cannot be accessed if the IP address is incorrect! ↳ Make certain that the correct IP address is entered. The device can otherwise no longer be accessed.

Setting the IP address with Device-Finder

↳ Download the program *Device-Finder* from the Internet to the PC.
  ⇨ Call up the Leuze website: **www.leuze.com**.
  ⇨ Enter the type designation or part number of the device as the search term.
  ⇨ The program *Device-Finder* can be found on the product page for the device under the *Downloads* tab.

↳ Connect the Ethernet interface of the device directly to the LAN port of the PC.

↳ Start the program *Device-Finder*.
  ⇨ The program displays all sensors of the IPS 400i series that are available in the network.

↳ Select the IPS 4xxi sensor from the list.
  ⇨ You can now change the IP address of the sensor to the desired IP address.

8.4.2 Automatically setting the IP address

Set the IP address automatically if a DHCP server assigns the IP addresses in the system.

↳ Select the option to obtain the IP address automatically in the webConfig tool:
Configuration > Control > Ethernet DCR > DHCP

↳ Use the configuration code to obtain the IP address automatically (Configuration via configuration codes).

8.4.3 Address Link Label

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

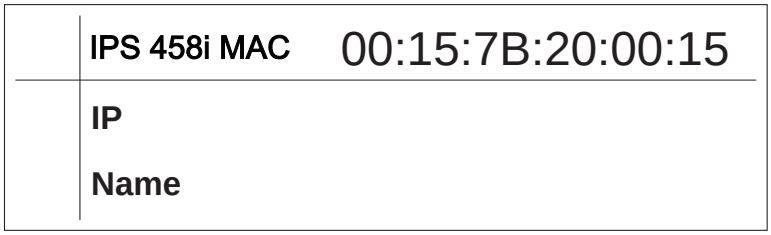


Fig. 8.1: Example of an "Address Link Label"; the device type varies depending on the series

- 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.

  There is no need for time-consuming searching, reading, and manually writing down of the MAC addresses of every device that is installed in the system.

	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.

8.4.4 Ethernet host communication

You can configure the connections to an external host system via the Ethernet host communication.

You can use both the UDP protocol as well as the TCP/IP protocol – in either client or in server mode. Both protocols can be activated simultaneously and used in parallel.

- The connection-free UDP protocol is used primarily to transfer process data to the host (monitor operation).
- The connection-oriented TCP/IP protocol can also be used to transfer commands from the host to the device. With this connection, the data is backed up by the TCP/IP protocol itself.
- If you would like to use the TCP/IP protocol, you must also define whether the device is to operate as a TCP client or as a TCP server.

UDP

The device requires from the user the IP address and the port number of the communication partner. In the same way, the host system (PC/control) also requires the set IP address of the device and the selected port number. By assigning these parameters, a socket is formed via which the data can be sent and received.

↳ Activate the UDP protocol.

↳ Set the following values:

  ⇨ IP address of the communication partner

  ⇨ Port number of the communication partner

The corresponding adjustment options can be found in the webConfig tool:
Configuration > Control > Host > Ethernet > UDP

TCP/IP

- Activate the TCP/IP protocol.
- Set the TCP/IP mode of the device.
  - In TCP client mode, the device actively establishes the connection to the superior host system, e.g., PC/control as server. The device requires from the user the IP address of the server (host system) and the port number on which the server (host system) accepts a connection. In this case, the device determines when and with whom a connection is established.
  - In TCP server mode, the superior host system (PC/control) actively establishes the connection and the connected device waits for the connection to be set up.
    The TCP/IP stack must be informed by the user as to the local port of the device (port number) on which connection requests from a client application (host system) are to be received.
    If there is a connection request and a connection is established by the superior host system (PC/control as client), the device – in server mode – accepts the connection. Data can then be sent and received.
- With a device as TCP client, set the following values:
  - IP address of the TCP server, normally the IP address of the control or the host computer
  - Port number of the TCP server
  - Timeout for the wait time for an answer from the server
  - Repetition time for renewed communication attempt following a timeout
- With a device as TCP server, set the following values:
  - Port number for the communication of the device with the TCP clients

The corresponding adjustment options can be found in the webConfig tool:
Configuration > Control > Host > Ethernet > TCP/IP

8.4.5 FTP client

To transfer images and log files, you can configure process data output via an FTP server.

- You can set the IP address and the port number of the FTP server with which communication is to occur.
- Assign user names and password settings or define the direction of communication using the *Passive mode* option.
  - When the *Passive mode* option is activated, the FTP client sets up an outgoing connection to the server.
- Activate the FTP client.
- Select which images (OK/NOK) are transferred. You can assign each one a name.

The corresponding adjustment options can be found in the webConfig tool:
Configuration > Control > Host > FTP client

	NOTICE
	- You can set the time stamp via **Maintenance > System clock**. ⇨ The system clock is reset if the operating voltage is interrupted.

8.5 Configuration via configuration codes

You can make configuration changes with the help of printed configuration codes (see chapter 18.2 "Configuration via configuration codes").

8.6 Activating device functions

You can activate the following device functions via the control buttons on the control panel:

- *AUTO*
- *ADJ*

↳ Connect the sensor to the voltage supply.

↳ Select the desired function via the control buttons on the control panel (see chapter 3.4.2 "Function selection and program selection").

AUTO

By activating the *AUTO* function, the following sequence is started:

1. Optimum image setting: The sensor determines the optimum illumination setting for the given scenario.
2. Determine marker: Automatic determination of the marker.
3. Feedback LEDs: Optical feedback for aligning the sensor.
4. Configuration code: Read in a printed configuration code.

This process then begins from the start.
As soon as a valid configuration code is read in, the sensor exits the *AUTO* function.

NOTICE
Only activate the *AUTO* function while at a standstill! ↳ Only activate the *AUTO* function if the marker is not moving relative to the device.

NOTICE
Deactivate the *AUTO* function! ↳ You must deactivate the *AUTO* function with the enter button ↵.

ADJ

Adjustment function for aligning the sensor.

- With activation of the alignment function, the four feedback LEDs signal the alignment of the sensor to the marker.
- By pressing the enter button ↵, the position is taught-in provided the entire region of interest fits in the sensor's field of view after shifting.

NOTICE
Deactivate the *ADJ* function! ↳ You must deactivate the *ADJ* function with the enter button ↵.

9 Starting up the device – Leuze webConfig tool

The positioning sensors of the IPS 400i series can be operated and configured via the Ethernet service interface with the integrated Leuze webConfig tool.

With the webConfig tool, an operating-system independent, web-technology based, graphical user interface is available for configuring sensors.

Through the use of HTTP as communication protocol and the client-side restriction to standard technologies (HTML, JavaScript and AJAX), which are supported by all of today's popular, modern browsers, it is possible to operate the webConfig tool on any Internet-enabled PC.

NOTICE

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

9.1 System requirements

To use the webConfig tool, you need a PC or laptop with the following specifications:

Tab. 9.1: System requirements for the webConfig tool

Monitor	Min. resolution: 1280 x 800 pixels or higher
Internet browser	Recommended is a current version of: • Mozilla Firefox • Google Chrome • Microsoft Edge

NOTICE

↳ Regularly update the operating system and the Internet browser.

↳ Install the current Windows Service Packs.

9.2 Start webConfig tool

✓ Prerequisite: IP address and subnet mask for the LAN connection with the device are set correctly.

↳ Connect the operating voltage to the device.

↳ Connect the HOST interface of the device to the PC. The connection to the HOST interface of the device is made via the LAN port of the PC.

↳ Start the webConfig tool via your PC's Internet browser with IP address **192.168.60.101** or with the IP address set by you.

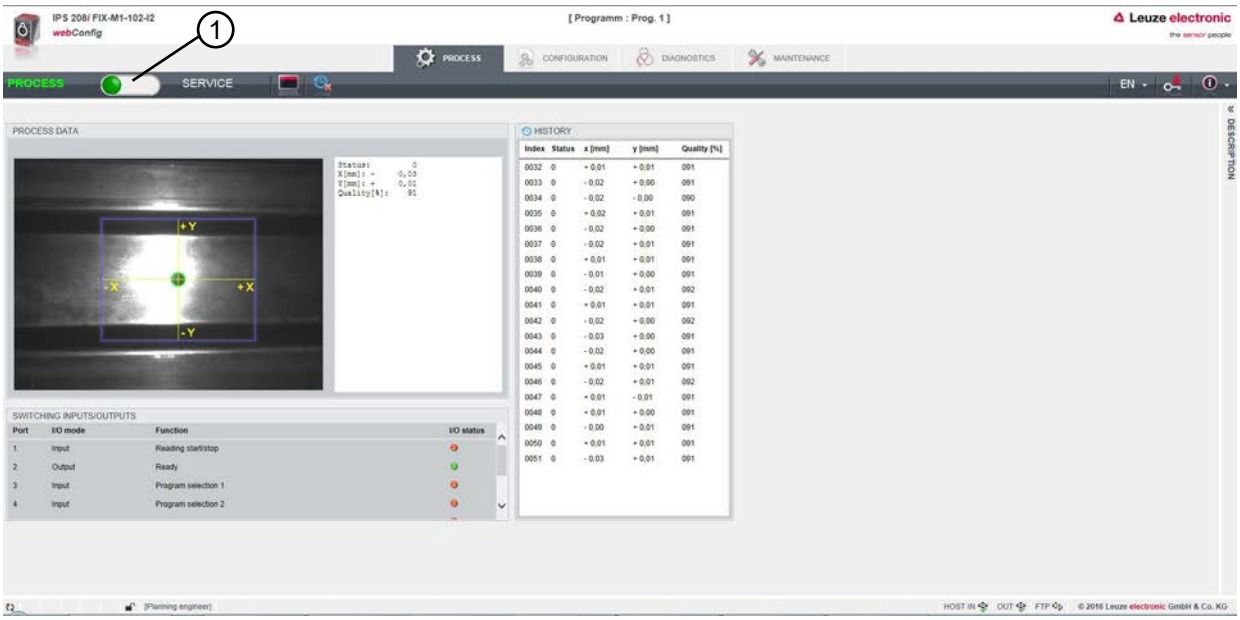
⇨ **192.168.60.101** is the standard Leuze IP address for communication with positioning sensors of the IPS 400i series.

The PC displays the webConfig start page with the current process information in the *Process* operating mode:

- Current image of the sensor
- Current results: X-value, Y-value, status, quality score
- Brief history of the last results
- States of the switching inputs/outputs

NOTICE

The process information may be displayed with a time delay depending on the current processing speed.



1 Changing the operating mode (*Process* - *Service*)

Fig. 9.1: 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 device. 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 webConfig tool.

Note limit of Firefox sessions for version 17.0 and higher

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

- Do not use the Internet browser's refresh function:
  [Shift] [F5] or [Shift] + mouse click

9.3 Short description of the webConfig tool

The menus and dialog boxes of the webConfig tool are intuitive to operate and provide texts and tool tips.

The start page of the webConfig tool displays the current process information.

9.3.1 Change operating mode

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

- *Process*

  The device is connected to the control or to the PC.
  - The process communication to the control is activated.
  - The switching inputs/outputs are activated.
  - The image currently recorded by the sensor is displayed if the function was not deactivated in the webConfig tool.
  - The configuration cannot be changed.
- *Service*
  - Process communication to the control or to the PC has been interrupted.
  - The switching inputs/outputs are deactivated.
  - The configuration can be changed.

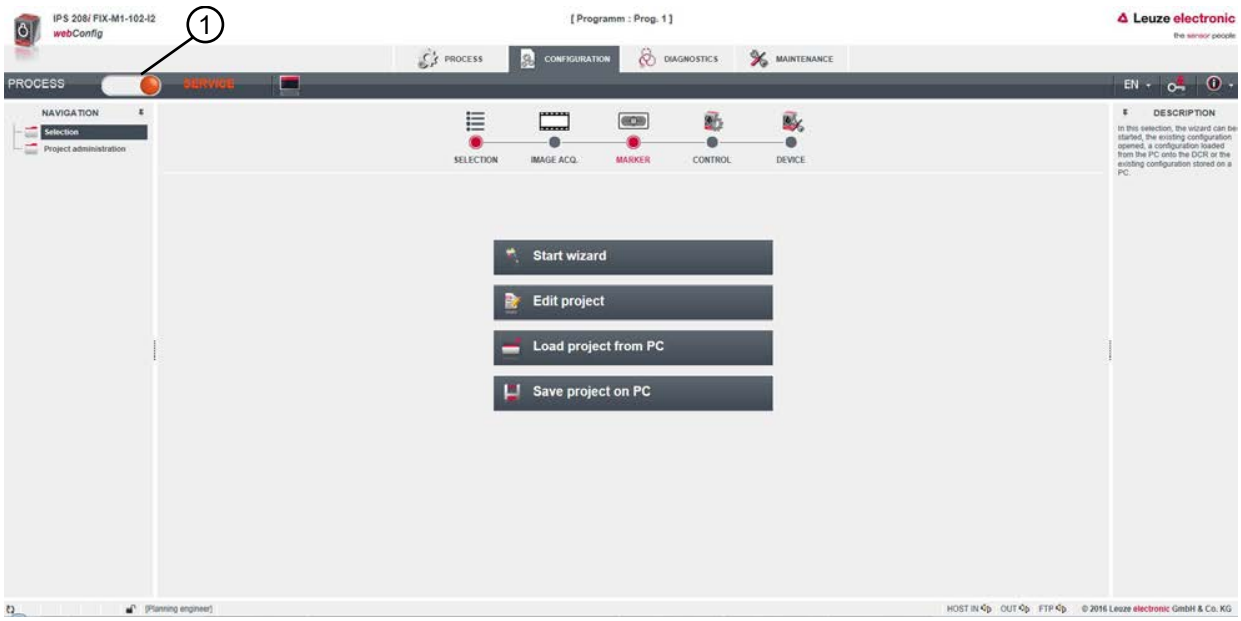
NOTICE

Configuration changes only in the *Service* operating mode!

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

Located in the upper left of all pages of the webConfig tool is a software switch for changing the operating mode (*Process* - *Service*).

After changing to the *Service* operating mode, the **CONFIGURATION** menu is displayed.



1 Changing the operating mode (*Process* - *Service*)

Fig. 9.2: **CONFIGURATION** menu of the webConfig tool

9.3.2 Menu options of the webConfig tool

The webConfig tool offers the following menu functions:

- **PROCESS**
  - Information on the current result
  - Current camera image
  - Status of the switching inputs/outputs
  - Reading statistics
- **CONFIGURATION**
  - Setting the application
  - Configuring data formatting and data output
  - Configuring the switching inputs/outputs
  - Configuring communication parameters and interfaces
  - General device settings, e.g. device names
  - Configuring operation with external illumination (see chapter 5.2.3 "Commissioning")
- **DIAGNOSIS**
  - Event logging of warnings and errors
- **MAINTENANCE**
  - Assigning user roles (user management)
  - Backup/restore the configuration file
  - Update firmware
  - Setting system time (system clock)
  - Managing user guidance

9.3.3 CONFIGURATION menu

NOTICE

Configuration changes only in the *Service* operating mode!

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

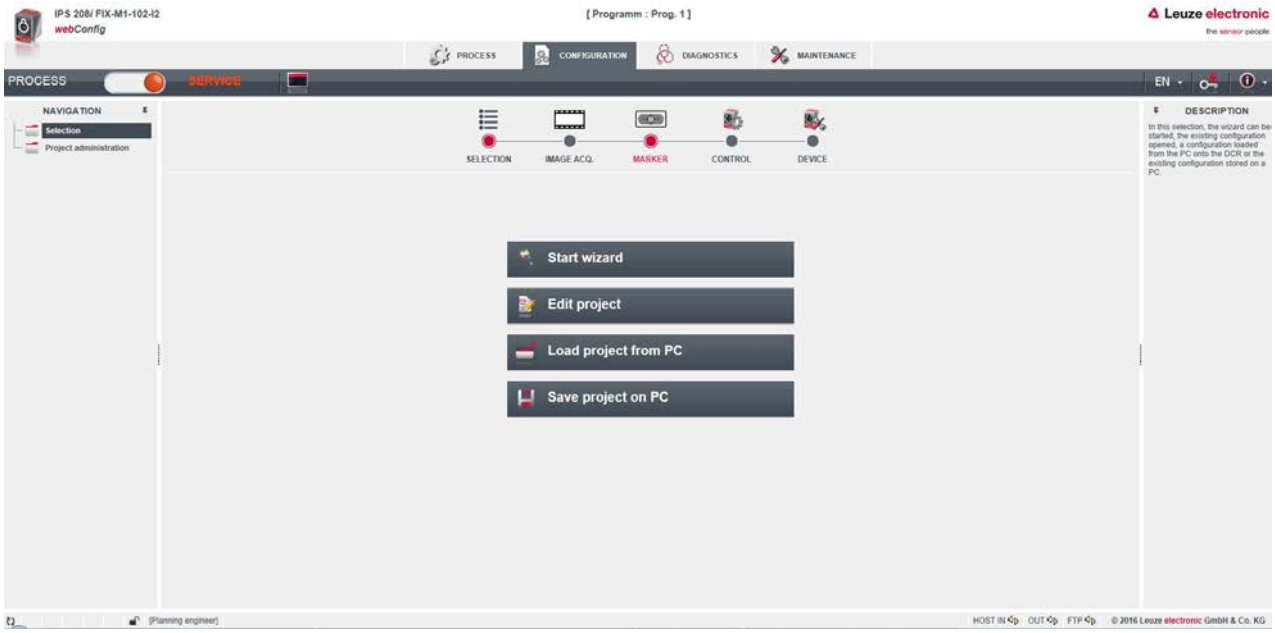


Fig. 9.3: **CONFIGURATION** menu

↳ Select the application that you would like to configure.

- [Start wizard]: Quick configuration in just a few steps
- [Edit project]: Configuration via the full view of the webConfig tool
- [Load project from PC]: Configuration via an existing configuration project
- [Save project on PC]: Save configuration project

9.3.4 Configuring applications with the wizard

With the configuration wizard, you can set up your application in just a few steps.

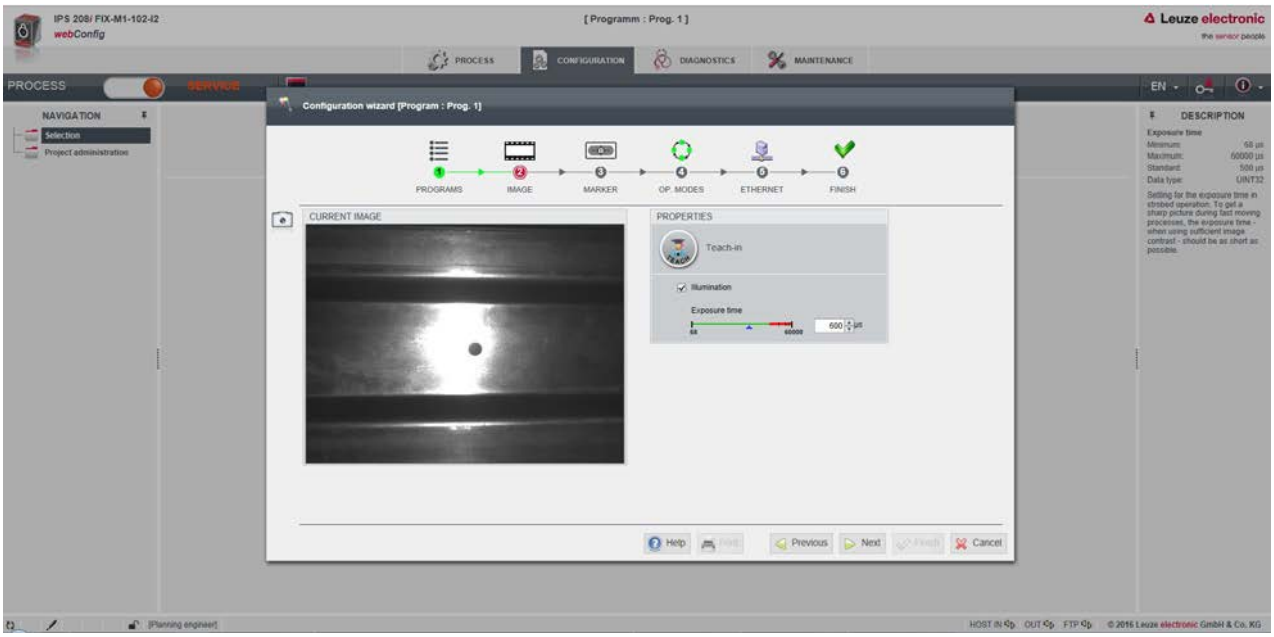


Fig. 9.4: Configuration wizard

↳ Select **CONFIGURATION >** [Start Wizard].

↳ Make the settings using the configuration steps presented by the wizard.

	NOTICE
	The settings are not saved until the final configuration step (FINISH) is performed.

9.4 Configuring compartment fine positioning

For faster commissioning, you can set the most important parameters for the programs (PROGRAM 1 … 8) using the configuration wizard. Alternatively, you can perform the configuration settings for compartment fine positioning manually or via configuration codes.

9.4.1 Selecting the program

A total of eight programs are available; these can be configured individually.

↳ Select **CONFIGURATION > PROGRAM ADMINISTRATION**.

⇨ The *Program overview* dialog is displayed.

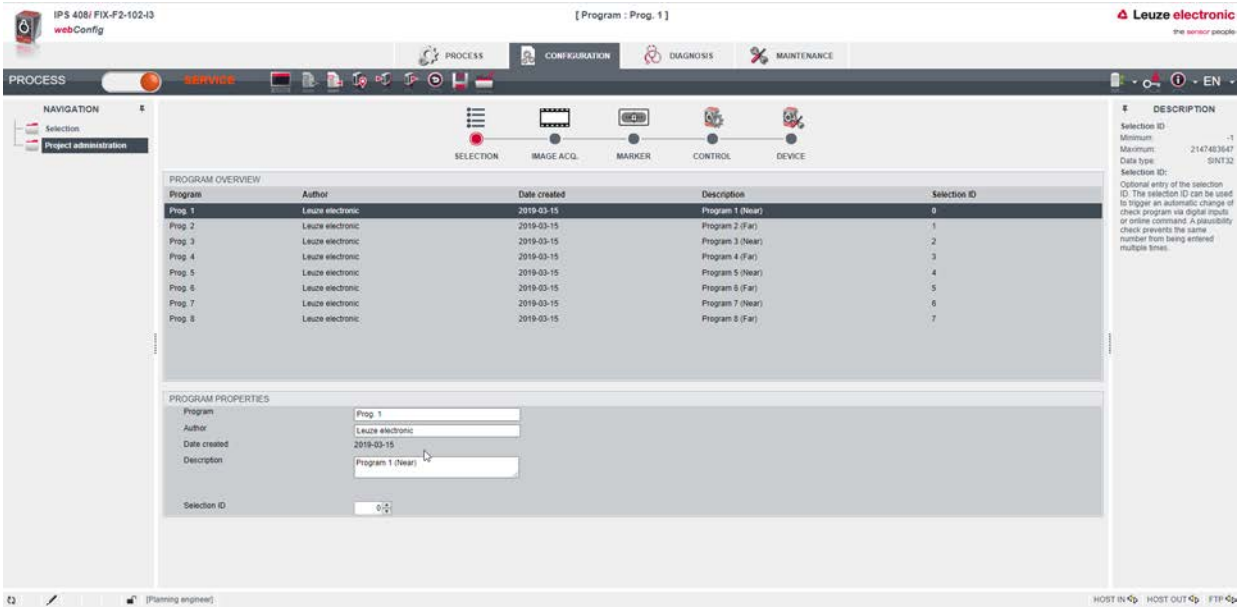


Fig. 9.5: *Program overview* dialog

↳ Select the program that you want to activate.

Tab. 9.2: Overview of the digital inputs for programs

Digital input SWI4	Digital input SWI3	Selection ID
0	0	0
0	1	1
1	0	2
1	1	3

NOTICE
Only four programs or the first four selection IDs can be selected via the digital inputs.

NOTICE
Selection ID assignment - Selection ID "0" must be assigned once. - Only selection IDs "0 – 14" are to be used.

9.4.2 Configuring image acquisition

↳ Select **CONFIGURATION > PROGRAM ADMINISTRATION**.

↳ Select the active program.

↳ Select **CONFIGURATION > Image acquisition**.

⇨ The *Image acquisition* dialog is displayed.

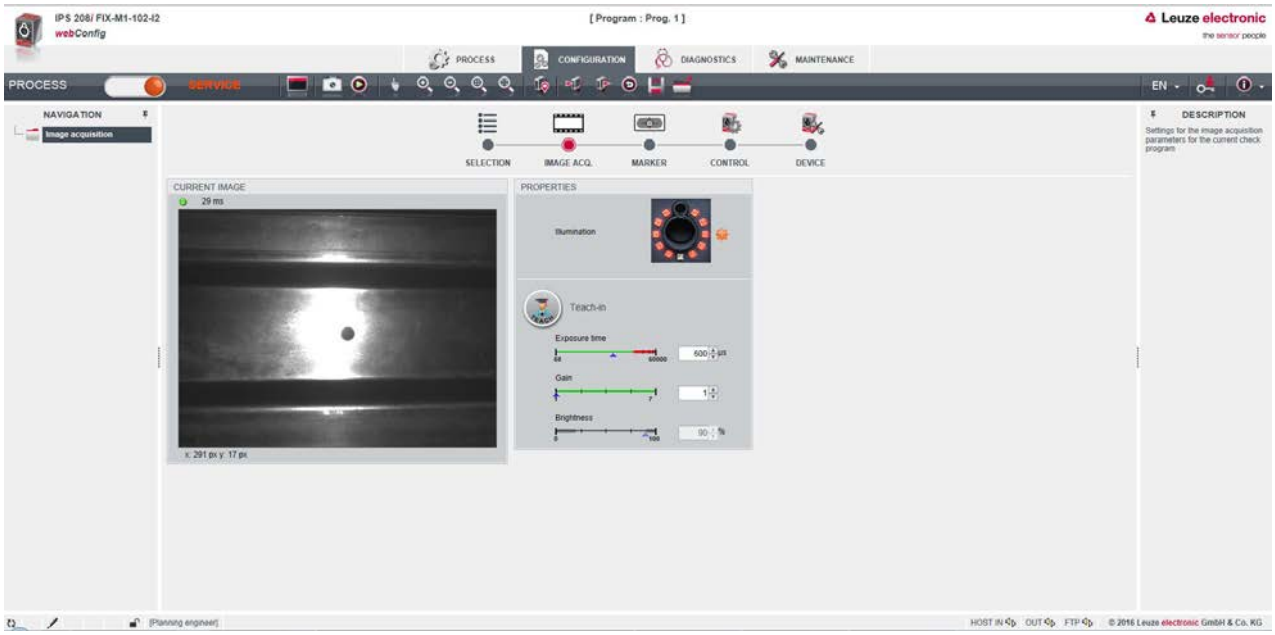


Fig. 9.6: Image acquisition

9.4.3 Configuring markers

Configuration of the current marker in the application.

↳ Select **CONFIGURATION > PROGRAM ADMINISTRATION**.

↳ Select the active program.

↳ Select **CONFIGURATION > Marker**.

⇨ The *Marker* dialog is displayed.

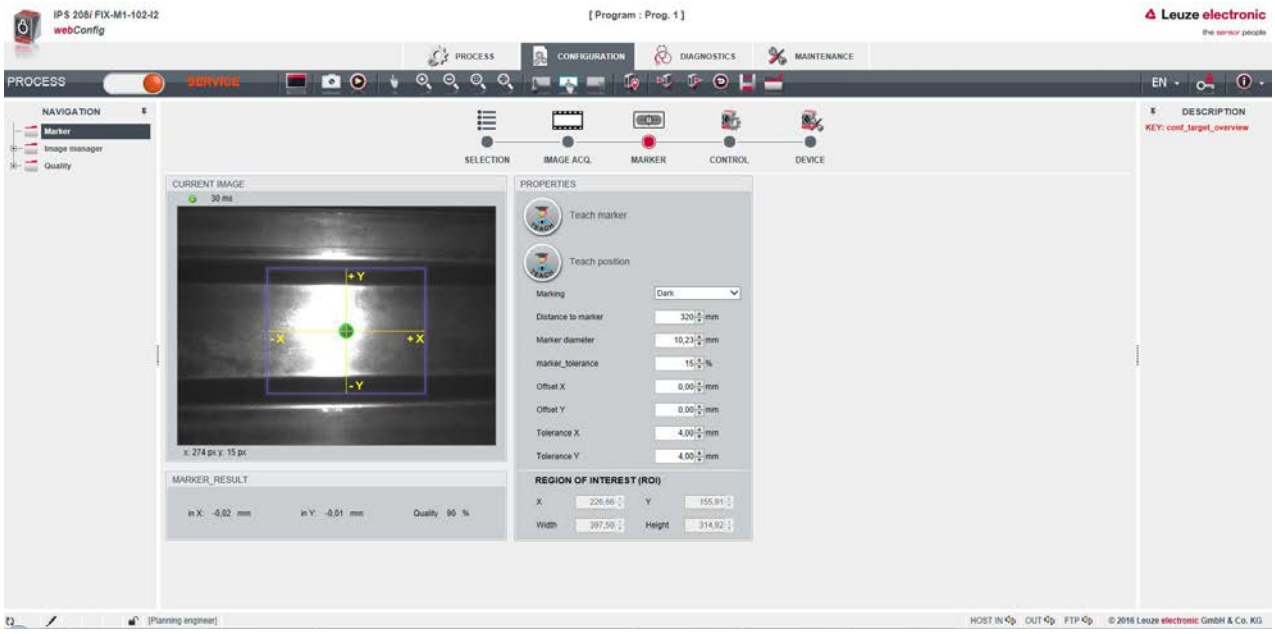


Fig. 9.7: Configuring markers

NOTICE

Set the working distance!

- Set the actual working distance of the sensor before you press the [Teach marker] button.
- The marker (center point) must be located within the sensor's region of interest (blue frame).

9.4.4 Assigning measurement values to digital switching outputs

Program-specific assignment of measurement values to the programmable digital switching outputs.

- Select the active program.
- Select **CONFIGURATION > CONTROL > Digital IOs**.
  - The *Digital IOs* dialog is displayed.

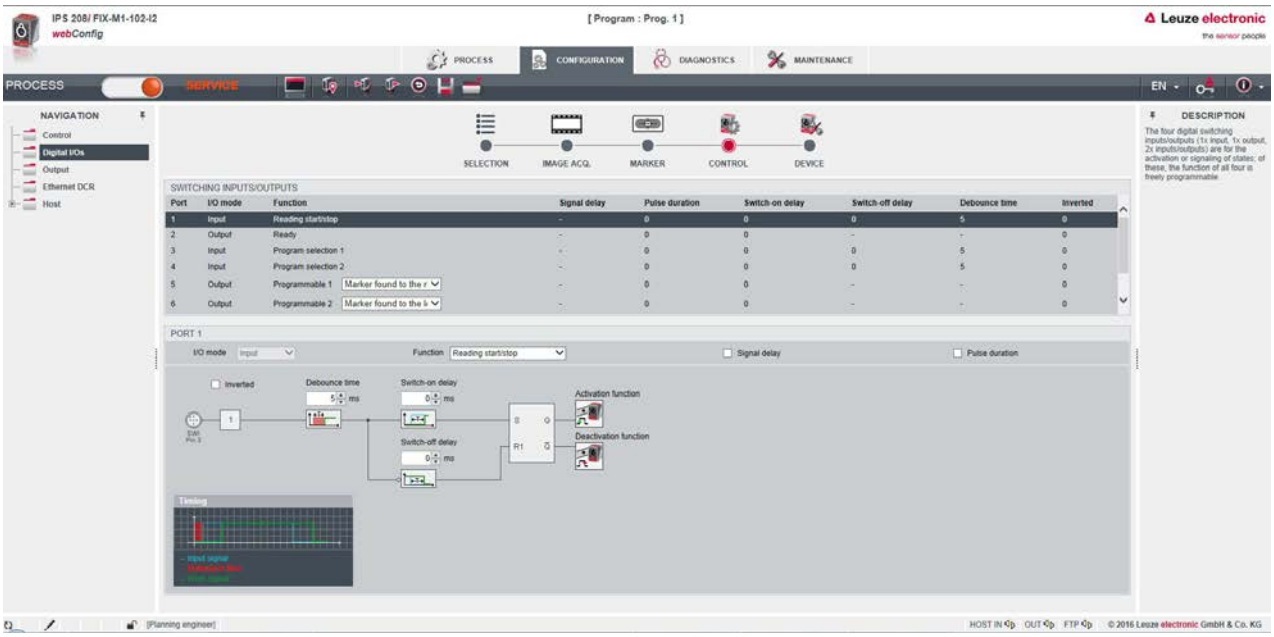
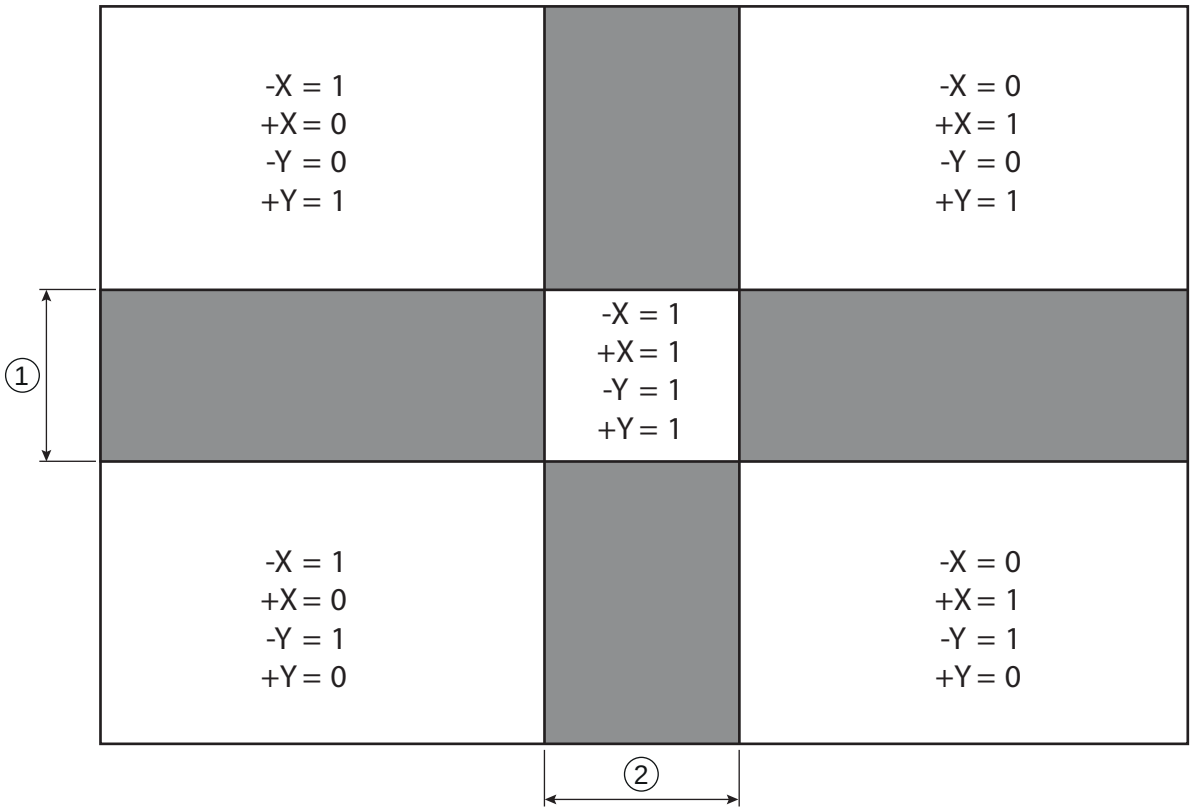


Fig. 9.8: Digital IOs

- The sensor makes the -X, +X, -Y, +Y digital switching outputs available.
- The nominal position is located within a rectangular tolerance range.
- The switching outputs are switched depending on the X deviations and Y deviations.



1 Tolerance range Y
2 Tolerance range X

Fig. 9.9: Viewing direction: Towards the marker

9.4.5 Outputting measurement values via Ethernet

Configuration of the measurement value output via the Ethernet interface.

The output of measurement values can be individually configured.

↳ Select the active program.

↳ Select **CONFIGURATION > CONTROL > Output**.

⇨ The *Output* dialog is displayed.

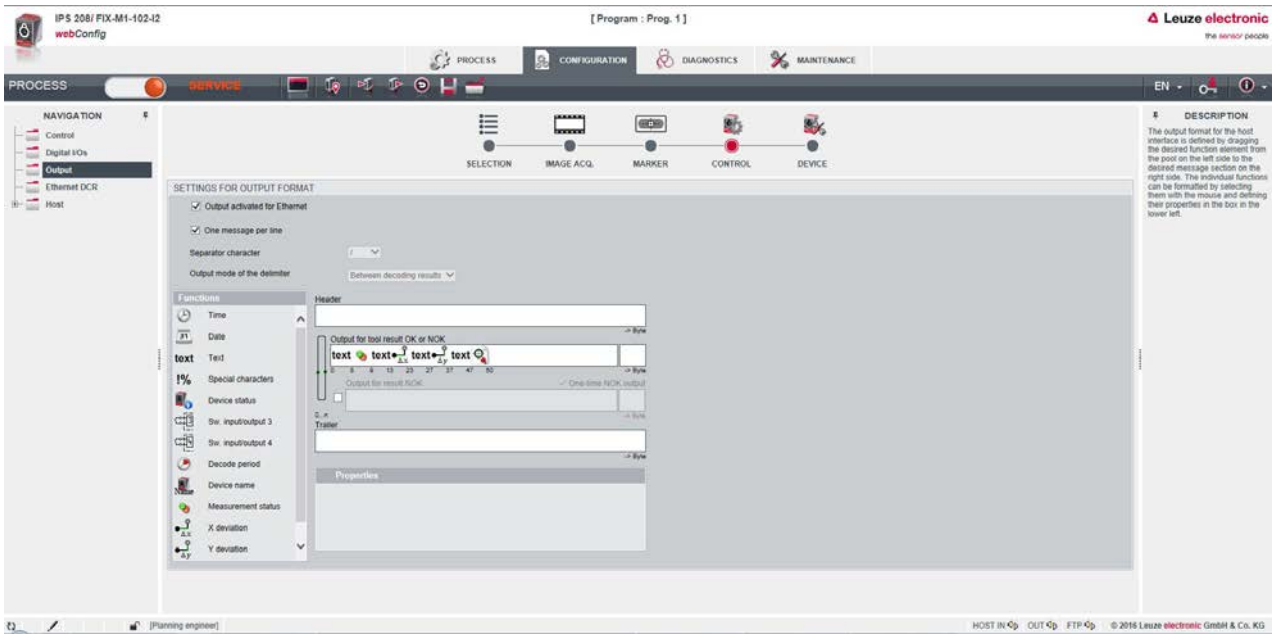


Fig. 9.10: Measurement value output

10 EtherNet/IP

10.1 Overview

The IPS 458i positioning sensor is a field device that communicates cyclically with the assigned EtherNet/IP controller.

The device can be operated as a single device (stand-alone) with individual IP address in an EtherNet/IP star or tree topology.

Commissioning on the EtherNet/IP is performed according to the following scheme:

1. Address assignment
   automatically via DHCP or manually using the webConfig tool
2. Configuration of the participant depending on the version of the control software
   either with the help of the Generic Ethernet Module or installation of the EDS file
3. Transferring the data to the control
4. Adapting the device parameters via the webConfig tool
5. Using explicit messaging services

Performance characteristics

The device has the following performance characteristics:

- An EDS file is available for the device description.
- Standard Fast Ethernet (100 Mbit/s), connection (M12 technology)
- Cyclical/acyclic data exchange
- 4-pin, M12 connectors with D-coding are used for the electrical connection.
- Transport class:
  1 Implicit (Cyclic real-time communication, Producer/Consumer) and
  3 Explicit (Acyclic non-real-time communication, Client/Server)

Communication

The IPS 458i can be configured in the planning tool/control using the EDS file (Electronic Data Sheet) if the control supports this.

The PLC software, e.g., Studio 5000 from Rockwell, offers EDS support for EtherNet/IP.

Without PLC support of the EDS integration, the settings are made via the Generic Ethernet Module. In this case, the respective configuration must be entered and adapted manually for each device. The parameter download from the control to the sensor is performed during every establishment of connection.

The EDS file does not support any configuration of the device functionality. Configuration is performed via other mechanisms, e.g., the webConfig tool or online/XML commands (see chapter 9 "Starting up the device – Leuze webConfig tool"; see chapter 11 "Interfaces – Communication").

Each device has a unique MAC address (Media Access Control). The MAC address (MAC-ID) is linked to an IP address during the course of configuration. The MAC address can be found on the name plate and on an easily removable "Address Link Label" (MAC address) that is also attached to the device.

On delivery, the automatic address assignment via DHCP server is defined as the standard setting of the sensor. If no automatic address assignment occurs, the network address is set as follows:

- IP address: 0.0.0.0

10.2 Manually setting the IP address

There are two ways to set the IP address manually:

- Via BOOTP/DHCP server tool
- Via the webConfig tool with the help of the Ethernet connection
  To do this, deactivate DHCP operation in the sensor.

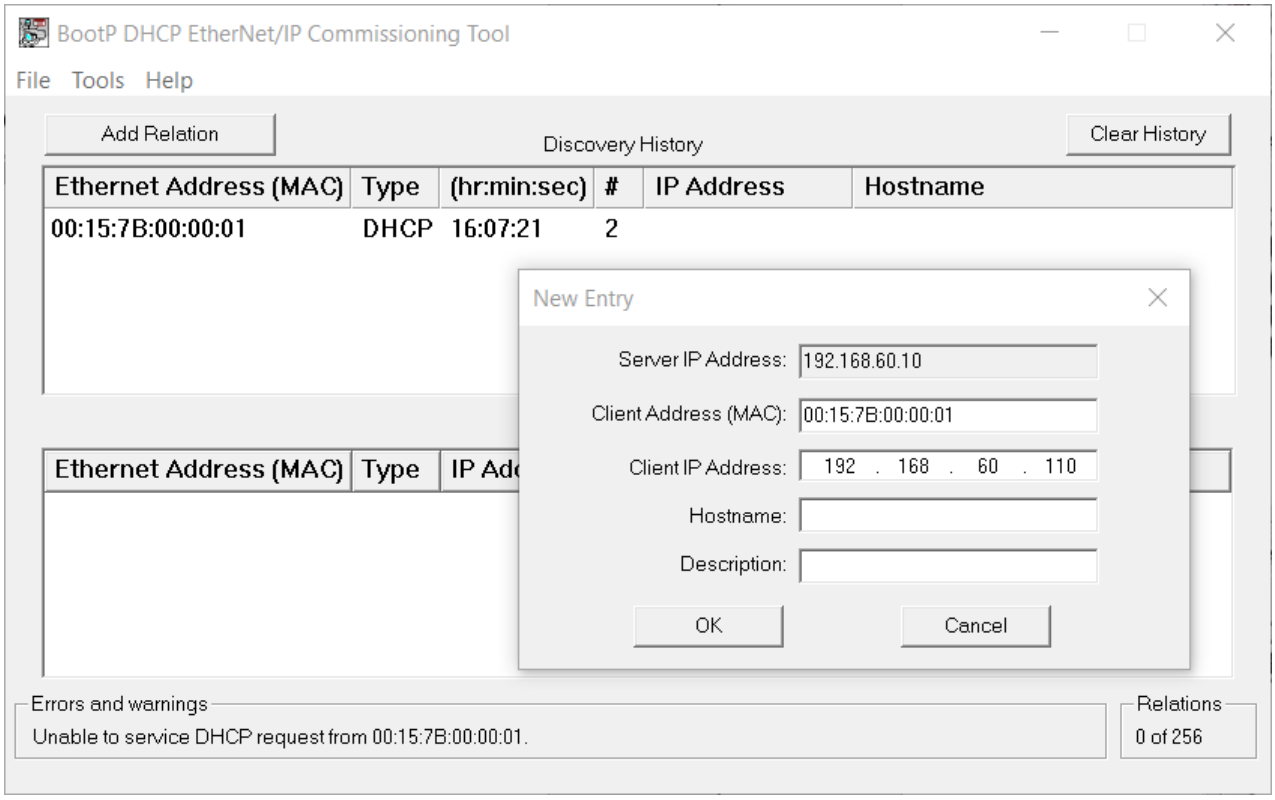


Fig. 10.1: Manually setting the IP address

If no DHCP server is present in your system, you must permanently set the IP addresses of the sensor. Proceed as follows:

- Have the network administrator specify the data for IP address, net mask and gateway address of the sensor.
- Connect the sensor to your computer via the Ethernet cable.
- Set the values for IP address, net mask and gateway address on the sensor:
  In the webConfig tool: Configuration menu > Control > Host > Ethernet interface
- Deactivate DHCP operation and enter the IP address.

	NOTICE
	If the IP address is set via the webConfig tool, it is active immediately after transfer to the device. A restart is not required.

10.3 Configuration for a Rockwell control without EDS support

Integrating the hardware into the PLC using the Generic Ethernet Module

In the configuration tool, e.g., Studio 5000, a so-called Generic Ethernet Module is created under the Communication path for the sensor.

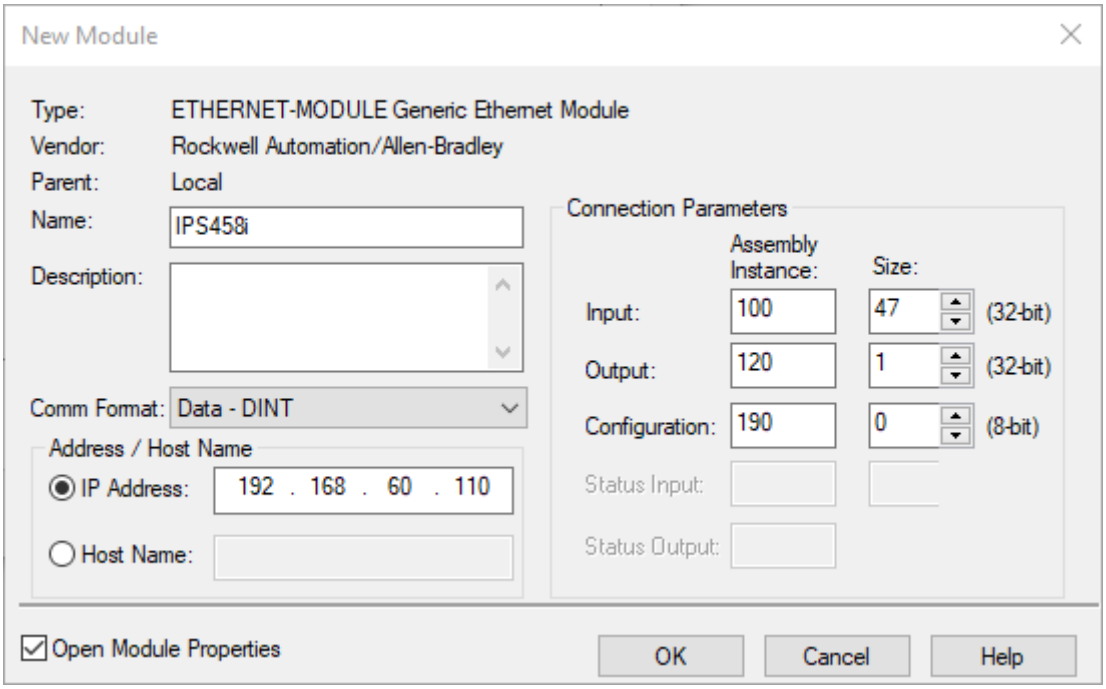


Fig. 10.2: Generic Ethernet Module dialog

↳ Set the following parameters in the input mask:

Tab. 10.1: Adjustment parameters for the Generic Ethernet module

Parameter	Description	Value/value range
Name	Name of the participant	Freely selectable; e.g., IPS 458i
Comm Format	Format of the I/O data	Data - SINT = 8 bits
IP Address	IP address of the participant	e.g., 192.168.60.101
Connection parameters		
Input Assembly Instance	Address of the input assembly	• Instance 100 • Instance 101 • Instance 102 • Instance 103
Input Size	Length of the input assembly	Min 1 byte - up to max. 270 bytes for the default input assembly of the read results
Output Assembly Instance	Address of the output assembly	• Instance 120 • Instance 121
Output Size	Length of the output assembly	Min 1 byte - up to max. 266 bytes for the default output assembly
Configuration Assembly Instance	Address of the configuration assembly	Instance 190
Configuration Size	Length of the configuration assembly	4 bytes

10.4 Configuration for a Rockwell control with EDS support

The following steps are necessary for commissioning with a Rockwell control:

- Install the EDS file via the EDS wizard.
- Create the EtherNet/IP participants in the PLC software, e.g., Studio 5000.
- Set the parameters of the sensor via the configuration assembly or the webConfig tool.

Integrating the hardware in the PLC and installing the EDS file

To integrate the sensor and to establish a connection between the PLC and the sensor, proceed as follows:

- Download the EDS file from the Leuze website **www.leuze.com** under the corresponding product on the *Downloads* tab.
- Load the EDS file for the device via EDS wizard into the PLC database.
- Select the device from the device list.
- Open the input dialog for setting the address and additional parameters by double-clicking on the device symbol and make the desired entries.
- Click on the [Change] button to define the combination of input and output assemblies.

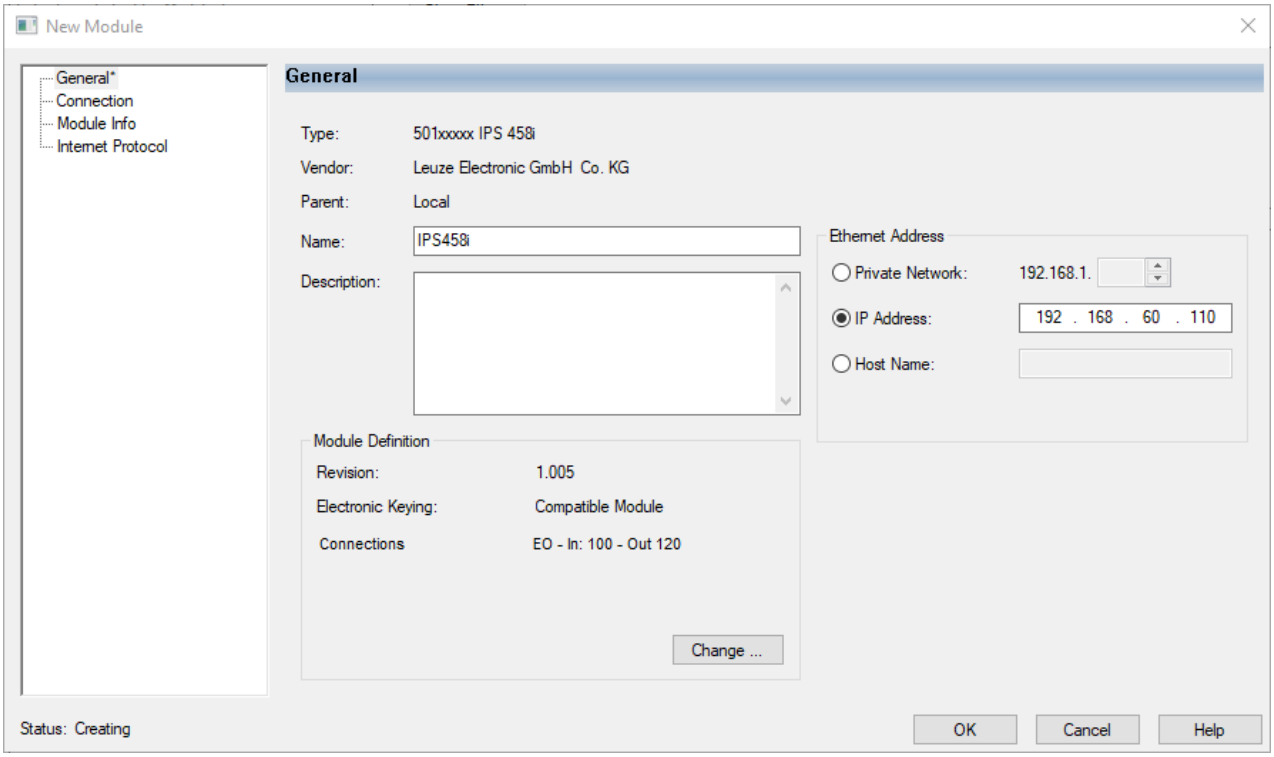


Fig. 10.3: New Module dialog

- Transfer the values to the control via download.

10.5 EDS file

The EDS file contains all identification and communication parameters of the device, as well as the available objects. The PLC software, e.g., Studio 5000 from Rockwell, offers EDS support for EtherNet/IP.

The sensor is uniquely classified via a class 1 identity object (component of the IPS458i.eds file) for the EtherNet/IP sensor.

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. If accepting the objects without change, all parameters are set to default values. The default settings are listed in the descriptions of the EDS object classes in the Default column.

NOTICE
The EDS object classes are described with their primary attributes in the following tables. Access permissions: **Get**: only read access is allowed. **Set**: read access and the setting of the attribute are allowed.

10.6 EDS object classes

10.6.1 Class 1 – Identity object

Object Class 1 = 0x01

Services:

- Get Attribute Single 0x0E
- Reset type 0x05

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
1	1	1	Vendor ID	16	UINT	524	-	-	Get
		2	Device type	16	UINT	43	-	-	Get
		3	Product Code	16	UINT	20	-	-	Get
		4	Revision (Major, Minor)	16	Struct {USINT major, USINT minor}	Major=1, Minor=1	Major=1, Minor=1	Major=127, Minor=999	Get
		5	Status	16	WORD	See CIP specification (5-2.2.1.5 status)			Get
		6	Serial number	32	UDINT	Manufacturer specific			Get
		7	Product Name	(max. 32) x 8	SHORT_STRING	"IPS 458i"			Get

In the network configuration (e.g., Studio 5000, Generic Module), it is possible to specify when entering the individual participants which attributes of the scanner are to be monitored from the identity object.

Vendor ID

The Vendor ID assigned by ODVA for Leuze electronic GmbH + Co. KG is 524D.

Device type

The IPS 458i is defined as a generic device (keyable) by Leuze. According to ODVA, the IPS 458i is assigned number 43D = 0x2B.

Product Code

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

Revision

Version number of the identity object.

Status

The device status is displayed in the status byte, the first part of the telegram.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Ext. device state				Reserved	Configured	Reserved	Owned
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8
Reserved							

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, as before, unique, but no longer corresponds to the serial number on the name plate.

Product Name

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

10.6.2 Class 4 – Assembly

The following assemblies are supported by the profile. A distinction is made between input and output assembly. The input assembly groups the data from the sensor for the control. The data from the control is transmitted to the sensor via the output assembly.

Input assembly

The input assembly is the cyclical data from the sensor to the control.

The following input assemblies are supported.

Input assembly instance 100

Instance 100, attribute 3

Input assembly, length: min. 1 byte … max. 262 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100	0	Device status							
	1	Number of results							
	2	Reserved		Waiting for acknowledgment	New result (toggle bit)	Buffer overflow	Further results in the buffer	User data or command	Status activation
	3	Device application status (low byte)							
	4	Device application status (high byte)							
	5	Result data length (low byte)							
	6	Result data length (high byte)							
	7	Data Byte 0							
	8	Data Byte 1							
	…	Data Byte xy							
	261	Data Byte 254							

The number of data starting at byte 7 is defined in the control while configuring the sensor. This makes it possible to use the assembly with any length.

NOTICE

An example for using the assembly: see chapter 10.6.10 "Example configuration"

Input assembly instance 101

Instance 101, attribute 3

Input assembly, length: min. 1 byte … max. 266 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
101	0	Device status							
	1	Reserved	Error code			Reserved		Data rejection (toggle bit)	Data acceptance (toggle bit)
	2	Fragment number							
	3	Remaining fragments							
	4	Fragment size							
	5	Number of results							
	6	Reserved		Waiting for acknowledgment	New result (toggle bit)	Buffer overflow	Further results in the buffer	User data or command	Status activation
	7	Device application status (low byte)							
	8	Device application status (high byte)							
	9	Result data length (low byte)							
	10	Result data length (high byte)							
	11	Data Byte 0							
	12	Data Byte 1							
	…	Data Byte xy							
	265	Data Byte 254							

The number of data starting at byte 11 is defined in the control while configuring the sensor. This makes it possible to use the assembly with any length.

Input assembly instance 102

Instance 102, attribute 3

Input assembly, length: min. 1 byte … max. 270 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
102	0	Device status							
	1	Reserved	Switching output, comparison state 2 (toggle bit)	Switching output, comparison state 2	Status input/output I/O 2	Reserved			Status input/output I/O 1
	2	Reserved			Status input/output I/O 4	Reserved			Status input/output I/O 3
	3	Reserved	Switching output, comparison state 6 (toggle bit)	Switching output, comparison state 6	Status input/output I/O 6	Reserved	Switching output, comparison state 5 (toggle bit)	Switching output, comparison state 5	Status input/output I/O 5
	4	Reserved	Switching output, comparison state 8 (toggle bit)	Switching output, comparison state 8	Status input/output I/O 8	Reserved	Switching output, comparison state 7 (toggle bit)	Switching output, comparison state 7	Status input/output I/O 7
	5	Reserved	Error code			Reserved		Data rejection (toggle bit)	Data acceptance (toggle bit)
	6	Fragment number							
	7	Remaining fragments							
	8	Fragment size							
	9	Number of results							
	10	Reserved		Waiting for acknowledgment	New result (toggle bit)	Buffer overflow	Further results in the buffer	User data or command	Status activation
	11	Device application status (low byte)							
	12	Device application status (high byte)							
	13	Result data length (low byte)							
	14	Result data length (high byte)							
	15	Data Byte 0							
	16	Data Byte 1							
	…	Data Byte xy							
	269	Data Byte 254							

The number of data starting at byte 15 is defined in the control while configuring the sensor. This makes it possible to use the assembly with any length.

Input assembly instance 103

Instance 103, attribute 3

Input assembly, length: min. 1 byte … max. 11 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
103	0	Device status							
	1	Device application status (low byte)							
	2	Device application status (high byte)							
	3	X position deviation (high byte)							
	4	X position deviation							
	5	X position deviation							
	6	X position deviation (low byte)							
	7	Y position deviation (high byte)							
	8	Y position deviation							
	9	Y position deviation							
	10	Y position deviation (low byte)							

NOTICE

Data format:
- 4 bytes for X-position deviation and 4 bytes for Y-position deviation
- Data type: Measurement value as signed integer value
- Byte sequence: big endian
- Unit: mm/100

Output assembly

The output assembly is the cyclical data from the control to the sensor. The following output assemblies are supported.

Output assembly instance 120

Instance 120, attribute 3

Output assembly, length: min. 1 byte … max. 266 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
120	0	Reserved			Standby	Error acknowledge	Data reset	Data acknowledgment	Activation signal
	1	Reserved				Reset Event Counter 2	Activation switching output 2 *)	Reserved	
	2	Reset Event Counter 8	Activation switching output 8 *)	Reset Event Counter 7	Activation switching output 7 *)	Reset Event Counter 6	Activation switching output 6 *)	Reset Event Counter 5	Activation switching output 5 *)
	3	Fragment number							
	4	Remaining fragments							
	5	Fragment size							
	6	Reserved						New entry (toggle bit)	Reserved
	7	Device application control (low byte)							
	8	Device application control (high byte)							
	9	Result data length (low byte)							
	10	Result data length (high byte)							
	11	Data Byte 0							
	12	Data Byte 1							
	…	Data Byte xy							
	265	Data Byte 254							

*) To be able to use the *Activation switching output* function, the output function must be set to External event in the webConfig tool.

The number of data starting at byte 11 is defined in the control while configuring the sensor. This makes it possible to use the assembly with any length.

It is also possible to specify the length of the assembly with one byte and only use the control bits. With a length of 2 bytes, the I/O monitoring control bits can be used in addition to the control bits.

NOTICE	
	An example for using the assembly: see chapter 10.6.10 "Example configuration"

Output assembly instance 121

Instance 121, attribute 3

Output assembly, length: min. 1 byte … max. 264 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
121	0	Reserved			Standby	Error acknowledge	Data reset	Data acknowledgment	Activation signal
	1	Fragment number							
	2	Remaining fragments							
	3	Fragment size							
	4	Reserved						New entry (toggle bit)	Reserved
	5	Device application control (low byte)							
	6	Device application control (high byte)							
	7	Result data length (low byte)							
	8	Result data length (high byte)							
	9	Data Byte 0							
	10	Data Byte 1							
	…	Data Byte xy							
	263	Data Byte 254							

The number of data starting at byte 9 is defined in the control while configuring the sensor. This makes it possible to use the assembly with any length.

It is also possible to specify the length of the assembly with one byte and only use the control bits.

NOTICE

Formula for calculating the assembly length:

Length of the assembly = 9 + length of the entry data

For entry data with length 10, the assembly must be configured with a length of 9 + 10 = 19.

Configuration assembly

The configuration assembly is the data from the control to the sensor which is transferred as the configuration during the establishment of communication. The following configuration assembly is supported.

Configuration assembly instance 190

Instance 190, attribute 3

Configuration assembly, length: 4 bytes

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
190	0	Reserved							
	1	Reserved							Activate result fragmentation 0 = Fragmentation inactive 1 = Fragmentation active
	2	Reserved							Activate input fragmentation 0 = Fragmentation inactive 1 = Fragmentation active
	3	Reserved							

Byte	Cross reference address	Function	Bit assignment (default)								Default (hex)
			7	6	5	4	3	2	1	0	
0	-	Reserved	-	-	-	-	-	-	-	-	00
1	107 / 1 / 9	Activate result fragmentation	-	-	-	-	-	-	-	0	00
2	108 / 1 / 8	Activate input fragmentation	-	-	-	-	-	-	-	0	00
3	-	Reserved	-	-	-	-	-	-	-	-	00

NOTICE

In the configuration assembly, all parameters have the value 0. Changing the individual default values is possible at any time. The participant is defined in off-line mode; the data must subsequently be transferred to the control.

10.6.3 Class 103 – I/O status and control

This class is for handling switching input and switching output signals.

Object class 103 = 0x67

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Path			Designation	Size in bits	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
103	1	1-4	Reserved						
SWIO 1		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get
103	2	1-4	Reserved						
SWIO 2		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get
103	3	1-4	Reserved						
SWIO 3		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get
103	4	1-4	Reserved						
SWIO 4		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get

Path			Designation	Size in bits	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
103	5	1-4	Reserved						
SWIO 5		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get
103	6	1-4	Reserved						
SWIO 6		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get
103	7	1-4	Reserved						
SWIO 7		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get
103	8	1-4	Reserved						
SWIO 8		5	Status (input/output)	8	U8	0	0	1	Get
		6	Output activation	8	U8	0	0	1	Set
		7	Reset Event Counter	8	U8	0	0	1	Set
		8	Switching output comparison state (event counter)	8	U8	0	0	1	Get
		9	Switching output comparison state toggle bit (event counter)	8	U8	0	0	1	Get

NOTICE

Toggle bits are control and monitoring control flags which are not level-sensitive, but rather triggered by edges.

Attributes 1-4

Attributes 1-4 are not supported in this profile.

Status (input/output)

Signal state of the switching input or switching output.

Output activation

Sets the state of the switching output:

0: Switching output 0, low, inactive

1: Switching output 1, high, active

Reset Event Counter

Resets the event counter of the activation function back to zero:

0 > 1: Perform reset

1 > 0: No function

Switching output comparison state (event counter)

Indicates whether the event counter has exceeded the set comparative value. The bit is reset to the initial value by resetting the event counter.

0: Not exceeded

1: Exceeded

Switching output comparison state toggle bit (event counter)

If *SWOUT switches several times* was configured as comparison mode, this bit is toggled each time the event counter is exceeded. The bit is reset to the initial value by resetting the event counter.

0 > 1: Event counter exceeded

1 > 0: Event counter exceeded again

	NOTICE
	The comparative value of the event counter must be configured using an XML command.

10.6.4 Class 106 – Activation

This class defines the control signals for activating the sensor as well as the signals for the control of the result output. It is possible to select between standard data output operation and handshake operation.

In handshake operation, the control must acknowledge the data reception via the ACK bit before the new data is written into the input area. After acknowledging the last result, the input data is reset (filled with zeros).

Object class 106 = 0x6A

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
106	1	1	Mode *)	8	U8	1	1	1	Set
		2	Number of results	8	U8	0	0	255	Get
		3	Activation signal	8	U8	0	0	1	Set
		4	Data acknowledgment	8	U8	0	0	1	Set
		5	Data reset	8	U8	0	0	1	Set

*) The *Mode* attribute is a parameter. The value of the parameter can be set via the configuration assembly.

Mode

The parameter defines the mode in which the communication is operated:

1: With ACK

Number of results

This value specifies how many messages are ready to be picked up in the sensor buffer.

Activation signal

Signal for activating the sensor. This action starts image acquisition with the sensor. This attribute is edge-triggered, not level-controlled.

0 > 1: Activation (e.g., open reading gate)

1 > 0: Deactivation (e.g., close reading gate)

Data acknowledgment

This control bit signals that the transmitted data have been processed by the master. Only relevant with handshake mode (with ACK), see Mode.

0 > 1: Data has been processed by the master

1 > 0: Data has been processed by the master

Data reset

Deletes results that may have been stored and resets the input data.

0 > 1: Data reset

If the data reset control bit is activated, the following actions are carried out:

1. Deletion of results that may still be stored
2. Resetting of the attributes of Class 107 – Result data

10.6.5 Class 107 – Result data

NOTICE
The result is the data from the sensor to the control.

This class defines the transfer of the result data. The result data comes from the Formatter currently selected. This can be selected and configured in the webConfig tool. This class also defines the output of fragmented results. To occupy few I/O data, the results may be split into several fragments with this class. The fragments can then be transmitted one after another with a handshake.

Object class 107 = 0x6B

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
107	1	1	Activation status	8	U8	0	0	1	Get
		2	User data or command	8	U8	0	0	1	Get
		3	Further results in the buffer	8	U8	0	0	1	Get
		4	Buffer overflow	8	U8	0	0	1	Get
		5	New results (toggle bit)	8	U8	0	0	1	Get
		6	Waiting for acknowledgment	8	U8	0	0	1	Get
		7	Result data length	16	U16	0	0	65535	Get
		8	Data	2040	U8 [255]	0	0	255	Get
		9	Activate result fragmentation *)	8	U8	0	0	1	Set
		10	Fragment number	8	U8	0	0	255	Get
		11	Remaining fragments	8	U8	0	0	255	Get
		12	Fragment size	8	U8	32	0	255	Get

*) The *Activate result fragmentation* attribute is a parameter. The value of the parameter can be set via the configuration assembly.

Activation status

Displays the current activation status:

0: Deactivated

1: Activated

User data or command

Distinction between result from the Formatter and answer from the command interpreter. Makes the distinction easy for the user:

0: User data

1: Response from command interpreter

Further results in the buffer

This signal indicates whether further results are in the buffer:

0: No

1: Yes

Buffer overflow

This signal indicates that all result buffers are occupied and that the sensor rejects data:

0: No

1: Yes

New result (toggle bit)

The toggle bit indicates whether a new result is present:

0 > 1: New result

1 > 0: New result

Waiting for acknowledgment

This signal represents the internal state of the control:

0: Base state

1: Control waiting for acknowledgment from the master

Result data length

Data length of the actual result information. If the result information fits in the selected assembly length, this value reflects the length of the transmitted data. A value larger than the assembly length indicates a loss of information caused by an assembly length which has been selected too small.

Data

Result information with a length of max. 255 bytes.

Activate result fragmentation

This attribute specifies whether the messages from the sensor to the control should be transferred in fragments:

0: Fragmentation inactive

1: Fragmentation active

Fragment number

Current fragment number

Remaining fragments

Number of fragments which still have to be read for a complete result.

Fragment size

The fragment size corresponds to the projected fragment length, except for the last fragment.

10.6.6 Class 108 – Entry data

NOTICE	
	The entry data are the data from the control to the sensor.

This class defines the transfer of entry data to a command interpreter in the sensor. This class also defines the transfer of fragmented entry data. To occupy few I/O data, the entry data may be split into several fragments with this class. The fragments can then be transmitted one after another with a handshake.

Object class 108 = 0x6C

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
108	1	1	Data acceptance (toggle bit)	8	U8	0	0	1	Get
		2	Data rejection (toggle bit)	8	U8	0	0	1	Get
		3	Error code	8	U8	0	0	8	Get
		4	Reserved						
		5	New entry (toggle bit)	8	U8	0	0	1	Set
		6	Entry data length	16	U16	0	0	65535	Set
		7	Data	2040	U8 [255]	0	0	255	Set
		8	Activate input fragmentation *)	8	U8	0	0	1	Set
		9	Fragment number	8	U8	0	0	255	Set
		10	Remaining fragments	8	U8	0	0	255	Set
		11	Fragment size	8	U8	0	0	255	Set

*) The *Activate input fragmentation* attribute is a parameter. The value of the parameter can be set via the configuration assembly.

Data acceptance (toggle bit)

The signal shows that the sensor has accepted the data or the data fragment (see also Toggle bit data rejection):

0 > 1: Data has been accepted

1 > 0: Data has been accepted

Data rejection (toggle bit)

The sensor has rejected the acceptance of the data or the data fragment (see also Toggle bit data acceptance).

0 > 1: Data has been rejected

1 > 0: Data has been rejected

Error code

Cause of error if a message is rejected:

0: No error

1: Receive buffer overflow, e.g., if the data length to be transferred is greater than the data buffer of the command interpreter.

2: Sequence error, i.e. an error was detected with the fragment number transferred from the control, the number of remaining fragments or the fragment size.

3: No receive buffer, i.e., there is no free receive buffer of the command interpreter present.

4: Invalid maximum fragment length, i.e., if the fragmentation is activated, the maximum fragment length is less than the data length.

5: Invalid fragment length, i.e., if fragmentation is activated, the current fragment length is less than the current data length.

6: Invalid number of remaining fragments, i.e., with activated fragmentation, the remaining fragments are not consistent.

NOTICE

The following sequence diagram shows with examples how the *Data acceptance*, *Data rejection* and *Error code* attributes are connected.

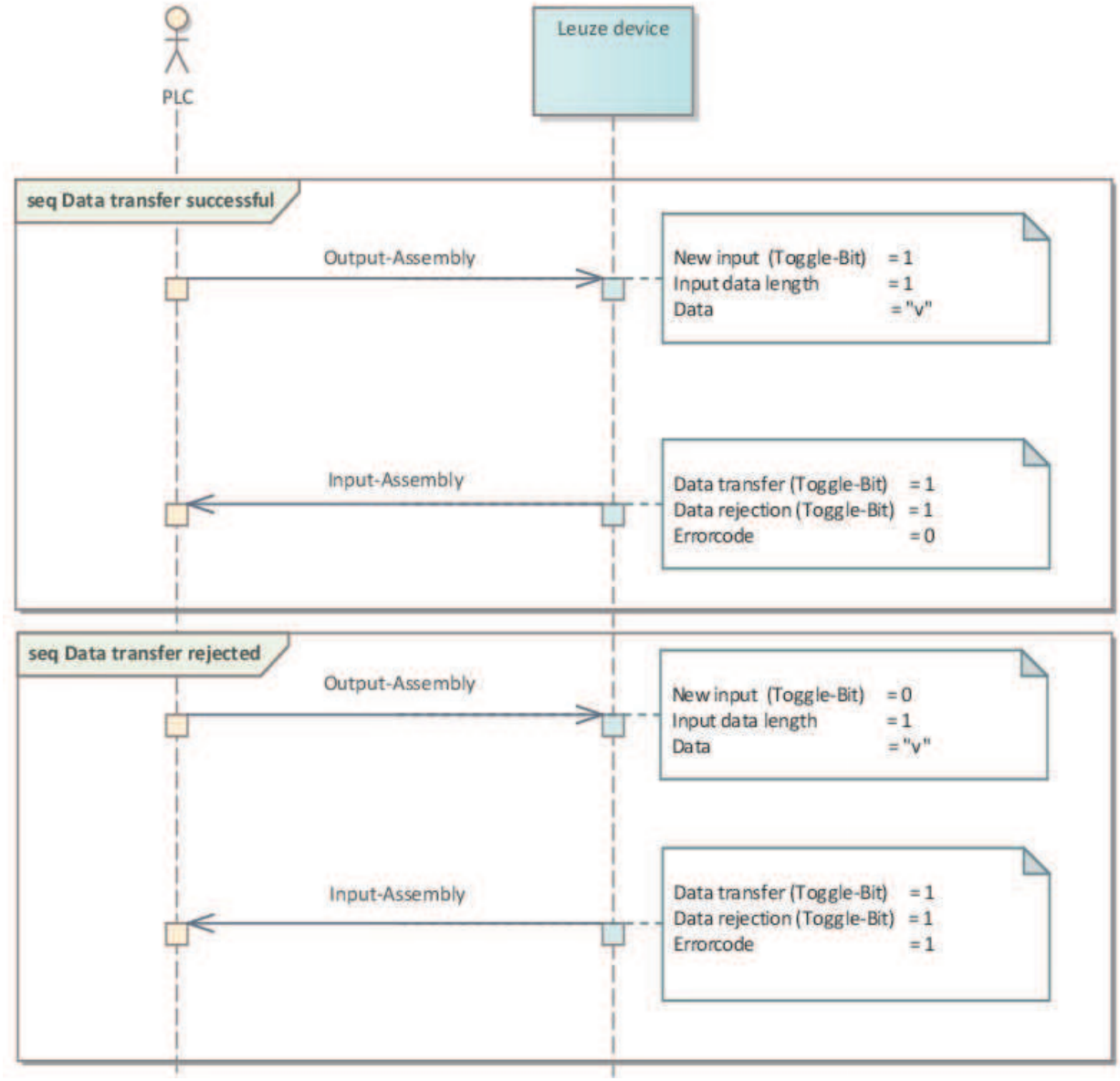


Fig. 10.4: Summary of the attributes *data acceptance*, *data rejection* and *error code*

New entry (toggle bit)

The toggle bit shows whether new entry data is present:

0 > 1: New result

1 > 0: New result

Entry data length

Data length of the actual information.

Data

Information with a length of max. 255 bytes.

Activate input fragmentation

This attribute specifies whether the messages from the control to the IPS 458i should be transferred in fragments:

0: Fragmentation inactive

1: Fragmentation active

Fragment number

Current fragment number

Remaining fragments

Number of fragments which still have to be transmitted for a complete entry.

Fragment size

The fragment size should always be identical, except for the last fragment to be transferred. A fragment size of 0 means that the fragmentation is not used.

10.6.7 Class 109 – Device status and device control

This class contains the display of the device status as well as control bits for deleting an error or putting the sensor into standby mode.

Object class 109 = 0x6D

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
109	1	1	Device status	8	U8	0	0	0x81	Get
		2	Error acknowledge	8	U8	0	0	1	Set
		3	Standby	8	U8	0	0	1	Set

Device status

This byte represents the device status:

10: Standby

15: Device is ready

0x80: Error

0x81: Warning

Error acknowledge

This control bit confirms and deletes errors or warnings that may be present in the system. It acts like a toggle bit.

0 > 1: Error Acknowledge

1 > 0: Error Acknowledge

Standby

Activates the standby function:

0: Standby off

1: Standby on

NOTICE
The standby function results in - no data going to the outside via the interfaces. - the IOs not being operated. - it not being possible to trigger a trigger. - the device displaying 'not ready'.

10.6.8 Class 110 – Device application status and control

From the viewpoint of the communication, this class contains generic status and control information which is interpreted for each device in the EDS file and in the device application.

Object Class 110 = 0x6E

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Tab. 10.2: Structure of the class "Device application status and control 110 / 0x6E"

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
110	1	1	Device application status	16	U16	0	0	65535	Get
		2	Device application control	16	U16	0	0	65535	Set

This section describes the specific bits in attributes 1 and 2 of class 110 Device application status and control.

Tab. 10.3: IPS x58i input data structure – Device application status

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Current program				Reserved	Quality threshold	Multiple markers	Position marker
1	Reserved	Quality score						

Tab. 10.4: IPS x58i output data structure – Device application control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved					Change program selection	Adjustment	Auto Setup
1	Reserved					Program selection		

Quality score in (binary-coded)

0 - 100%: Acknowledgment of current quality score

Current program (binary-coded)

0 - 14: Acknowledgment of selection ID of the current program

15: Impermissible selection ID

Quality threshold

The signal indicates that the detected marker is below the threshold value.

0: Marker is at or above the quality threshold

1: Marker has fallen below the quality threshold

Multiple markers

The signal indicates that the device detected multiple markers.

0: No marker detected

1: Multiple markers detected

Position marker

The signal indicates that the device successfully detected a marker.

0: Measurement not successful

1: Measurement successful

Program selection (binary-coded)

Selection of various programs in the device.

The value range corresponds to the selection ID in the device.

Change program selection

Trigger for the program changeover

0 > 1: Trigger program changeover

Adjustment

Starts and stops the adjustment function.

0 > 1: Start adjustment

1 > 0: Stop adjustment

Auto Setup

Starts and stops the auto setup function.

0 > 1: Start auto setup

1 > 0: Stop auto setup

10.6.9 Class 111 – Position deviation

This class contains the binary-coded output of the position deviations in the X and Y direction.

Object Class 111 = 0x82

Services:

- Get Attribute Single 0x0E
- Set Attribute Single 0x10

Path			Designation	Size in bit	Data type	Default (dec)	Min (dec)	Max (dec)	Access
Cl.	Inst.	Attr.							
111	1	1	X position deviation	32	S32	0	-999999	+999999	Get
		2	Y position deviation	32	S32	0	-999999	+999999	Get

NOTICE

Data format:
- 4 bytes for X-position deviation and 4 bytes for Y-position deviation
- Data type: Measurement value as signed integer value
- Byte sequence: big endian
- Unit: mm/100

10.6.10 Example configuration

Using an example, we will show how the previously described profile can be used to solve different scenarios.

Example – Activation and position deviation

The following screenshot shows the configuration of the device in the Studio 5000 control software.

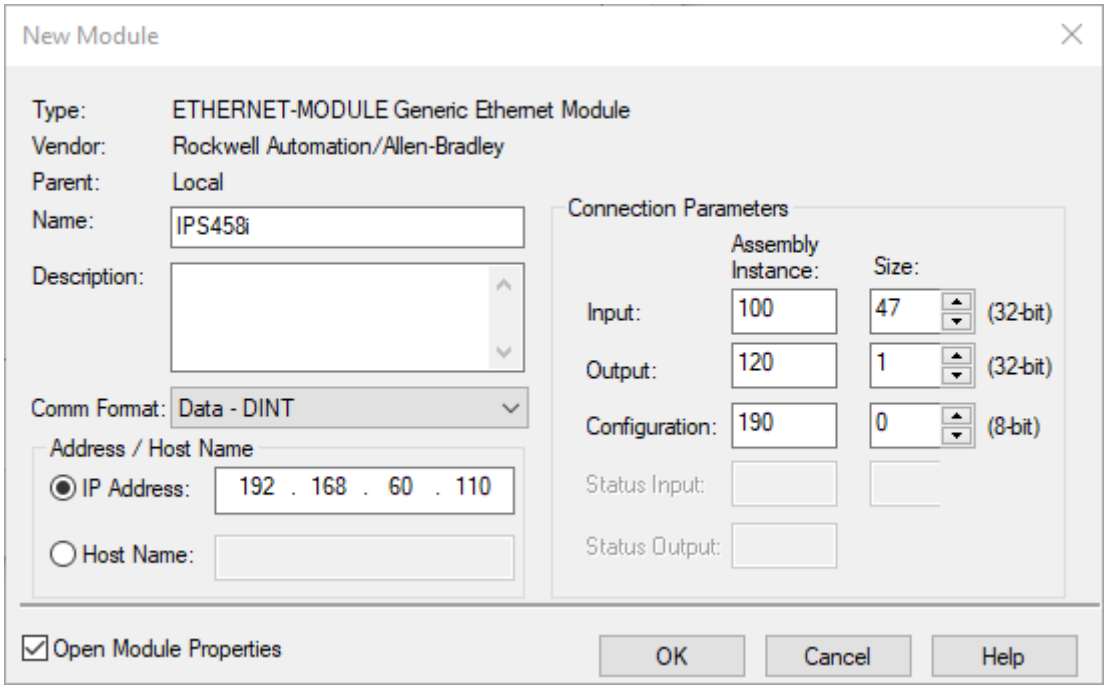


Fig. 10.5: Configuration example – module definition with Generic Module

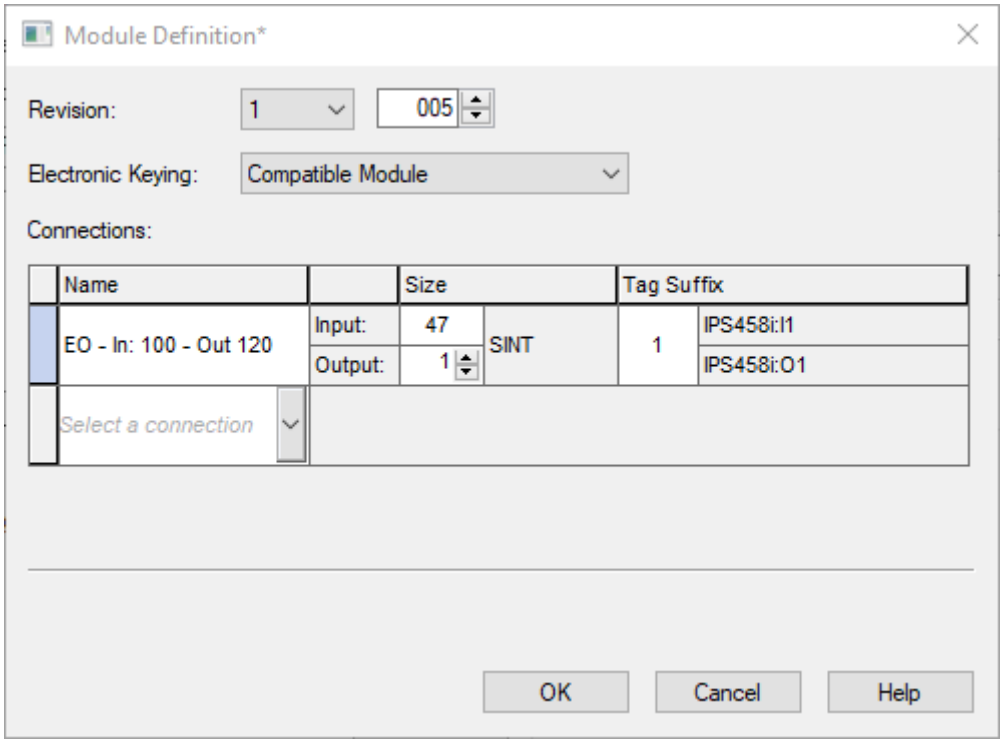


Fig. 10.6: Configuration example – module definition with the EDS file

Tab. 10.5: Structure of input assembly 100

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100	0	Device status							
	1	Number of results							
	2	Reserved		Waiting for acknowl-edgment	New result (toggle bit)	Buffer overflow	Further results in the buffer	User data or com-mand	Status acti-vation
	3	Device application status (low byte)							
	4	Device application status (high byte)							
	5	Result data length (low byte)							
	6	Result data length (high byte)							
	7	Data Byte 0							
	8	Data Byte 1							
	…	Data Byte xy							
	46	Data Byte 39							

Tab. 10.6: Structure of output assembly 120

Inst.	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
120	0	Reserved			Standby	Error ac-knowledge	Data reset	Data ac-knowledg-ment	Activation signal

Structure of configuration assembly 190

Since the configuration is not used, the length of the configuration assembly is specified as 0. The device then operates with the default values. In this case, the acknowledge mode is not used.

Below, examples of what data exchange looks like during two subsequent activations are shown.

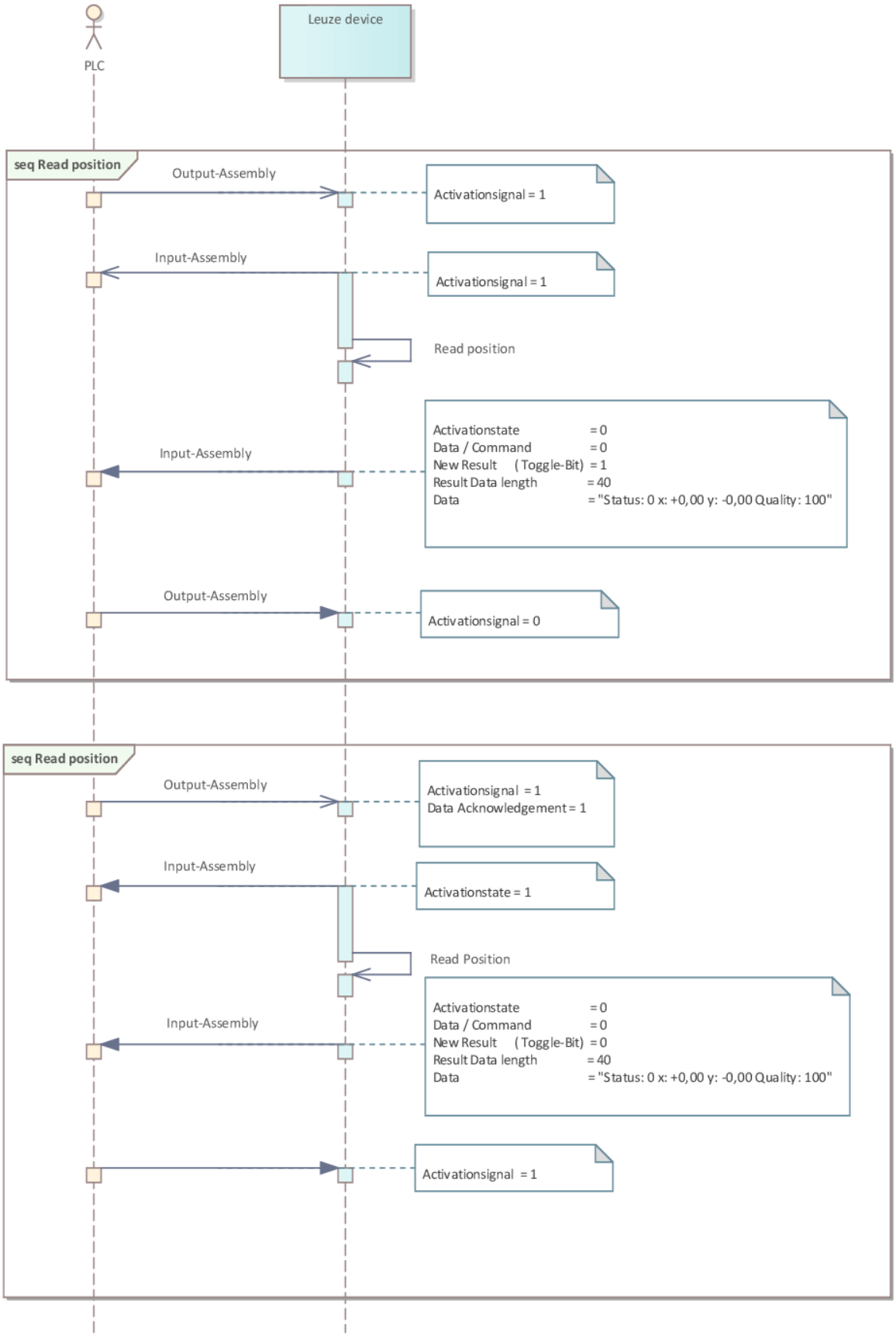


Fig. 10.7: Sequence diagram: data exchange when reading the position deviation

11 Interfaces – Communication

Commands can be used to send commands directly to the positioning sensor for control and configuration. The following transmission options are available for the commands:

- Online commands via the Ethernet interface (see chapter 11.1 "Online commands")
- XML-based communication via the Ethernet interface (see chapter 11.2 "XML-based communication")

11.1 Online commands

11.1.1 Overview of commands and parameters

Online commands can be used to send commands directly to the sensor for control and configuration. For this, the sensor must be connected to a computer (host) via the Ethernet interface (see chapter 8.4.4 "Ethernet host communication").

Online commands offer the following options for controlling and configuring the sensor:

- Control/activate sensor
- Read/write/copy parameters
- Carry out an automatic configuration
- Call up error messages
- Query statistical device information
- Perform a software RESET and re-initialize the sensor

Syntax

Online commands consist of one or two ASCII characters followed by command parameters.

No separation characters may be entered between the command and the command parameter(s). Both small and capitalized letters can be used.

Example:

Command '**CA**':	Auto setup function
Parameter '**+**':	Activation
Transmitted is:	'**CA+**'

Notation

Commands, parameters and returned data are enclosed between single quotation marks ' ' in the text of this manual.

Most online commands are acknowledged by the device and any requested data returned. For commands that are not acknowledged, command execution can be observed or monitored directly on the device.

11.1.2 General online commands

Software version number

Command	**'V'**
Description	Requests device version information
Parameter	None
Acknowledgment	Example: **'IPS 458i FIX-M3-102-I3-G V2.3.8 2021-09-01'** The first line contains the device type of the sensor, followed by the device version number and version date. The data which is actually displayed may vary from the values given here.

NOTICE	
	You can use this command to check whether the communication between PC and sensor is functional. ↳ If you do not receive an acknowledgment, please check the interface connections or the protocol.

Software reset

Command	'H'		
Description	Carries out a software reset. The device is restarted and reinitialized, leaving it in the same state as when the operating voltage is switched on.		
Parameters	None		
Acknowledgment	'S' (start signal)		

Auto setup

Command	'CA'		
Description	Activates the *Auto setup* function: • Determine optimum illumination settings. • Determine marker. • Teach position, if possible. This function must again be deactivated!		
Parameters	'+'	Activates *Auto setup*	
	'-'	Deactivates *Auto setup*	
Acknowledgment	'CS=x'		
	x	Status	
		'00'	Valid **'CA'** command
		'01'	Invalid command
		'02'	'Auto setup' could not be activated
Response	'x yyyy zzz'		
	x	Status of the current detection	
		'0'	Detection successful; marker detected
		'1'	Detection not successful; multiple markers detected
		'2'	Detection not successful; no marker detected
	yyyy		Position values for X and Y deviation
	zzz		Quality score in [%]

Alignment mode

Command	'JP'		
Description	Activates or deactivates the alignment mode for simple mounting alignment of the device. After activating the function with **JP+**, the sensor constantly outputs status information on the Ethernet interface. Using online commands, the sensor is set so that it constantly outputs the position values, the status and the quality score. Upon deactivation of this mode, the position is re-taught, provided this is possible. This function must again be deactivated!		
Parameters	'+'	activates the alignment mode	
	'-'	deactivates the alignment mode	
Response	'x yyyy zzz'		
	x	Status of the current detection	
		'0'	Detection successful; marker detected
		'1'	Detection not successful; multiple markers detected
		'2'	Detection not successful; no marker detected
	yyyy	Position values for X and Y deviation	
	zzz	Quality score in [%]	

Device status

Command	'SST?'		
Description	The command queries the device status. If the command is sent via the host interface (Ethernet), acknowledgment is only given in the *Process* operating mode. The host interface is blocked in the *Service* operating mode.		
Parameters	None		
Acknowledgment	'SST=xxxxxxxx' **x** stands for a single bit (value '1' or '0') Bit 7 is at the far left, bit 0 is at the far right		
	0	Ready	
		'1'	The sensor is ready to receive a trigger and start a program.
		'0'	The sensor does not respond to an incoming trigger signal.
	1	Operating mode	
		'1'	*Process* operating mode
	2	Device error	
		'1'	Device error, no inspection possible
		'0'	No device error, ready
	3 … 7	No function, value is always '0'	
	Alternatively, the following acknowledgment is output: 'DS=xx'		
	x	Error acknowledgment	
		'00'	Syntax error
		'01'	Other error

Program query

Command	'GAI?'
Description	The command queries the currently active program.
Acknowledgment	**'GAI=<bbb>'** The selection ID of the currently active program is sent as the answer, e.g., 'GAI=0'.

Program changeover

Command	'GAI=<xxx>'		
Description	The command activates changeover to the desired program.		
Parameter	'**xxx**' The program number (selection ID) must be entered as a 3-digit number, e.g., '001'.		
Acknowledgment	'**GS=<bb>**'		
	bb	The following values are defined	
		'00'	Positive answer
		'01'	Syntax Error
		'02'	Wrong parameter
		'03'	Wrong operating mode
		'04'	Other error

11.1.3 Online commands for system control

Activate positioning

Command	'+'
Description	The command activates configured positioning.
Parameter	None
Acknowledgment	None

Deactivate positioning

Command	'-'
Description	The command deactivates configured positioning.
Parameter	None
Acknowledgment	None

11.2 XML-based communication

You can send commands for control and configuration directly to the device via XML-based communication.

- The device must be connected to a computer (host) via the Ethernet interface (see chapter 8.4.4 "Ethernet host communication").
- The device is designed as an XML server and communicates on port 10004.

You can find detailed information on XML-based communication on the Leuze website: **www.leuze.com**

- Enter the type designation or part number of the device as the search term.
- You can find the information on the *Downloads* tab.

11.3 Parameter files

The following files are available for loading/saving. These files are, for example, relevant for the device exchange of sensors.

Project parameters

This file (e.g., IPS_458_Projects_2023_12_01.arc) contains all project parameters of all programs (e.g., exposure time, working distances, marker diameter, etc.).

Parameter file

This file (e.g., IPS_458_2023_12_01.bct) contains all project parameters and device parameters incl. communication parameters (e.g., IP address), but **without** user management (roles).

Backup/Restore

This file (e.g., IPS_458_Backup_2023_12_01.arc) contains all project parameters and device parameters incl. communication parameters (e.g., IP address), but **with** user management (roles).

12 Care, maintenance and disposal

Usually, the device does not require any maintenance by the operator.

Cleaning

Clean the lens cover of the device with a soft cloth before mounting.

	NOTICE
	**Do not use aggressive cleaning agents!** ↳ Do not use aggressive cleaning agents such as thinner or acetone for cleaning the device.

Maintenance

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 14 "Service and support").

Disposing

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

13 Diagnostics and troubleshooting

Error signaling via LED

Tab. 13.1: Meaning of the LED indicators

Error	Possible error cause	Measures
PWR LED		
Off	• No operating voltage connected to the device • Hardware error	• Check operating voltage • Contact Leuze customer service (see chapter 14 "Service and support")
Red, continuous light	Device error/parameter enable	Contact Leuze customer service (see chapter 14 "Service and support")
Red, flashing	Warning set Temporary operating fault	Query diagnostic data and carry out the resulting measures
NET LED		
Off	No operating voltage connected to the device	• Check operating voltage • Contact Leuze customer service (see chapter 14 "Service and support")
Red, continuous light	Network error No communication established to the IO controller	Check interface
Red, flashing	No communication Parameterization or configuration failed	Check interface
Orange, flashing	Topology error was detected by the device.	Check interface

14 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 and 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:	
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

15 Technical data

15.1 General specifications

Tab. 15.1: Electrical equipment

Operating voltage U_B	18 V … 30 V DC PELV, Class 2 / SELV
Average power consumption	8 W without load on the switching output During strobed operation, a higher power can briefly be consumed.
Switching input Switching output	• SWI1: Digital switching input 1 (default: "Trigger") • SWO2: Digital switching output 2 (default: "Ready") • SWI3: Digital switching input 3 (default: "Program selection 0") • SWI4: Digital switching input 4 (default: "Program selection 1") • SWO5 … SWO8: digital switching outputs 5 … 8 (default: Position output) 18 V … 30 V DC, depending on operating voltage I_{max}: 60 mA per switching output; 100 mA total current Short-circuit proof, protected against polarity reversal
Process interface	Ethernet 10/100 Mbit/s EtherNet/IP

Tab. 15.2: Operating and display elements

Keyboard	2 control buttons
LEDs	1 dual LED (green/red) for power (PWR) 1 dual LED (green/red) for bus state (NET) 1 dual LED (green/yellow) for link state (LINK) Display with 6 LEDs (green) for function selection and program selection 4 feedback LEDs (green) for alignment indication

Tab. 15.3: Mechanical data

Degree of protection	IP65 acc. to EN 60529 With screwed-on M 12 connectors or mounted caps
VDE protection class	III (EN 61140)
Connection technology	M12 connectors
Weight	124 g (housing hood with glass pane)
Dimensions (H x W x D)	65.6 x 43 x 44 mm
Fastening	2 M4 threaded inserts on each of the side walls, 5 mm deep 4 M4 threaded inserts on the rear, 3.5 mm / 5 mm deep
Housing	Housing: polycarbonate Housing base: diecast aluminum
Optics cover	Glass

Tab. 15.4: Environmental data

Ambient temp. (operation/storage)	0 °C … +45 °C/-20 °C … +70 °C
Air humidity	max. 90% rel. humidity, non-condensing
Ambient light	Max. 2000 Lux
Electromagnetic compatibility	EN 61000-6-2, EN 61000-6-4
Vibration	IEC 60068-2-6, test Fc
Continuous shock	IEC 60068-2-29, test Eb
Conformity	CE

15.2 Optical data

Tab. 15.5: Optical data

Integrated LED illumination	Infrared (not visible, 850 nm) Exempt group in acc. with IEC 60825-1, EN 62471:2008
Integrated feedback LEDs	Green (525 nm)
Beam exit	Front
Image sensor	Global shutter CMOS Imager
Number of pixels	1280 x 960 pixels
Electronic shutter speeds	68 µs … 5 ms (flash)

15.3 Reading performance

Tab. 15.6: Reading performance

Working distances	F2 optics: • 250 mm … 1900 mm with a marker diameter of 13 mm / 15 mm F4 optics: • 350 mm … 2400 mm for marker diameter 13 mm / 15 mm Reflector necessary at working distance from 1.9 m
Reading distance	Determining the working distance

15.4 Device with heating

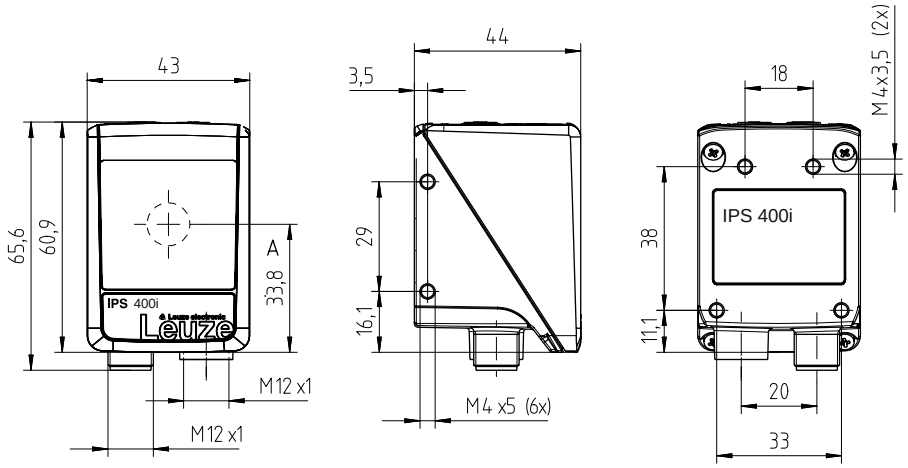
Tab. 15.7: Electrical equipment

Operating voltage U_B	18 V … 30 V DC PELV, Class 2 / SELV
Average power consumption	12 W without load on the switching output During strobed operation, a higher power can briefly be consumed.
Warmup time	Minimum 30 minutes at +24 V DC and an ambient temperature of -30 °C

Tab. 15.8: Environmental data

Ambient temperature (operation)	-+30 °C … +45 °C
Ambient temperature (storage)	-20 °C … +70 °C

15.5 Dimensioned drawings



all dimensions in mm

A Optical axis

Fig. 15.1: IPS 400i dimensioned drawing

16 Order guide and accessories

16.1 Nomenclature

Part designation:

IPS 4xxi FIX-Of-102-Ir-Z-A

Tab. 16.1: Part number code

IPS	Operating principle: Imaging Positioning Sensor (camera-based)
4	Series: IPS 400i
xx	Host interface 08: Ethernet TCP/IP 48: PROFINET-IO, Ethernet TCP/IP, UDP 58: Ethernet TCP/IP, UDP, EtherNet/IP
i	Integrated fieldbus technology
FIXED	Fixed focal length
O	Focus position: F: Far Density
f	Lens: 2: 12 mm 4: 16 mm
102	Device with connector/socket Beam exit at front
I	Illumination: infrared
r	Resolution range: 3: 1280 x 960 pixels
Z	Type of protective screen: G: Glass
A	Heating variant: -: without heating H: with heating

NOTICE

A list with all available device types can be found on the Leuze website **www.leuze.com**.

16.2 Type overview

Tab. 16.2: Type overview

Type designation	Description	Part no.
IPS 458i FIX-F2-102-I3-G	Camera-based positioning sensor, F2 optics	50145998
IPS 458i FIX-F2-102-I3-G-H	Camera-based positioning sensor, F2 optics, heating	50145999
IPS 458i FIX-F4-102-I3-G	Camera-based positioning sensor, F4 optics	50146000
IPS 458i FIX-F4-102-I3-G-H	Camera-based positioning sensor, F4 optics, heating	50146001

16.3 Cables accessories

Tab. 16.3: Accessories – PWR connection cable (open cable end)

Part no.	Part designation	Description
M12 socket (12-pin, A-coded), axial connector, open cable end, shielded, UL		
50130281	KD S-M12-CA-P1-020	PWR connection cable, length 2 m
50130282	KD S-M12-CA-P1-050	PWR connection cable, length 5 m
50130283	KD S-M12-CA-P1-100	PWR connection cable, length 10 m
M12 socket (12-pin, A-coded), angled connector, open cable end, shielded, UL		
50134943	KD S-M12-CW-P1-050	PWR connection cable, length 5 m

Tab. 16.4: Accessories – PWR connection cable (extension, to M12 plug)

Part no.	Part designation	Description
M12 socket (12-pin, A-coded), axial connector M12 plug (12-pin, A-coded), shielded, UL		
50143811	KDS S-M12-CA-M12-CA-P1-003	Connection cable, length 0.3 m
50130284	KDS S-M12-CA-M12-CA-P1-020	Connection cable, length 2 m
50130285	KDS S-M12-CA-M12-CA-P1-050	Connection cable, length 5 m
50130286	KDS S-M12-CA-M12-CA-P1-100	Connection cable, length 10 m

Tab. 16.5: Accessories – PWR interconnection cable (reduction to M12, 5-pin)

Part no.	Part designation	Description
M12 socket (12-pin, A-coded), axial connector M12 connector (5-pin, A-coded), shielded		
50137694	KDS S-M12-CA-M12-5A-P1-004-23X	Interconnection cable, length 0.4 m

Tab. 16.6: Accessories – Ethernet connection cable (to RJ-45)

Part no.	Part designation	Description
M12 plug (4-pin, D-coded), axial connector to RJ-45 connector, shielded, UL		
50135080	KSS ET-M12-4A-RJ45-A-P7-020	Ethernet connection cable (on RJ-45), length 2 m
50135081	KSS ET-M12-4A-RJ45-A-P7-050	Ethernet connection cable (on RJ-45), length 5 m
50135082	KSS ET-M12-4A-RJ45-A-P7-100	Ethernet connection cable (on RJ-45), length 10 m
50135083	KSS ET-M12-4A-RJ45-A-P7-150	Ethernet connection cable (on RJ-45), length 15 m
50135084	KSS ET-M12-4A-RJ45-A-P7-300	Ethernet connection cable (on RJ-45), length 30 m

Tab. 16.7: Accessories – Ethernet connection cable (open cable end)

Part no.	Part designation	Description
M12 plug (4-pin, D-coded), axial connector, open cable end, shielded, UL		
50135073	KS ET-M12-4A-P7-020	Ethernet connection cable, length 2 m
50135074	KS ET-M12-4A-P7-050	Ethernet connection cable, length 5 m
50135075	KS ET-M12-4A-P7-100	Ethernet connection cable, length 10 m
50135076	KS ET-M12-4A-P7-150	Ethernet connection cable, length 15 m
50135077	KS ET-M12-4A-P7-300	Ethernet connection cable, length 30 m

Part no.	Part designation	Description
M12 plug (4-pin, D-coded), angled connector, open cable end, shielded, UL		
50134942	KS ET-M12-4W-P7-050	Ethernet connection cable, length 5 m

Tab. 16.8: Accessories – BUS IN/BUS OUT connection cable (to M12)

Part no.	Part designation	Description
M12 plug (4-pin, D-coded), BUS IN/BUS OUT to M12 socket, shielded, UL		
50106899	KB ET-2000-SSA	BUS OUT connection cable, length 2 m
50106900	KB ET-5000-SSA	BUS OUT connection cable, length 5 m
50106901	KB ET-10000-SSA	BUS OUT connection cable, length 10 m
50106902	KB ET-15000-SSA	BUS OUT connection cable, length 15 m
50106905	KB ET-30000-SSA	BUS OUT connection cable, length 30 m

16.4 Other accessories

Tab. 16.9: Accessories – reflectors

Part no.	Part designation	Description
50140183	MTKZ 7-30 SET	Reflector SET for 7 mm bore hole, set contains 100 pieces
50130343	MTKZ 13-30 SET	Reflector SET for 13 mm bore hole, set contains 100 pieces
50129092	MTKZ 15-30 SET	Reflector SET for 15 mm bore hole, set contains 100 pieces
50132911	REF 7-A-15-30 SET	Reflective tape SET for affixing, set contains 500 pieces

Tab. 16.10: Accessories – Mounting aids

Part no.	Part designation	Description
50132150	BTU 320M-D12	Mounting system for rod, 12 mm
50132151	BT 320M	Mounting bracket
50144298	BT 330M	Mounting bracket
50144299	BTU 330M-1	Mounting system for rod, 10 – 16 mm

Tab. 16.11: Accessories – Ethernet switch

Part no.	Part designation	Description
50135196	MD 708-21-42/D4-12	Ethernet switch with 5 connections
50135197	MD 708-21-82/D4-12	Ethernet switch with 9 connections

Tab. 16.12: Accessories – External illumination

Part no.	Part designation	Description
50144030	IL AL 034/031 IR 110 H	LED surface illumination, infrared LED, heating

17 EC Declaration of Conformity

The positioning sensors of the IPS 400i 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 part number can be found on the name plate of the device under the "Part No." entry. ↳ The documents can be found on the product page for the device under the *Downloads* tab.

18 Appendix

18.1 ASCII character set

ASCII	Dec.	Hex.	Oct.	Designation	Meaning
NUL	0	00	0	ZERO	Zero
SOH	1	01	1	START OF HEADING	Start of heading
STX	2	02	2	START OF TEXT	Start of text characters
ETX	3	03	3	END OF TEXT	Last character of text
EOT	4	04	4	END OF TRANSMISS.	End of transmission
ENQ	5	05	5	ENQUIRY	Request for data trans.
ACK	6	06	6	ACKNOWLEDGE	Positive acknowledgment
BEL	7	07	7	BELL	Bell signal
BS	8	08	10	BACKSPACE	Backspace
HT	9	09	11	HORIZ. TABULATOR	Horizontal tabulator
LF	10	0A	12	LINE FEED	Line feed
VT	11	0B	13	VERT. TABULATOR	Vertical tabulator
FF	12	0C	14	FORM FEED	Form feed
CR	13	0D	15	CARRIAGE RETURN	Carriage return
SO	14	0E	16	SHIFT OUT	Shift out
SI	15	0F	17	SHIFT IN	Shift in
DLE	16	10	20	DATA LINK ESCAPE	Data link escape
DC1	17	11	21	DEVICE CONTROL 1	Device control character 1
DC2	18	12	22	DEVICE CONTROL 2	Device control character 2
DC3	19	13	23	DEVICE CONTROL 3	Device control character 3
DC4	20	14	24	DEVICE CONTROL 4	Device control character 4
NAK	21	15	25	NEG. ACKNOWLEDGE	Negative acknowledge
SYN	22	16	26	SYNCHRONOUS IDLE	Synchronization
ETB	23	17	27	EOF TRANSM. BLOCK	End of data transmission block
CAN	24	18	30	CANCEL	Invalid
EM	25	19	31	END OF MEDIUM	End of medium
SUB	26	1A	32	SUBSTITUTE	Substitution
ESC	27	1B	33	ESCAPE	Escape
FS	28	1C	34	FILE SEPARATOR	File separator
GS	29	1D	35	GROUP SEPARATOR	Group separator
RS	30	1E	36	RECORD SEPARATOR	Record separator
US	31	1F	37	UNIT SEPARATOR	Unit separator
SP	32	20	40	SPACE	Space
!	33	21	41	EXCLAMATION POINT	Exclamation point
"	34	22	42	QUOTATION MARK	Quotation mark
#	35	23	43	NUMBER SIGN	Number sign
$	36	24	44	DOLLAR SIGN	Dollar sign
%	37	25	45	PERCENT SIGN	Percent sign

ASCII	Dec.	Hex.	Oct.	Designation	Meaning
&	38	26	46	AMPERSAND	Ampersand
’	39	27	47	APOSTROPHE	Apostrophe
(	40	28	50	OPEN. PARENTHESIS	Open parenthesis
)	41	29	51	CLOS. PARENTHESIS	Closed parenthesis
*	42	2A	52	ASTERISK	Asterisk
+	43	2B	53	PLUS	Plus sign
,	44	2C	54	COMMA	Comma
-	45	2D	55	HYPHEN (MINUS)	Hyphen
.	46	2E	56	PERIOD (DECIMAL)	Period (decimal)
/	47	2F	57	SLANT	Slant
0	48	30	60	0	Number
1	49	31	61	1	Number
2	50	32	62	2	Number
3	51	33	63	3	Number
4	52	34	64	4	Number
5	53	35	65	5	Number
6	54	36	66	6	Number
7	55	37	67	7	Number
8	56	38	70	8	Number
9	57	39	71	9	Number
:	58	3A	72	COLON	Colon
;	59	3B	73	SEMICOLON	Semicolon
<	60	3C	74	LESS THAN	Less than
=	61	3D	75	EQUALS	Equals
>	62	3E	76	GREATER THAN	Greater than
?	63	3F	77	QUESTION MARK	Question mark
@	64	40	100	COMMERCIAL AT	Commercial AT
A	65	41	101	A	Capital letter
B	66	42	102	B	Capital letter
C	67	43	103	C	Capital letter
D	68	44	104	D	Capital letter
E	69	45	105	E	Capital letter
F	70	46	106	F	Capital letter
G	71	47	107	G	Capital letter
H	72	48	110	H	Capital letter
I	73	49	111	I	Capital letter
J	74	4A	112	J	Capital letter
K	75	4B	113	K	Capital letter
L	76	4C	114	L	Capital letter
M	77	4D	115	M	Capital letter

ASCII	Dec.	Hex.	Oct.	Designation	Meaning
N	78	4E	116	N	Capital letter
O	79	4F	117	O	Capital letter
P	80	50	120	P	Capital letter
Q	81	51	121	Q	Capital letter
R	82	52	122	R	Capital letter
S	83	53	123	S	Capital letter
T	84	54	124	T	Capital letter
U	85	55	125	U	Capital letter
V	86	56	126	V	Capital letter
W	87	57	127	W	Capital letter
X	88	58	130	X	Capital letter
Y	89	59	131	Y	Capital letter
Z	90	5A	132	Z	Capital letter
[	91	5B	133	OPENING BRACKET	Opening bracket
\	92	5C	134	REVERSE SLANT	Reverse slant
]	93	5D	135	CLOSING BRACKET	Closing bracket
^	94	5E	136	CIRCUMFLEX	Circumflex
_	95	5F	137	UNDERSCORE	Underscore
`	96	60	140	GRAVE ACCENT	Grave accent
a	97	61	141	a	Lower case letter
b	98	62	142	b	Lower case letter
c	99	63	143	c	Lower case letter
d	100	64	144	d	Lower case letter
e	101	65	145	e	Lower case letter
f	102	66	146	f	Lower case letter
g	103	67	147	g	Lower case letter
h	104	68	150	h	Lower case letter
i	105	69	151	i	Lower case letter
j	106	6A	152	j	Lower case letter
k	107	6B	153	k	Lower case letter
l	108	6C	154	l	Lower case letter
m	109	6D	155	m	Lower case letter
n	110	6E	156	n	Lower case letter
o	111	6F	157	o	Lower case letter
p	112	70	160	p	Lower case letter
q	113	71	161	q	Lower case letter
r	114	72	162	r	Lower case letter
s	115	73	163	s	Lower case letter
t	116	74	164	t	Lower case letter
u	117	75	165	u	Lower case letter

ASCII	Dec.	Hex.	Oct.	Designation	Meaning
v	118	76	166	v	Lower case letter
w	119	77	167	w	Lower case letter
x	120	78	170	x	Lower case letter
y	121	79	171	y	Lower case letter
z	122	7A	172	z	Lower case letter
{	123	7B	173	OPENING BRACE	Opening brace
|	124	7C	174	VERTICAL LINE	Vertical line
}	125	7D	175	CLOSING BRACE	Closing brace
~	126	7E	176	TILDE	Tilde
DEL	127	7F	177	DELETE (RUBOUT)	Delete

18.2 Configuration via configuration codes

The positioning sensor can also be configured using configuration codes. The device/application parameters in the device are set and permanently saved after reading this code.

Configuration codes are created with the *Code Generator* tool. You can find the *Code Generator* on the Internet at **www.leuze.com/code-generator**.

Configuration changes via the configuration codes are only possible via button activation on the control panel of the sensor (*AUTO* function).

Proceed as follows to read in a configuration code:

- Connect the sensor to the operating voltage and activate the *AUTO* function on the control panel.
- Hold the printed configuration code at the correct distance in front of the optics of the sensor.
- ⇨ As soon as a configuration code is read in, the sensor exits the *AUTO* function mode.
- ⇨ Upon exiting the function mode, the four feedback LEDs signal whether reading was successful: single, brief flash: reading successful

NOTICE

Read in configuration codes individually!

The printed configuration codes can only be read in individually.

18.3 License terms

This product contains software components that are licensed by the copyright holders as "free software" or as "open source software" under the GNU General Public License, Version 2. We can provide you with the source code of these software components on a data carrier/download (CD-ROM or DVD) if you submit a request to our customer support within three years of distribution of the product at the following address:

Service center

Leuze electronic GmbH + Co. KG

In der Braike 1

D-73277 Owen / Germany

Source code DCR 200i