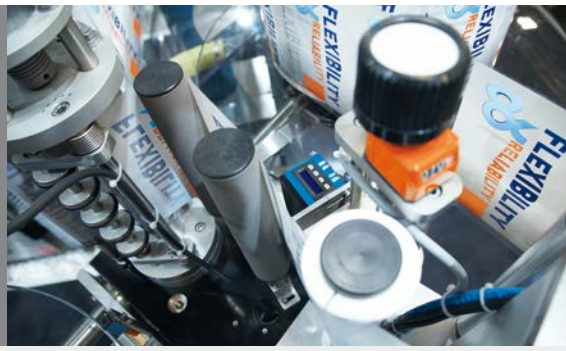
OPERATING INSTRUCTIONS



PS30

Pattern sensors

EN

SICK
Sensor Intelligence.

Only NFPA79 applications.
Adapters including field wiring cable are available.
See product information.
Enclosure Type 1.

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1 General information

1.1 Information on the operating instructions

These operating instructions provide important information on how to handle PS30 pattern sensors from SICK AG. Adherence to all the specified safety notes and guidelines is a prerequisite for working safely.

You must also comply with any local work safety regulations and general safety specifications applicable to the use of the pattern sensors.

Ensure that you read through these operating instructions carefully before starting any work. They constitute an integral part of the product and should be stored in the direct vicinity of the pattern sensors so they remain accessible to personnel at all times.

Should the pattern sensor be passed on to a third party, these operating instructions should be handed over with it.

NOTE!

A machine cycle as the input signal, e.g. via an encoder or a motor feedback system, is necessary for the operation of the pattern sensor.

1.2 Explanation of symbols

Warnings

Warnings in these operating instructions are labeled with symbols. The warnings are introduced by signal words that indicate the extent of the danger.

These warnings must be observed at all times and care must be taken to avoid accidents, personal injury, and material damage.

DANGER!

... indicates a situation of imminent danger, which will lead to a fatality or serious injuries if not prevented.

WARNING

... indicates a potentially dangerous situation, which may lead to a fatality or serious injuries if not prevented.

CAUTION!

... indicates a potentially dangerous situation, which may lead to minor/slight injuries if not prevented.

WARNING!

... indicates a possible hazardous situation which may lead to physical damage if it is not avoided.

Tips and recommendations

NOTE!

... highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

1.3 Limitation of liability

Applicable standards and regulations, the latest state of technological development, and our many years of knowledge and experience have all been taken into account when assembling the data and information contained in these operating instructions.

The manufacturer accepts no liability for damage caused by:

- Failing to observe the operating instructions
- Incorrect use
- Use by untrained personnel
- Unauthorized conversions
- Technical modifications
- Use of unauthorized spare parts/consumable parts.

With special variants, where optional extras have been ordered, or owing to the latest technical changes, the actual scope of delivery may vary from the features and illustrations shown here.

1.4 Scope of delivery

Included with delivery:

- PS30 pattern sensor
- Blind plug for M12 Ethernet connection
- Adjustment tool
- Optional: Accessories (→ page 71, chapter 16).

Documentation enclosed for each pattern sensor:

- Quickstart

1.5 Customer service

If you require any technical information, our customer service department will be happy to help.

See the back page for your agency.

NOTE!

Before calling, make a note of the type designation, serial number, and software version to enable faster processing. You can find the type designation and serial number on the type label. → See page 13, Fig. 1.
The software version can be read out via the “SWVers” parameter on the sensor. → See page 47, 9.7.

1.6 EU declaration of conformity

→ You can download the EU declaration of conformity online from “www.sick.com/PS30”.

1.7 Environmental protection

→ See page 65, chapter 13.4 “Disposal”.

2 Safety

2.1 Intended use

The PS30 pattern sensor is an opto-electronic sensor intended for non-contact recognition of recurring patterns. A machine cycle as the input signal, e.g. via an encoder or a motor feedback system, is necessary for the operation of the pattern sensor.

SICK AG assumes no liability for losses or damage arising from the use of the product, either directly or indirectly. This applies in particular to use of the product that does not conform to its intended purpose and is neither described nor mentioned in this documentation.

2.2 Incorrect use

The PS30 pattern sensor does not constitute a safety component according to the EC Machinery Directive (2006/42/EC).

The pattern sensors must not be used in explosion-hazardous areas.

Any other use that is not described as intended use is prohibited.

Never install or connect accessories if their quantity and composition are not clearly specified, or if they have not been approved by SICK AG.

WARNING

Danger due to improper use!

Any improper use can result in dangerous situations.

For this reason:

- Pattern sensors should be used only according to intended use specifications.
- All information in these operating instructions must be strictly observed.

2.3 Modifications and conversions

Modifications and conversions to the pattern sensor and/or the installation may result in unforeseeable dangers.

Before any technical modifications to and expansions of the pattern sensor, the prior written approval of the manufacturer must be obtained.

2.4 Requirements for skilled persons and operating personnel

WARNING

Risk of injury due to insufficient training.

Improper handling may result in considerable personal injury and material damage.

For this reason:

- All work must only ever be carried out by the stipulated persons.

The operating instructions state the following qualification requirements for the various areas of work:

- **Instructed personnel**
  During a briefing by the operator, such persons have been instructed about tasks assigned to them and about potential dangers in the event of improper action.
- **Qualified personnel**
  are able to carry out the work assigned to them and independently recognize potential risks due to their specialist training, knowledge, and experience, as well as knowledge of the relevant regulations.
- **Electrical specialists**
  are able to carry out work on electrical systems and independently recognize potential risks due to their specialist training, knowledge, and experience, as well as knowledge of the relevant standards and regulations.
  In Germany, electrical specialists must meet the specifications of the work safety regulation BGV A3 (e.g., master electrician). Other relevant regulations applicable in other countries must be observed.

2.5 Operational safety and particular hazards

Please observe the safety notes and the warnings listed here and in other chapters of these operating instructions to reduce the possibility of risks to health and avoid dangerous situations.

2.6 Hazard warnings and operational safety

Light sender

The PS30 pattern sensor is equipped with LED illumination. The sensor meets the criteria of risk group 1 according to IEC 62471:2006.

No special measures are required.

3 Identification

3.1 Type label

The type label is located on the back of the pattern sensor.

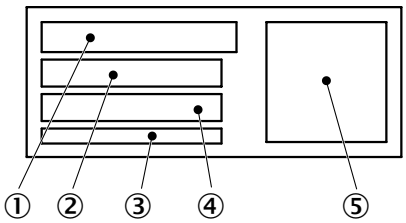


Fig. 1: Type label

1 Type designation

2 Material number

3 MAC address

4 Serial number

5 Machine-readable code

4 Setup and function

4.1 Design

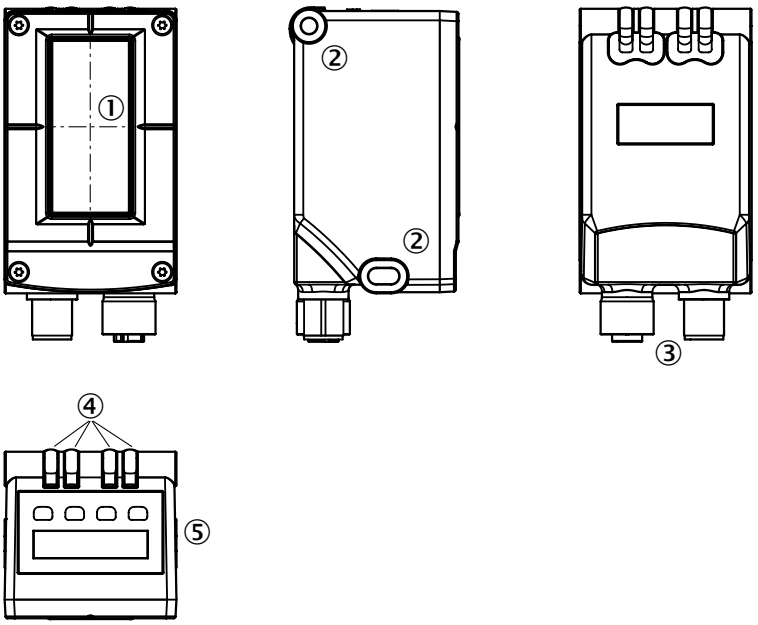


Fig. 2: "PS30 pattern sensor" design

1 Center of the optical axis

2 Fixing hole

3 M12 male connector, 12-pin/M12 female connector, 4-pin, rotatable
→ See page 27, chapter 7.5.

4 Function indicators

5 Display and control unit

4.2 Function

Fig. 3: Recorded image from the perspective of the "PS30 pattern sensor"

Vertical bars:
Cuts of the individual lines, corresponds to the encoder resolution
(→ See page 69, chapter 15.7).

Blue square marks:
Clear and contrast-rich pattern areas automatically selected by the sensor. Five areas are shown here as examples.

The PS30 pattern sensor is an opto-electronic sensor which detects recurring patterns without making contact.

The principle of operation is based on a line sensor which constantly searches for contrast differences and sharp edges in the print image (see figure 3). These clear areas significant in the pattern are automatically selected by the sensor during the teach-in process. The points are in exactly the same spot in the same image and contrast pattern. The sensor evaluates grayscale.

A taught-in image is used as a reference for the subsequent detection of a recurring contrast pattern. The print marks usually used for determining position are no longer necessary. The identification of a pattern matching the reference pattern initiates a switching output.

Information about the speed of the material, e.g. from encoder pulses or a motor feedback system, is necessary for operation of the PS30 pattern sensor.

4.3 Operating modes

The PS30 pattern sensor can be operated in two operating modes:

a) Endless material

b) Single object.

4.3.1 Endless material operating mode

Exact determination of position for defining, for instance, the cut positions is necessary for further processing of endless materials such as film and paper webs, for example for creating labels and packaging with constant repeat length. Typically, the target cut position is selected as the start point of the reference image which is completed before the end of the repeat length. The start point of the teach-in area is the position of the switching signal. Shifting of the switching point can also be configured.

Fig. 4: Endless operating mode

4.3.2 Single object operating mode

The position is to be determined by separate, repeating objects with identical patterns but not with fixed distances. An object or a section of the object is taught in as a reference. The end of the teach-in area is used as the position for output of the switching signal. Shifting of the switching point can be defined.

Fig. 5: Single object operating mode

4.4 Display and operating elements

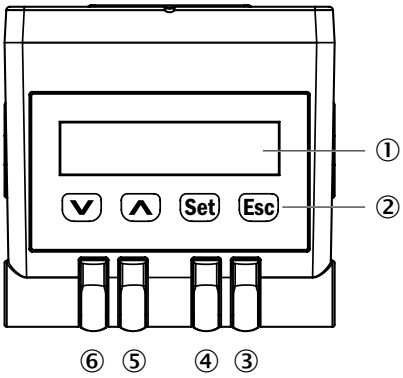


Fig. 6: Display and operating elements

1 *Display*
2 *Pushbuttons*
3 *Function indicator (yellow) “Act”*
4 *Function indicator (green) “Link”*
5 *Function indicator (yellow) “Q”*
6 *Function indicator (green) “ON”*

Function indicators (LEDs)

Function indicator	Description
Act	Data transfer display • LED yellow: data transfer • LED off: no data transfer
Link	Ethernet connection display • Green LED: Ethernet connection available • LED off: No Ethernet connection available
Q	Switching output display • LED yellow: output high • LED off: output low • LED flashes (10 Hz): overcurrent/undercurrent/short-circuit protection has triggered
ON	Operating status display • Green LED: normal operation/supply voltage on • LED off: no operation

Table 1: Function indicators (LEDs)

Operating menu symbols

The operating menu differentiates between the symbols “RUN”, “MEN” and “SET”.

Icon	Description
RUN	If the “RUN” signal lights up in the display, the current operating data of the sensor is displayed.
MEN	The MEN symbol lights up when the device is in the menu and the last selection level has not yet been reached.
SET	If the “SET” symbol light up, the settings of the sensor can be changed and, for example, values can be set.

Table 2: Operating menu symbols

Pushbuttons

Pushbutton	Description
(V)	• Select operating menu, parameter, or option. • Reduce value.
(^)	• Select operating menu, parameter, or option. • Increase value.
Set	• Short press: – Switch to the next-lowest menu level. – Save parameter change. – Confirm selection. • Long pressing time (> 2 sec.): – Operating menu start.
Esc	• Short press: Exit parameters without saving. Switch to the next-highest menu level. • Long press: Exit parameters without saving. Change to the default display - Quality of Run.

Table 3: Pushbuttons

4.5 Display

Default display

The Quality of Run is displayed by default:

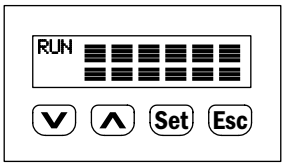


Fig. 7: Default display

Operating menus - 4 x , Monitoring/Setting/Teach-in/Info

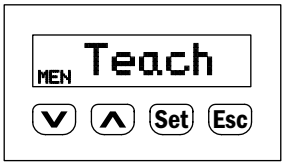


Fig. 8: Operating menu

Parameters using example of monitoring

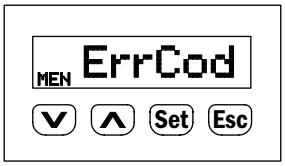


Fig. 9: Parameter display

4.6 Bar graph

Teach-in quality

After teach-in has been run, the number of flashing bars signals the quality of the teach-in process:

- 3 or more bars flashing: teach-in process was successful.
- Fewer than 3 bars flashing: check whether the signal correctly switches. If the signal does not correctly switch, repeat the teach-in process.

Process quality

If the “RUN” signal lights up, the number of bars shows the process quality.

- If 2 bars or fewer flashing: check whether the signal correctly switches.
- If the signal does not correctly switch, check the sensor for correct installation, monitor the quality of the print image of the object or the mechanical control of the object.
- If necessary, repeat the teach-in process.

5 Transport and storage

5.1 Transport

Improper transport

WARNING!

Damage to the pattern sensor due to improper transport.

Substantial material damage may result in the event of improper transport.

For this reason:

- The distance measuring device should be transported only by trained specialist staff.
- The utmost care and attention is required at all times during unloading and transportation on company premises.
- Note the symbols on the packaging.
- Do not remove packaging until immediately before you start mounting.

5.2 Transport inspection

Improper transport

Upon receipt, please check the delivery for completeness and for any damage that may have occurred in transit.

In the case of transit damage that is visible externally, proceed as follows:

- Do not accept the delivery or only do so conditionally.
- Note the scope of damage on the transport documents or on the transport company's delivery note.
- File a complaint.

NOTE!

Complaints regarding defects should be filed as soon as these are detected. Damage claims are only valid before the applicable complaint deadlines.

5.3 Storage

Store the pattern sensor under the following conditions:

- Do not store outdoors.
- Store in a dry area that is protected from dust.
- Do not expose to any aggressive substances.
- Protect from sunlight.
- Avoid mechanical shocks.
- Storage temperature: between –20 and +75 °C
- Relative humidity: max. 95%, non-condensing
- For storage periods of longer than 3 months, check the general condition of all components and packaging on a regular basis.

6 Mounting

6.1 Mounting procedure

1. Select the mounting site for the pattern sensor based on the information in the next chapter, “Requirements at the mounting site”.
2. Mount the pattern sensor using the fixing holes.
   → For dimensions, see page 67, chapter 15.1.
   → For mounting accessories, see page 72, chapter 16.2.

6.2 Requirements at the mounting site

The mounting site must meet the following requirements:

- For technical data, → see page 67, chapter 15.
- The light spot must cover a significant area on the print image (→ See page 21, Fig. 10). Select a range with high contrast differences and unique pattern elements as the significant area. The center of the light spot is marked with a notch on the upper side of the housing.
- Sensing distance: 20 mm
  The sensing distance is the distance from the front edge (housing edge) to the sensing material, e.g. an object.
- Angle: 15° (→ See page 22, Fig. 11)

NOTE!

We recommend that you use the supplied alignment tool to adjust the pattern sensor. → page 22, Fig. 13.

Significant areas

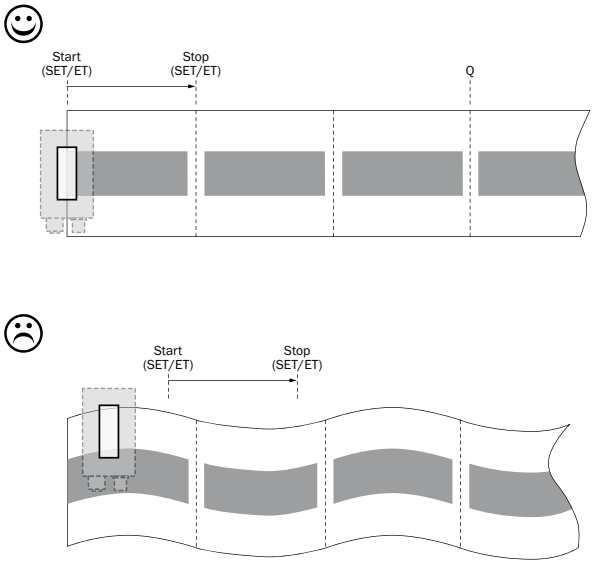
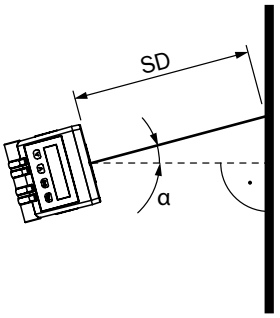


Fig. 10: Align light spot on the print image

The gray squares correspond to the printed area with clear features.

Arrangement when scanning on a flat surface or flat material



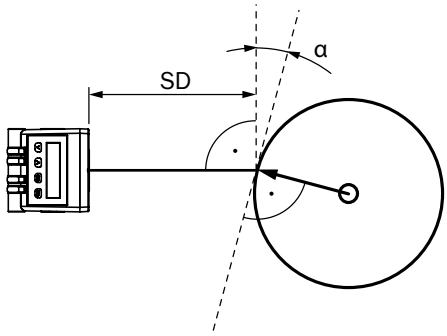
α ~ 15 °; SD = Sensing distance

Fig. 11: Arrangement of pattern sensor when scanning on a flat surface or flat material

α: angle 15 °

SD: sensing distance 20 mm

Arrangement when scanning rotary systems



α ~ 15 °; SD = Sensing distance

Fig. 12: Arrangement of pattern sensor when scanning rotary systems

α: angle 15 °

SD: sensing distance 20 mm

Use of adjustment tool

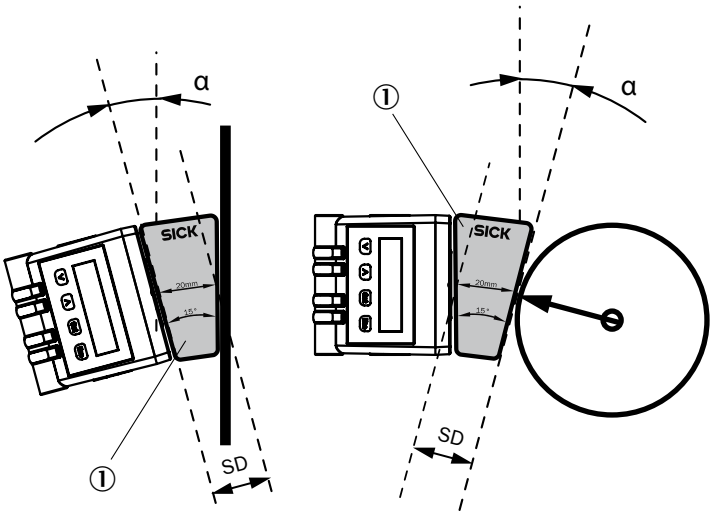


Fig. 13: Use of adjustment tool

1 Adjustment tool

7 Electrical connection

7.1 Safety

Incorrect supply voltage

WARNING!

Equipment damage due to incorrect supply voltage!

An incorrect supply voltage may result in damage to the equipment.

For this reason:

- Operate the pattern sensor using only safety extra-low voltage.
- The power supply unit must ensure safe electrical isolation (SELV/PELV) and limit the current to a maximum of 8 A.

Working with live parts

WARNING!

Equipment damage or unpredictable operation due to working with live parts.

Working with live parts may result in unpredictable operation.

For this reason:

- Only carry out wiring work when the power is off.
- Only connect and disconnect cable connections when the power is off.

7.2 Wiring notes

WARNING!

Faults due to incorrect wiring.

Incorrect wiring may result in operational faults.

For this reason:

- Only use shielded cables with twisted-pair wires.
- Follow the wiring notes precisely.

NOTE!

→ For pre-assembled cables, see page 71, chapter 16.1.

All electrical connections of the pattern sensor are configured as M12 round connectors.

The IP65 protection class is only achieved with screwed plug connectors or cover caps.

Please observe the following wiring notes:

- A correct and complete cable shielding concept is required for trouble-free operation.
- The cable shield must be connected at both ends in the control cabinet and at the sensor. The shield of the pre-assembled cable is connected to the knurled nut and thus to the sensor housing as well.
- The cable shield in the control cabinet must be connected to the operating ground over a large surface area.
- Appropriate measures must be taken to prevent equipotential bonding currents flowing through the cable shield.
- Do not lay cables parallel to other cables, especially not to devices with a high level of radiated emission, such as a frequency converter.

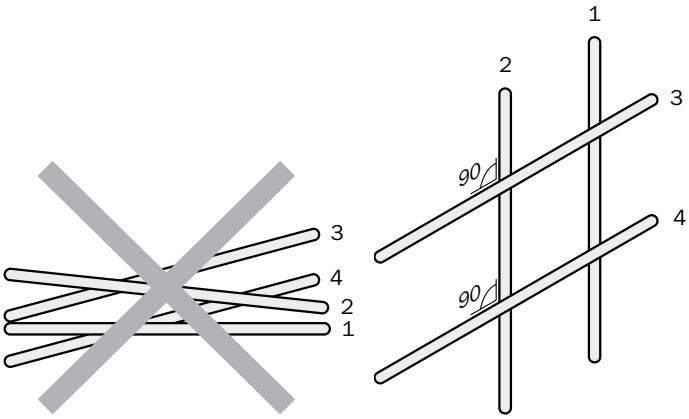


Fig. 14: Cross cables at right angles

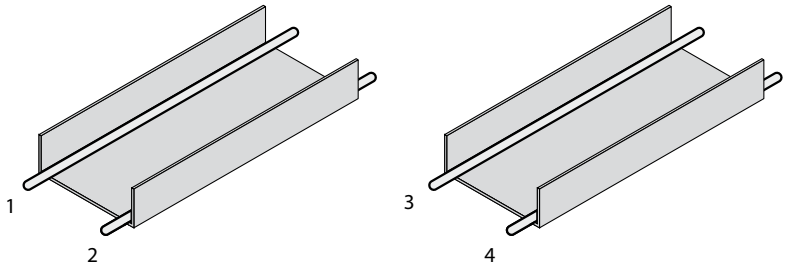


Fig. 15: Ideal laying – place cables in different cable channels

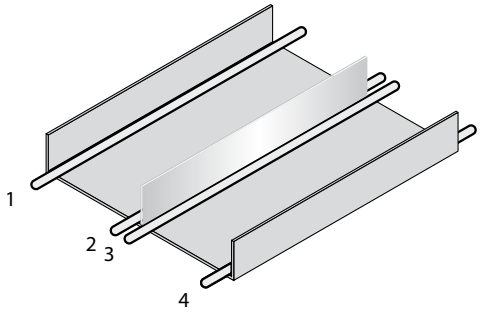


Fig. 16: Alternative laying – separate cables with metallic separators

1 Cables very sensitive to interference (analog measuring cables)

2 Cables sensitive to interference (sensor cables, communication signals, bus signals)

3 Cables which are a source of interference (control cables for inductive loads, motor brakes)

4 Cables which are powerful sources of interference (output cables from frequency inverters, welding system power supplies, power cables)

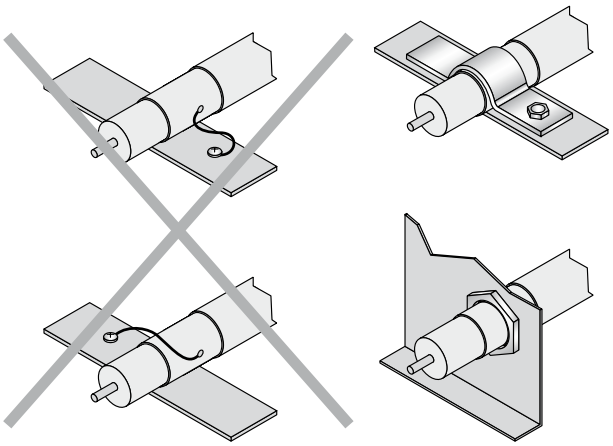


Fig. 17: Attach the screen using a short connection with a large surface area – ground both ends

7.3 System construction

Integration of the PS30 pattern sensor into the machine controller is shown in Fig. 18. The information on material movement must not necessarily be provided by an encoder, the signal can of course also be created by a motor feedback system or by the control.

Connection to an operating terminal is not required, but it is recommended for utilization of the visually-supported operation and diagnosis. If no connection is made to the HMI, e.g. operation is done via the display and operating elements on the pattern sensor, a PC can also be connected by Ethernet for commissioning and/or service work if needed and the SOPASair configuration tool made available via the web server can be used.

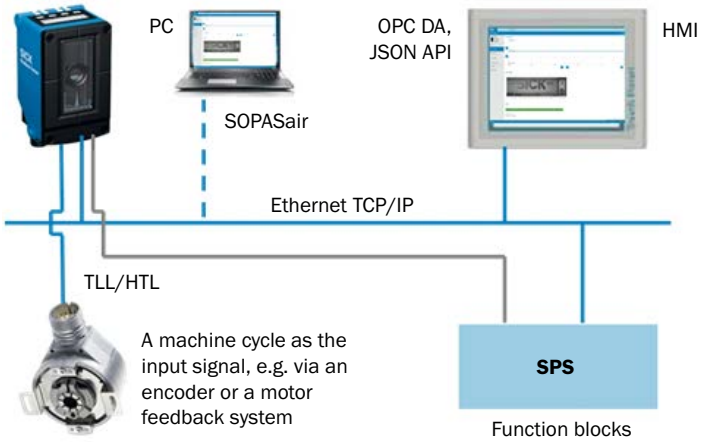


Fig. 18: Example of system construction

7.4 Connecting the pattern sensor electrically

NOTE!

→ For pre-assembled cables, see page 71, chapter 16.1.

1. Ensure that the voltage supply is not connected.
2. If necessary, turn the rotatable plug unit into the desired position in accordance with the figure.

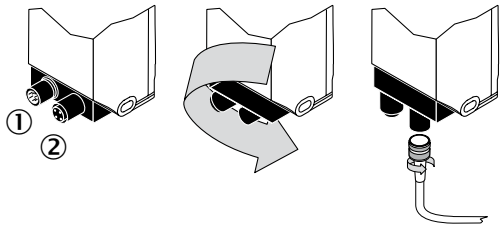


Fig. 19: Turn the control unit, make electrical connection

1 Supply voltage, external teach-in signal, encoder signal and switching output

2 Ethernet

3. Connect the pattern sensor according to the connection example.

7.5 Connection diagrams

7.5.1 Connection example, supply voltage and encoder signals

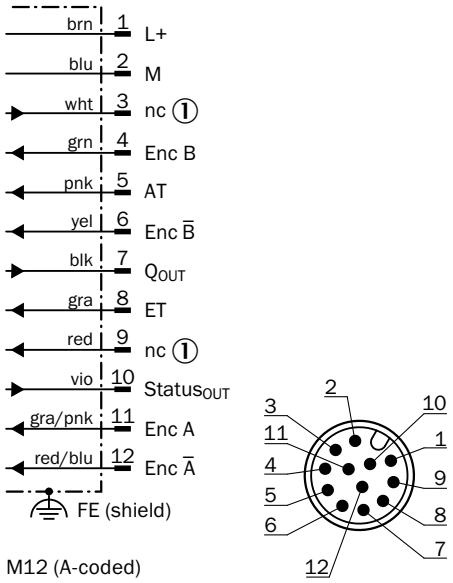


Fig. 20: Connection example, supply voltage, external teach-in signal, encoder signal and switching output, M12 male connector, 12-pin, A-coded

1 nc: not connected

Contact	Marking	Wire color	Description
1	L+	brown	Supply voltage: +12 ... +30 V DC
2	M	blue	Supply voltage: 0 V
3	nc	white	Not assigned
4	Enc B	green	Encoder signal B
5	AT	pink	Blanking input
6	Enc $\overline{B}$	yellow	Encoder signal B'
7	Q_{OUT}	black	Switching output → See page 69, chapter 15.5.
8	ET	gray	External teach-in signal
9	nc	red	Not assigned
10	$Status_{OUT}$	violet	Sensor status → See page 69, chapter 15.5.
11	Enc A	gray/pink	Encoder signal A
12	Enc $\overline{A}$	red/blue	Encoder signal A'

Table 4: Description of operating voltage male connector, external teach-in signal, encoder signal and switching output

7.5.2 Ethernet connection diagram

The pattern sensor has a 100Base-T Ethernet connection.

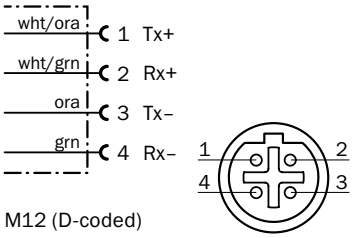


Fig. 21: Ethernet connection diagram, M12 female connector, 4-pin, D-coded

Contact	Marking	Wire color	Description
1	Tx+	white/or-ange	Send data signal, not inverted
2	Rx+	white/green	Receive data signal, not inverted
3	Tx–	orange	Send data signal, inverted
4	Rx–	green	Receive data signal, inverted

Table 5: Ethernet female connector description

8 Commissioning

Pushbutton damage

WARNING!

Pushbutton damage due to improper handling.

Improper handling of the pushbuttons can damage them. This will make operation difficult or impossible.

For this reason:

- Only operate the pushbuttons with your fingers or a suitable pointing device.
- Do not operate the pushbuttons using sharp or hard objects.

8.1 Steps to take

1. Switch on the supply voltage. “RUN” appears on the display during initial commissioning. In this case, press the Set pushbutton for longer than 2 seconds. “Setup” appears in the display.
2. Set the parameters for the encoder. → See page 30, chapter 8.2.
3. Operating mode
   - Select “Endless material” or “Single object“.
     → See page 34, chapter 9.4.1 or page 53, chapter 11.4.
4. If necessary, vary the resolution.
   - → See page 53, chapter 11.4.
5. Run teach-in process and, if necessary, set identical areas for blanking.
   - You can choose between the following options for the teach-in process:
     - Manual start-length teach-in via the “Teach” menu,
       → See page 40, chapter 9.5.1
     - Start-stop teach-in via an external teach-in signal,
       → See page 36, chapter 9.4.5.1
     - Start-length teach-in via an external teach-in signal,
       → See page 37, chapter 9.4.5.2
     - Start-length teach-in via SOPASair or Ethernet
       → See page 49.

- You can choose between the following options for blanking:
  - Blanking via the “Blank” parameter in the Teach menu of the operating field → See page 43, chapter 9.5.3.
  - Blanking via the AT input, → See page 45, chapter 9.5.4.
  - Blanking via SOPASair or Ethernet → See page 52, Fig. 32.

6. If necessary, set the offset for switching point shifting
   - via the “Offset” menu item in the Teach menu of the operating field → See page 41, chapter 9.5.2
   - via SOPASair or Ethernet, → See page 51.

NOTE!

Teach-in via an external signal always has priority over other teach-in processes.

8.2 Setting up the encoder

NOTE!

The encoder resolution (EncRes) must be between 100 µm ... 600 µm. If necessary, use a configurable encoder. If the encoder resolution is upheld, you can also use an existing motor feedback system.

Menu structure

→ See page 75, chapter 18.

Encoder settings

“Setup” is shown on the display during initial commissioning. In this setup, the settings of the encoder used are queried. The following parameters must be entered for the encoder:

- “EncTyp” (encoder type)
- “EncRes” (encoder resolution) → See the following section for determining the encoder resolution.
- “EncDir” (encoder direction)

NOTE!

For a correct signal, the rotational direction during the teach-in process and the set encoder direction must match.

Determining the encoder resolution

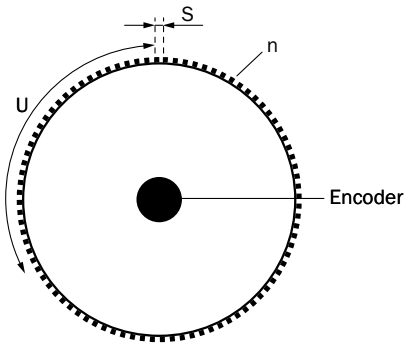


Fig. 22: Determining the encoder resolution

The graphic is an example and is used to illustrate the encoder resolution. A role is not absolutely mandatory.. The encoder resolution is the path covered by the material from encoder bar to encoder bar.

Calculate the encoder resolution (EncRes) using the following formula:

S = U/n

S: encoder resolution

U: outer scope of the role

n: number of encoder bars for 360 °

"Setup" menu encoder settings

CW

CCW

Display	Description
EncTyp	Select encoder type. **Options** • TTL: 4.5 V ... 5.5 V, TTL / RS-422 (differential) • HTL: 12 V ... 30 V, HTL / push-pull **Factory setting** • TTL
EncRes	Set encoder resolution.. **Adjustment range** • 100 ... 600 µm (in 1 µm steps) **Factory setting** • 100 µm
EncDir	Select encoder direction. **Options** • Auto: direction is automatically determined at the beginning of the teach-in process. • CW: clockwise • CCW = counter-clockwise **Factory setting** • Car

Table 6: "Setup" menu, encoder settings

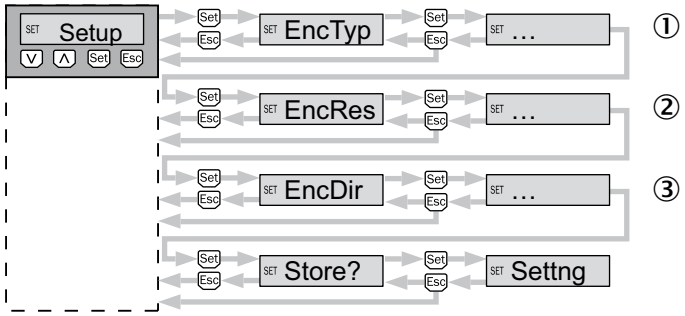
Running “Setup” menu

“Setup” appears in the display.

1. Press the Set pushbutton. The “EncTyp” (encoder type) parameter is displayed.
2. Press the Set pushbutton. The current value is displayed.
3. Select the encoder type used with the ▲ or ▼ pushbuttons.
4. Press the Set pushbutton, the “EncRes” (encoder resolution) parameter appears. The first digit on the left flashes.
5. Press the ▲ pushbutton to increase the digit. Press the ▼ pushbutton to decrease the digit.
6. Press the Set pushbutton. The next digit flashes.
7. Repeat steps 5 and 6 up to and including the last digit. The “EncDir” (encoder direction) parameter is displayed.
8. Select the encoder direction using the ▲ or ▼ pushbuttons.
9. Press the Set button. The “Store?” query appears.
10. Complete one of the following steps:
    - Press the Set pushbutton to save all inputs for the encoder. The “Monitor” menu appears.
    - Press the Esc pushbutton to cancel the process.

NOTE!

The encoder values are saved even after a reset. You can change the encoder values later in the “Setting” menu.



① Basic setting: TTL
Area: TTL / HTL
Description: The encoder type must be defined.

② Basic setting: 100 µm
Area: 100 µm ... 600 µm in steps of 1 µm
Description: The encoder resolution must be defined.

③ Basic setting: Auto
Area: Auto / CW / CCW
Description: The rotational direction of the encoder must be defined.

Fig. 23: Setup initial commissioning

9 Operating the sensor

Pushbutton damage

WARNING!

Pushbutton damage due to improper handling.

Improper handling of the pushbuttons can damage them. This will make operation difficult or impossible.

For this reason:

- Only operate the pushbuttons with your fingers or a suitable pointing device.
- Do not operate the pushbuttons using sharp or hard objects.

9.1 Navigation

A menu, a parameter, an option or a value can be selected using the Set, ▽, and △ pushbuttons. The menu path is specified in the respective chapters.
→ For the overall menu structure and navigation, see page 75, chapter 18.

9.2 Selecting an option

1. Select the desired parameter using the Set, ▽, and △ pushbuttons.
2. Select the desired option using the ▽ or △ pushbuttons.
3. Perform one of the following steps:
   - Press the Set pushbutton to save the change.
   - Press the Esc pushbutton to cancel the process. The parameter name is displayed again.
4. Perform one of the following steps to return to the Quality of Run default display:
   - Press the Esc pushbutton repeatedly until the status indicator is displayed again.
   - Wait for approx. one minute. The display will automatically switch back to the status indicator if no buttons are pressed. Any settings you have made will also be saved.

9.3 Changing the value

1. Select the desired parameter using the Set, ▽, and △ pushbuttons.
2. Press the Set pushbutton. The current value of the parameter is displayed. The first digit on the left flashes.
3. Press the △ pushbutton to increase the digit. Press the ▽ pushbutton to decrease the digit.
4. Press the Set pushbutton to save the digit entered. The next digit flashes. Press the Esc pushbutton to cancel the process.
5. Repeat steps 3 and 4 until the last digit is saved. The parameter name is displayed.
6. Press the Esc pushbutton repeatedly until the Quality of Run default display is shown again. Alternatively, you can wait for approx. one minute. The display will automatically switch back to the default display if no buttons are pressed.

9.4 Setting menu

In the Setting – Display MENSetting menu, the parameter configurations of the sensors listed below are made.

The parameters are reached in the Setting menu by pressing Set and selecting with ▽ △.

The available options are confirmed after pressing Set and then ▽ △ and confirmed with Set

9.4.1 Parameter operating mode

Options	Description
Endl	**Endless operating mode** A web with recurring, connected patterns is moved past the pattern sensor. This switching point corresponds to the beginning of the teach-in area. The switching point can be shifted via an offset.
Single	**Single object operating mode** Single, non-connected patterns are moved past the pattern sensor. This switching point corresponds to the end of the taught-in object area. The switching point can be shifted via an offset.

Factory settings: Endl – endless material

9.4.2 Encoder type (EncTyp) parameter

Parameter	Description
EncTyp	Select encoder type. **Options** • TTL: 4.5 V ... 5.5 V, TTL / RS-422 (differential) • HTL: 12 V ... 30 V, HTL / push-pull **Factory setting** • TTL

9.4.3 Encoder resolution (EncRes) parameter

Parameter	Description
EncRes	Set encoder resolution.. **Adjustment range** • 100 ... 600 µm (in 1 µm steps) **Factory setting** • 100 µm

9.4.4 Encoder direction (EncDir) parameter

Parameter	Description
EncDir	Select encoder direction. **Options** • Auto: • CW: clockwise • CCW: counter-clockwise **Factory setting** • Car

9.4.5 External teach-in parameter (ETeach)

Option	Description
Start-stop teach-in (StaSto)	The rising signal edge at the input starts the teach-in process, the following signal edge ends the teach-in process. For execution → See page page 36, chapter 9.4.5.1
Start-length teach-in (StaLen)	The rising signal edge at the input starts the teach-in process. The teach-in process is automatically ended by the sensor after the teach-in length entered as the parameter is reached. For execution → See page 37, chapter 9.4.5.2.

Factory settings: StaSto - start-stop teach-in

9.4.5.1 Executing start-stop teach-in via an external teach-in signal

Pre-requisite: the encoder settings, the selection of the operating mode and the resolution have been made.

1. Press the Set pushbutton for at least 2 seconds to reach the “Monitr” menu.
2. Select the “StaSto” option.
   Menu path: status indicator → Set → Monitr → ▼ ▲ → Setting → Set → Mode → ▼ ▲ → ETeach → Set → StaSto
3. Position the light spot at a significant point on the print image. This point later becomes the start point. The start point corresponds to the switching point when in Endless material operating mode.
4. Create external voltage signal at the “ET” input. The teach-in process starts. The current point is saved as the start point.
5. Lead a maximum of one object length/format length through the light spot in the rotational direction of the encoder with positional accuracy. Note that for a correct signal, the rotational direction during the teach-in process and the set encoder direction (EncDir) must match.
6. Remove external voltage signal from the “ET” input. The current point is saved as the end point. The stop point is the switching point when in Single object operating mode. The teach-in process ends. The “Busy” display appears.
7. Move formats through the light spot in the Endless material operating mode until the “Busy” display goes out. No other objects are necessary in the Single object operating mode. The calculation of the teach-in image and the reference areas is done while the “Busy” display is present. After teach-in is complete, a bar graph is shown in the display which shows the quality of the teach-in process:
   - Three or more bars flashing: teach-in process successful.
   - Fewer than 3 bars flashing: check whether the signal correctly switches. If the signal does not correctly switch, the teach-in process must be repeated. → See page 40, chapter 9.5.1.
8. The bar graph flashes for another 10 format lengths and then automatically changes the display to the “Quality of Run” status indicator. The bar graph no longer flashes and signals the process quality. The RUN symbol is displayed.

Requirements

- Note the “Minimum format length”, “Maximum format length” and “Minimum format height” technical data. → See page 68, chapter 15.2.
- The light spot must cover a significant area on the print image. Select a range with high contrast differences and unique features as the significant area. → See page 21, chapter 6.2.
- The sensing distance (distance from front sensor edge to the object) and the pattern sensor angle to the image must be upheld. → See page 21, chapter 6.2.
- Avoid fluctuations in distance and height.
- Teach in a maximum of a complete format length/object length.

9.4.5.2 Executing start-length teach-in via an external teach-in signal

Pre-requisite: the encoder settings, the selection of the operating mode and the resolution setting have been made.

1. Press the Set pushbutton for at least 2 seconds to reach the “Monitr” menu.
2. Select the “StaLen” option.
   Menu path: status indicator → Set → Monitr → ▽ △ → Setting → Set → Mode → ▽ △ → ETeach → Set → StaSto → ▽ △ → StaLen
3. Press the Set pushbutton. The currently entered object length/format length is displayed.
4. Press the Set pushbutton. The first digit on the left flashes.
5. If necessary, change the value. → See page 34, chapter 9.3.
6. Position the light spot at a significant point on the print image. This point later becomes the start point. The start point corresponds to the switching point when in Endless material operating mode.
7. Create external voltage pulse at the “ET” input. The teach-in process starts with rising signal edge. The current point is saved as the start point.
8. Lead the format or the object through the light spot in the rotational direction of the encoder with positional accuracy. Note that for a correct signal, the rotational direction during the teach-in process and the set encoder direction (EncDir) must match.
9. After the entered teach-in length has run through, the teach-in process stops automatically. The end point of the teach-in process corresponds to the switching point when in Single object operating mode.
10. Move formats through the light spot in the Endless material operating mode until the “Busy” display goes out. No other objects are necessary in the Single object operating mode. The calculation of the teach-in image and the reference areas is done when the “Busy” display is present. A bar graph is shown in the display which shows the quality of the teach-in process:
    - Three or more bars flashing: teach-in process successful.
    - Fewer than 3 bars flashing: check whether the signal correctly switches. If the signal does not correctly switch, the teach-in process must be repeated. → See page 40, chapter 9.5.1.
11. The bar graph flashes for another 10 format lengths and then automatically changes the display to the “Quality of Run” status indicator. The bar graph no longer flashes and signals the process quality. The RUN mode is displayed.

Requirements

- Note the “Minimum format length”, “Maximum format length” and “Minimum format height” technical data. → See page 68, chapter 15.2.
- The light spot must cover a significant area on the print image. Select a range with high contrast differences and unique features as the significant area. → See page 21, chapter 6.2.
- The sensing distance (distance from front sensor edge to the object) and the pattern sensor angle to the image must be upheld. → See page 21, chapter 6.2.
- Avoid fluctuations in distance and height.
- Teach in a maximum of one format length/object length.

9.4.6 Ethernet configuration (Ethern) parameter

NOTE!

Changes to the “Ethern” parameter are not adopted until the device is restarted.

Enter the Ethernet configuration via the “Ethern” parameter.
→ For more information on the Ethernet interface, see page 49, chapter 11.

→ For the menu structure and navigation, see page 75, chapter 18.

Parameter	Description
IPAdr	Enter IP address. **Factory setting** • MSB: 192 • Byte2: 168 • Byte1: 100 • LSB: 100
SubMas	Enter IP network mask. **Factory setting** • MSB: 255 • Byte2: 255 • Byte1: 255 • LSB: 0
D-gate	Enter standard gateway. **Factory setting** • MSB: 0 • Byte2: 0 • Byte1: 0 • LSB: 0

DHCP	Factory setting: deactivated.
MAC ID	Individual address

Table 7: “Ethern” parameter - the default values are shown

Entering PAdr, SubMas, DHCP, MAC ID and D-Gate

The “IPAdr”, “SubMas” and “D-Gate” parameters are entered in the same way. The entry is described here for the IP address.

1. Select the “IPAdr” parameter under “Ethern”.
2. Press the Set pushbutton. The current value for the “most significant byte” is displayed. The first digit on the left flashes.
3. Press the ⌃ pushbutton to increase the digit. Press the ⌄ pushbutton to decrease the digit.
4. Press the Set pushbutton to save the digit entered.
   The next digit flashes.
5. Repeat steps 3 and 4 until the last digit is saved. The value of the next byte is displayed.
6. Repeat steps 3 to 5 for the second, third and fourth byte (least significant byte).
7. After you have confirmed your entry for the value of the fourth byte with the Set pushbutton, the “IPAdr” parameter is displayed.

9.4.7 Device reset (Reset) parameter

Performing reset

Parameter	Description
Reset	Perform a reset. **Options** • Yes: perform a reset. • No **Factory setting** • No

1. Select the “Reset” parameter in the “Setting” menu.
   → See page 34, chapter 9.4.
2. Press the Set pushbutton.
3. Select the “Yes” option.
4. Press the Set pushbutton to reset the device to its initial state. Press the Esc pushbutton to cancel the process.

9.5 Teach menu

In the Teach – Display MENTeach menu, the manual start-length teach-in can be executed via the control panel. In addition, a switching point shift and the blanking areas can be configured for the manual and external teach-in.

The parameters are reached in the Teach menu by pressing Set and selecting with ▲ ▼.

The available options are confirmed after pressing Set and then ▲ ▼ and confirmed with Set.

9.5.1 Manual start-length teach-in parameter via control panel (StaLen)

Requirements

- Note the “Minimum format length”, “Maximum format length” and “Minimum format height” technical data. → See page 67, chapter 15.
- The light spot must cover a significant area on the print image. Select a range with high contrast differences and unique features as the significant area. → See page 21, chapter 6.2.
- The sensing distance (distance from front sensor edge to the object) and the pattern sensor angle to the image must be upheld. → See page 21, chapter 6.2.
- Avoid fluctuations in distance and height.
- Teach in a maximum of the format length or object length.

“StaLen” parameter

Value/Option	Description
Length	Enter the length of the teach-in area in mm. Use a maximum of the format length or object length as a teach-in length.
Currently entered format length	Display of the currently entered length of the teach-in area. Confirm or change the current length of the teach-in area in mm. **Input area** • 15 mm ... 1000 mm **Factory setting** • 240 mm
START?	Set the start point for the teach-in process.
Busy	Move an object past the sensor in the Single object operating mode, no other objects are necessary for the teach-in. Move formats through the light spot in the Endless material operating mode until the “Busy” display goes out.

Table 8: “StaLen” parameter

Performing start-length teach-in

Pre-requisite: the encoder settings, the selection of the operating mode and the resolution setting have been made.

1. Press the Set pushbutton for at least 2 seconds to reach the “Monitr” menu.
2. Select the “StaLen” parameter.
   Menu path:
   status indicator → Set → Monitr → ▲ ▼ → Teach → Set → StaLen
3. Press the Set pushbutton. The currently entered format length is displayed.
4. Press the Set pushbutton. The first digit on the left flashes.
5. If necessary, change the value. → See page 34, chapter 9.3.
6. Repeat step 5 until the last digit is saved. The “Start?” parameter is displayed.
7. Position the light spot at a significant point on the print image. This point later becomes the start point. The start point corresponds to the switching point when in Endless material operating mode.
8. Press the Set pushbutton. The point is saved as the start point. The “Busy” display appears.
9. Lead the object past the sensor when in Single object operating mode. The stop point of the teach-in process corresponds to the switching point of the Single object operating mode.

   Move formats through the light spot in the Endless material operating mode until the “Busy” display goes out. A bar graph appears in the display which shows the quality of the teach-in process:

   - Three or more bars flashing: teach-in process successful.
   - Fewer than 3 bars flashing: check whether the signal correctly switches. If the signal does not correctly switch, the teach-in process must be repeated. → See page 40, chapter 9.5.1.
10. The bar graph flashes for another 10 format lengths and then automatically changes the display to the “Quality of Run” status indicator. The bar graph no longer flashes and signals the process quality. The “RUN” symbol lights up in the display.

9.5.2 Switching point shift parameter (OffSet)

NOTE!

If an offset is necessary, it must be entered after the areas to be blanked are set.
An offset is reset to 0 mm after every new teach-in.

Fig. 24: Set offset (switching point shift) for Endless material operating mode

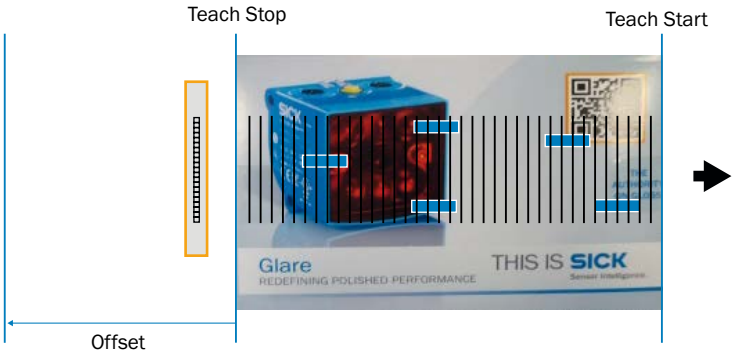


Fig. 25: Set offset (switching point shift) for Single object operating mode

“Offset” parameter

You can shift the switching point for the “Q” switching output using the “Offset” parameter.

→ For the menu structure and navigation, see page 75, chapter 18.

Parameter	Description
Offset	Shift the switching point for the “Q” switching output into the desired position. The start point of the teach-in process is used as the switching point in the Endless material operating mode, in the Single object operating mode, the stop point of the teach-in process is used. **Adjustment range** • 0 mm ... taught-in format length in mm **Factory setting** • 0 mm

Table 9: “Offset” parameter

Performing “Offset” setting

Pre-requisite: the encoder setting, the selection of the operating mode and the resolution setting have been made.

1. Press and hold the pushbutton for at least 2 seconds to reach the “Monitr” menu.
2. Select the “Offset” parameter.

Menu path: status indicator → Set → Monitr → ▼ ▲ → Teach → Set → StaLen → ▼ ▲ → OffSet

Performing “Offset” setting (continued)

3. Press the Set pushbutton. The currently entered offset is displayed.
4. Press the Set pushbutton. The first digit on the left flashes.
5. If necessary, change the value. → See page 34, chapter 9.3
6. Repeat step 5 until the last digit is saved.
7. Press the Set pushbutton. The point is saved as the start point.

9.5.3 Blanking areas (Blank) parameter

NOTE!

The blanking of image areas can only be done after a successful teach-in process. The blocked areas are deactivated after another teach-in process.

The teach quality can change due to the use of blanking areas.

Fig. 26: Blanking image areas

1 Start value for blanking
2 Blanking range
3 End value for blanking

You can blank identical image areas via the “Blank” parameter.

→ For the menu structure and navigation, see page 75, chapter 18.

Parameter/ option	Description
Area1	Enter the first area for blanking. An upper and lower limit can be entered for every area. **Adjustment range** • 0 ... 999 mm
Area2	Select the second area for blanking. **Adjustment range** • 0 ... 999 mm
Apply?	Start the blanking process using the Set pushbutton.

Table 10: "Blank" parameter

Entering blanking areas

In Endless material operating mode you can configure two areas for blanking in the sensor's operating field. Areas that have been blanked are no longer analyzed. Blanking provides a way of ignoring varying elements (a best-before date, for example). The process is identical for the "Area1" and "Area2" parameters.

1. Select the "Blank" parameter.
   Menu path: status indicator → Set → Monitr → ▼ ▲ → Teach → Set → StaLen → ▼ ▲ → Blank
2. Press the Set pushbutton. The "IDArea" parameter and, after Set is pressed several times, "Area1" are selected. Either jump to "Area2" by pressing ▼ or display the current value for the start of "Area1" with Set.
3. If necessary, change the value. → See page 34, chapter 9.3.
4. The end ("End") for the "Area1" parameter is shown. The first digit on the left flashes.
5. If necessary, change the value. → See page 34, chapter 9.3.
6. If necessary, repeat steps 2 to 6 for the "Area2" parameter.

Blanking out image areas

You must activate the entered image areas using the "Apply?" parameter so they can be blanked.

1. Select the "Apply?" parameter under "Blank"
   Menu path: status indicator → Set → Monitr → ▼ ▲ → Teach → Set → StaLen → ▼ ▲ → Blank → Set → IDArea → Set → Area1 → ▼ ▲ → Apply?
2. Press the Set pushbutton. "Busy" is displayed. The sensor recalculates the reference areas for the now-defined area.
3. After recalculation, a bar graph is shown in the display which shows the quality of the teach-in process:
   - 3 or more bars flashing. teach-in with blanking areas was successful.
   - Fewer than 3 bars flashing: check whether the signal correctly switches. If the signal does not correctly switch, the blanking areas must be modified.

Blanking out image areas

4. The bar graph flashes for another 10 format lengths in the Endless material operating mode and then automatically changes the display to the “RUN” status indicator. The bar graph no longer flashes and signals the process quality. The RUN mode is displayed.

Deactivating blanking

You can deactivate blanking as follows:

- Execute a new teach-in process.
- Do so using the “Blank” parameter. The teach-in data is recalculated from the saved teach-in image.

Deactivate blanking using the “Blank” parameter as follows:

1. Select the “Area1” or “Area2” parameter under “Blank”.
2. Set the upper and lower limit to “0 mm”.
3. Press the Set pushbutton. The teach-in data is recalculated from the saved teach-in image.

9.5.4 Specifying image areas via “AT” external signal

NOTE!

The specification for the blanking areas via an external signal at input “AT” is only possible during a teach-in process.

NOTE!

The start and end values of the blanking areas can be read out after a teach-in process for the “Blank” parameter.

Fig. 27: Blanking out image areas

1 Start value for blanking
2 Blanking range
3 End value for blanking

During the teach-in process, set the signal to “High” to blank via the “AT” input. The image areas, for which a high signal was present during the teach-in process, are blanked during operation.

You can blank up to a maximum of two image areas. If a high signal is often present, other image areas are not blanked.

9.6 Monitoring menu

In the Monitoring – Display MENMonitr menu, the quality specification parameters listed below concerning the teach-in process, current parameter values and error messages are displayed.

The parameters are reached in the Monitoring menu by pressing Set and selecting with ▲ ▼.

The available values are displayed after pressing Set (parameter selection) and selected via ▲ ▼ and displayed with Set.

→ For the menu structure and navigation, see page 75, chapter 18.

Parameter	Description
QoR (Quality of Run)	Displays the quality of the pattern recognition in the process **Displays** • Analog to 4.5 • The QoR display is the default display and is automatically selected after 60 s if the device is not operated.
QoT (Quality of Teach-in)	Displays the quality of the teach-in process **Displays** • 3 or more bars: teach-in process successful. • Fewer than 3 bars: check whether the signal correctly switches. If the signal does not correctly switch, the teach-in process must be repeated. → See page 40, chapter 9.5.1.
TeaLen	Shows the programmed pattern length in mm.
ActLen	Shows the current format length in mm in the Endless material operating mode.
EncPos	Displays the current encoder position. **Display range 40** • 0 ... 16383 • A “+” indicates that the current rotational direction matches the taught-in rotational direction. • A “-” indicates that the current rotational direction is opposite the taught-in rotational direction. **Unit** Bars
ErrCod	Shows the current error code when an error is present. “NoErr” is displayed if there is no error present. → See error codes page 59, chapter 13.1.

Table 11: “Monitoring” menu

9.7 Info menu

The IP address, the serial number and the software version can be read out in the Info Menu.

The parameters are reached in the Monitoring menu by pressing Set and selecting with ▲ ▼.

The corresponding values are displayed after pressing Set (parameter selection).

10 Operation via Ethernet TCP/IP

Operation and integration variants

Configuration, operation and diagnosis of the PS30 pattern sensor can be done with the Ethernet interface as an alternative to manual operation using the operating and display elements on the device. SICK AG offers the following tools for the activation and evaluation of the PS30 via Ethernet TCP/IP:

1. Function blocks for integrating the PS30 via the machine controller for conventional PLC systems. The function blocks including documentation are available as downloads on the SICK AG homepage (www.sick.de/ps30).
2. OPC DA for activating the PS30 via the machine controller or HMI of the machine. The OPC DA profile including documentation is available as a download on the SICK AG homepage (www.sick.com/PS30).
3. SICK AGA provides the SOPASair configuration and diagnosis software for the PS30 which can be accessed by a PC or HMI through the web server integrated in the sensor. If only specific operating and display elements are to be integrated in the user interface of the machine, these controls can be accessed and integrated by the user via specific addresses. An overview of the controls as well as their IP addresses can be found on the SICK AG homepage (www.sick.com/PS30).

IP network configuration

The web server of the PS30 pattern sensor is accessed via the IP address of the sensor.

The PS30 supports UPnP. The sensor is automatically configured in an UPnP-capable system.

The DHCP function is deactivated on delivery. When the DHCP is activated and a DHCP server is available in the network, the PS30 obtains the IP address from this server.

If DHCP is deactivated, the configured static IP address is used (factory settings 192.168.100.100).

NOTE!

The currently set IP address can be found on the device via the display and operating element in the “INFO” menu (see page 76, chapter 18.5).

NOTE!

If the IP configuration of the sensor is changed, the supply voltage must be switched off, then back on to activate the new setting.

11 Operation via SOPASair

11.1 Integrating PS30 pattern sensor in the network

1. Connect the PS30 pattern sensor to the PC or machine network using an Ethernet cable.
2. Call up the IP address with the web browser. SICK recommends using the Google Chrome web browser.
3. The SOPASair configuration software starts. The Fig. 28 user interface for the PS30 appears.

Fig. 28: Structure of the user interface

1 Basic functions
2 Device identification
3 Menu selection
4 Configuration of SOPASair software tool
5 Display and user interface
6 Selecting the user level
7 Status bar

1. Basic functions
   - ≡ Monitoring: folding out objects 2, 3 and 4
   - Search function
   - Updating of interface
     Reloading of the interface with updated sensor data
   - **Switching operation lock on/off for input fields**
     If the operation lock is not active, entries via the sensor display are not visualized in SOPASair.
2. Device identification
   - Display of part description
   - User-assigned name for sensor placement
   - Software version of the sensor
   - Serial number of the sensor

3. Selection of menus
   Four menus are available as with the operation on the sensor:
   - Monitoring
   - Teach-in
   - Settings
   - Device info

   The currently selected menu with the respective interface displayed in field ⑥ is color-coded. Clicking the cursor on the corresponding line in field ③ switches between the menus.
4. Settings of SOPASair software tool
   Click the cursor in this field to switch to this mode.
   The corresponding interface is displayed in field ⑥.
5. Display and user interface for the selected menu
   - Operating elements for teach-in
   - Display of the teach-in image
   - Display of the teach-in quality
   - Operating elements for job protection
6. Selection of the user level: The Run and Maintenance user levels are available. The factory-set password for the Maintenance user level is Maintenance. It can be changed in the settings.
7. Status bar
   - Display of the device status via text plus color signals
   - Display of the process success via text plus color signals

11.2 Monitoring menu

The display control panel is shown in Fig. 29 when in Endless material operating mode.

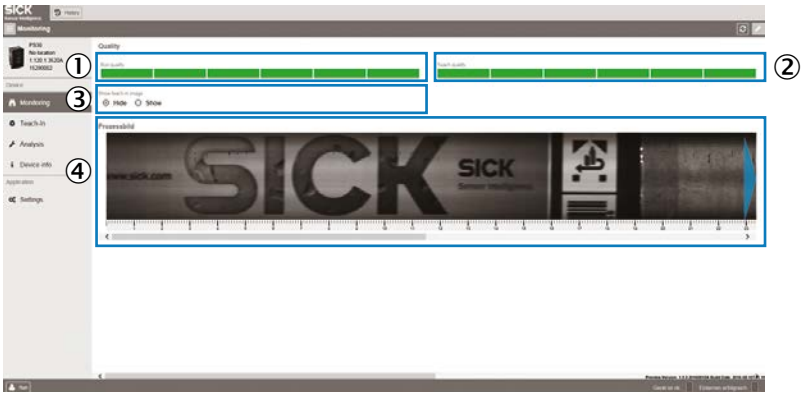


Fig. 29: Display in the Monitoring menu when in Endless material operating mode.

1. The “Quality of Run” and the resulting switching accuracy is shown qualitatively by the bar diagram.
   When fewer than 3 bars are flashing, the color changes to red, there is no measurement accuracy, and switching is not ensured.
2. The bar graph displays the quality of teach and the resulting teach-in accuracy. If fewer than 3 bars are displayed, the color changes to red to indicate that the teach-in operation has failed.
3. If needed, display of the current teach-in image can be selected, e.g. to make a comparison of the process image with the teach-in image.
4. An image of the object recorded when the process is running can be accessed by double clicking. It is a snapshot; a continuous display is not possible due to the data volume.

11.3 Teach-in menu

The display control panel in the Teach-in menu is shown in Fig. 30. In this menu, the teach-in process can be done as a start-length teach-in.

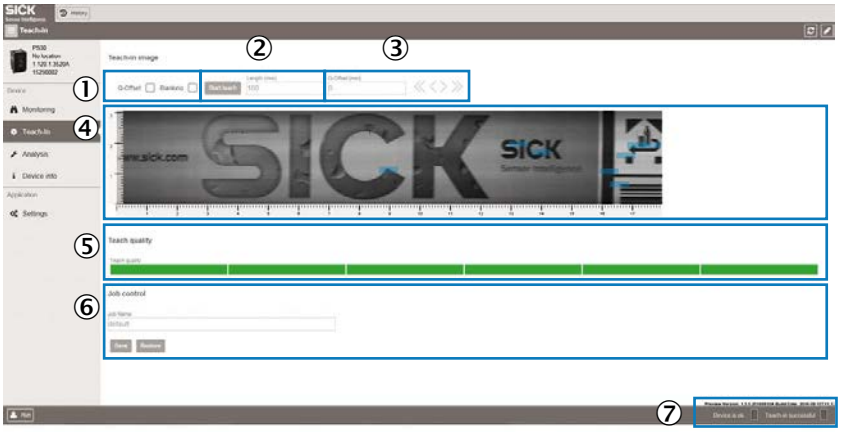


Fig. 30: Display in the Teach-in menu when in Endless material operating mode

1 Activate / deactivate switching point offset and blanked areas

2 Start teach-in process (start-length teach-in)
Define length of teach-in area

3 Activate switching point shift

4 Display of the teach-in image after successful teach-in process The reference areas are displayed with blue squares

5 Display of the teach-in quality via the bar diagram

6 Job protection function for easy format change

7 Display of the process status

Fig. 31: Display in the Teach-in menu with activated offset when in Endless material operating mode.

1. If switching point shifting is required, it can be selecting by clicking on the checkbox. The mark shown in green (see ① in Fig. 31) can be shifted by pulling the point to the desired position with the cursor. After deactivating the checkbox, the mark is deleted and the switching point shift is deactivated.

.

Fig. 32: Display in the Teach-in with blanking menu.

1 Blanked areas or teach-in areas

2 Recalculation of reference areas.

Clicking on the checkbox with the cursor selects the Blanking function, then moving the red marks (see ① in Fig. 32) with the cursor blanks up to two areas (in Endless material operating mode). Areas that have been blanked are no longer analyzed. Blanking provides a way of ignoring varying elements (a best-before date, for example). In Single object operating mode, this provides a way of restricting the area of the label to be analyzed. The reference areas must be recalculated to activate the function. This is activated via the “Recalculate teach” field (see ② in Fig. 32). The reference areas are placed in the non-blanked area. This can reduce the teach quality.

2. Pressing on the “Start teach” field initiates the teach-in process. When in Single object operating mode, it is sufficient to lead the object past the sensor. Then the teach image and the reference areas are calculated. During the entire process, the process is signaled as “In progress” and by the color yellow in the status bar (see ⑦ in Fig. 30). After the teach-in process is complete, the teach quality is displayed in the bar diagram.
   The material is to be led past the sensor during the entire teach-in process, displayed in the status bar, when in Endless material operating mode. The repeat length is also calculated by the sensor.
3. The required switching point offset can also be entered directly as a numerical value in mm or it can be shifted to the left or right using the arrows displayed. In Endless material operating mode, the switching point offset can only be set starting from the end of the format. The value must be entered in mm. Instead of being at the end of the format, the switching point is then offset by the distance value entered. The length of the teach-in area is to be selected for the start-length teach-in. Values between 15 mm and 1000 mm are permitted.
4. Display of the teach-in screen once the teach-in operation has been completed. The reference areas are represented by blue rectangles.
5. The bar graph displays the quality of teach and the resulting teach-in accuracy. If fewer than 3 bars are displayed, the color changes to red to indicate that the teach-in operation has failed.
6. Back up job The data of the current job including the teach-in screen, teach-in data (blanked areas and offset, for example), and the sensor configuration can be saved outside of the sensor. This data is saved in a .job file. After this, the format can be changed easily by selecting one of the .job files saved previously. If more than one file is selected initially when a file is loaded, the correct format can be selected from a preview screen.
7. Status bar
   - Displays the device status in text format plus color-coded signals
   - Displays the success of the process in text format plus color-coded signals

11.4 Settings menu

The first time the sensor is accessed, this happens automatically in the Run user level. This user level is where the machine operator can find all of the options for teaching and monitoring the sensor.

If any of the sensor settings (the sensor resolution, for example) need to be changed, you must switch to the Maintenance user level. The password when logging in for the first time is maintenance. It can be changed at any time in the settings for the SOPASair WebUI.

The display control panel is shown in Fig. 33.

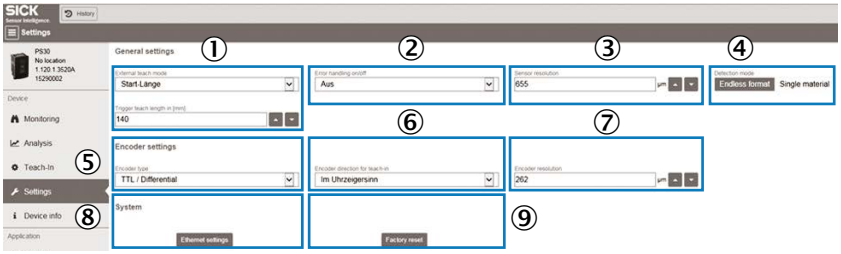


Fig. 33: Structure of the user interface in the Settings menu

1. The two options
   a) Start-length teach-in and
   b) Start-stop teach-in
   are available for setting the external teach-in.
   The desired length of the teach-in area is to be configured for the start-length teach-in. The teach-in is started in SOPASair in the Teach-in menu or by the machine controller by activating the ET input signal. When the start-length teach-in is selected, the teach-in is automatically ended by the sensor after the configured length. When the start-stop teach-in is selected, the teach-in process is automatically ended when the ET input signal is deactivated.
2. Automatic error handling can be activated in the Endless material operating mode. The sensor sets up to 5 switching outputs according to the reported repeat length even when the image could not be detected. This option is not available in the Single object operating mode.
3. The sensor resolution can be set from 150 µm to 1000 µm.
   The maximum possible object speed correlates with the selected resolution. Fig. 34 shows this correlation.

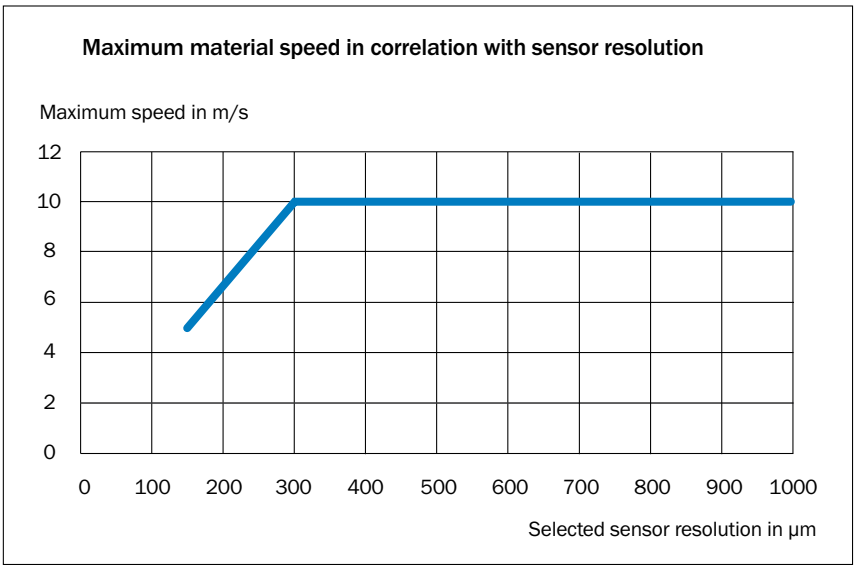


Fig. 34: Maximum material speed in correlation with sensor resolution

4. The two Endless material or Single object operating modes are selected.
5. The TTL/differential and HTL/PushPull options are available for encoder type selection.

6. The encoder resolution can be calculated in 1 µm steps according to the method described in → page 30, chapter 8.2 and set here.
7. The Auto (the sensor automatically determines the rotation direction), CW (clockwise) and CCW (counter-clockwise) options are available for determining the rotational direction of the encoder.
8. The Ethernet interface can be configured here.
   It is shown in the entry field displayed in Fig. 35.
9. The device can be reset to the factory settings.

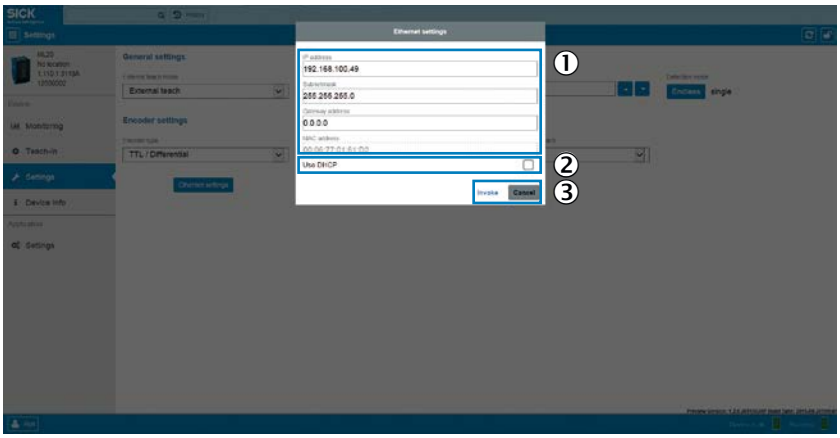


Fig. 35: Display in the Settings menu with selected Ethernet setting

1 The IP address, the sub-net mask, the gateway address and the MAC address can be set here.

2 The DHCP function is used by clicking on the checkbox.

3 The change is activated.
The change is not applied until the sensor has been restarted.

11.5 Device info menu

The display control panel in the Device menu is shown in Fig. 36.

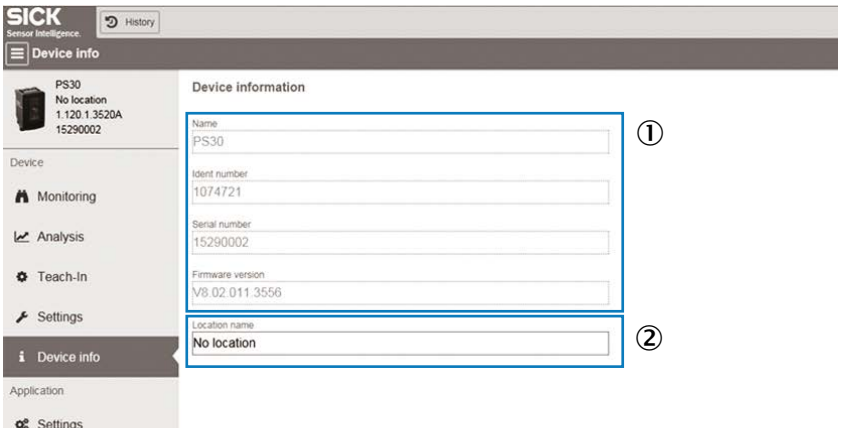


Fig. 36: Display in the Device info menu

1. The part description, part number, serial number and firmware version number product information is displayed.
2. The user can assign a label to the specific sensor.

11.6 Settings (of SOPASair WebUI) menu

The display control panel in the Settings menu is shown in Fig. 37.

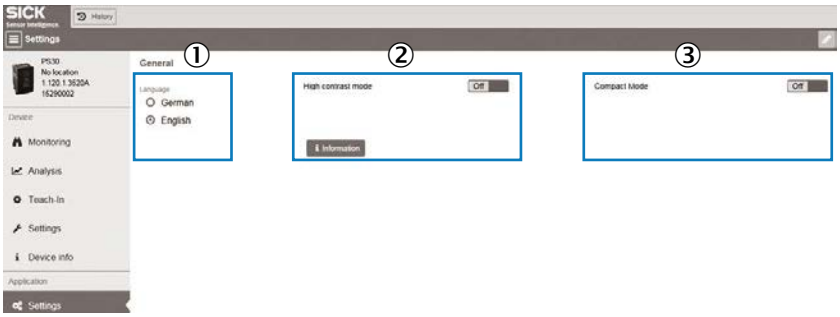


Fig. 37: Display in SOPASair settings operating mode

1 Language selection

2 Contrast mode

3 Compact mode

1. The language options are German and English.
   The password can also be changed in the Maintenance user level.
2. In addition to the normal display in the figures, a display with high black/white contrast can be selected. This may be necessary when ambient light is strong.
3. The display is optimized for small screens in Compact mode.

11.7 Analysis menu

In the Analysis menu on the Maintenance user level, there are two different plots which can be used to analyze the detected format length (in Endless material operating mode) and the digital outputs Q as well as the status output.

Detailed analyses of the switching behavior of the sensor can be carried out with the Zoom function, plot offset, and the high-precision time axis in seconds or milliseconds.

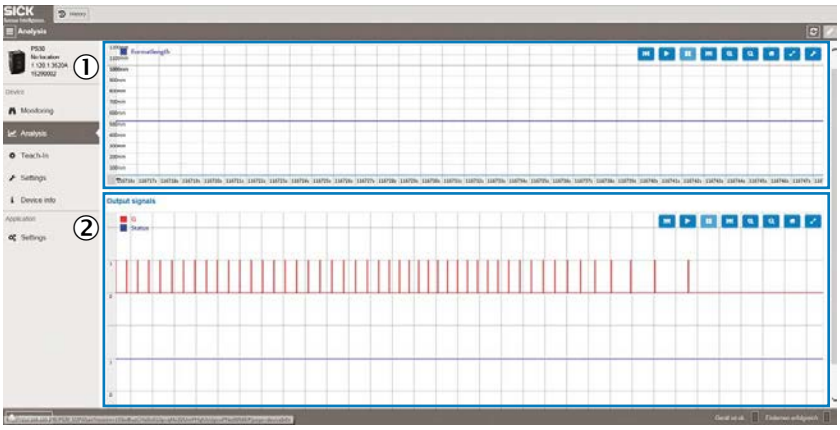


Fig. 38: Display in the Analysis menu

1 Display of format length over time

2 Display of the switching output (Q) and the status output over time

12 Cleaning and maintenance

12.1 Cleaning

WARNING!

Equipment damage due to improper cleaning.

Improper cleaning may result in equipment damage.

For this reason:

- Never use cleaning agents containing aggressive substances.
- Never use sharp objects for cleaning.

Clean the front screen at regular intervals with a lint-free cloth and plastic cleaning agent. Cleaning agents containing solvents are not allowed.

The cleaning interval essentially depends on the ambient conditions.

12.2 Maintenance

The pattern sensor requires the following maintenance work at regular intervals:

Interval	Maintenance work	To be performed by
Cleaning interval depends on ambient conditions and climate	Clean housing, particularly the front screen.	Specialist
Every 6 months	Check the screw connections and plug connections.	Specialist

Table 12: Maintenance schedule

13 Troubleshooting

Potential malfunctions and rectification measures are described in the table below and in the next chapter.

In the case of faults that cannot be rectified using the description below, please contact the manufacturer. See the back page for your agency.

Warnings

Warnings can only occur during a teach-in process. If there is a warning, the teach-in process is run again in its entirety. If the teach result is not sufficient, the teach-in process must be run again.

Warnings are displayed in the “ErrCod” parameter with “Wrn” and a number. → See page 46, chapter 9.6.

Errors

Errors may occur during the teach-in process or as a result of other events, such as a short-circuit. In the case of an error, the teach-in process will be terminated. If valid teach-in data is already available, this will be used.

Errors are displayed in the “ErrCod” parameter with “Err” and a number. → See page 46, chapter 9.6.

13.1 Possible error indicators

Error code indicator on the display	Possible causes (SOPASair display)	Troubleshooting
NoErr	There is no error present.	–
Wrn011	The taught-in format length is over 1000 mm.	Repeat teach-in process with smaller teach-in range. → See page 51, chapter 11.3.
Wrn012	Sensor signal is overridden due to overexposure.	Check mounting. → See page 21, chapter 6.
Wrn013	Contrast in taught-in format is too low.	Check mounting. → See page 21, chapter 6. If necessary, select another image area with a higher contrast.
Wrn015	The taught-in format was larger than the actual format length (in Endless material).	Repeat teach-in process with smaller teach-in range.
Err001	A short-circuit exists at the Q_{OUT} or $Status_{OUT}$ output.	Fix short circuit.

Error code indicator on the display	Possible causes (SOPASair display)	Troubleshooting
Err010	The taught-in format length undercuts the minimum teach-in length, e.g. 15 mm.	Repeat teach-in process with larger teach-in range.
Err014	Image speed during the teach-in process too fast	Repeat teach-in process with reduced speed.
Err016	Blanked area is too large or two few reference areas were found in the pattern.	Select a smaller area to be blanked. Repeat teach-in process.
Err017	No taught-in image available	Repeat teach-in process.
Err018	The label can not be clearly detected at the selected position.	Change angle or position of the sensor. Repeat teach-in process. Contact your SICK agency if the error occurs again. For the address, see the addresses on the rear side of these operating instructions.
Err101	Device/Operation is locked.	Contact your Sick agency. For the address, see the addresses on the rear side of these operating instructions.

Table 13: Possible error indicators

13.2 Troubleshooting guide

Possible causes of errors

The possible errors can be summarized in the following groups.

- Errors caused by the combination pattern sensor – encoder
- Errors caused by mounting or teach-in
- Errors caused by the system
- Errors caused by the network connection and SOPASair

13.2.1 Errors caused by the combination pattern sensor – encoder

Frequent sources of error

Frequent sources of error of the pattern sensors are:

- Incorrectly connected encoder
- Incorrectly configured encoder/sensor
- Unsuitable encoder.

Checking wiring

The following encoder cables must be connected to the pattern sensor:

- “HTL” encoder type: cables A and B
- “TTL” encoder type: cables A, A‘, B and B‘

→ For the pattern sensor connection example, see page 27, chapter 7.5.1.

Checking mounting

→ See page 61, Fig. 39 and page 21, chapter 6.

Checking encoder settings

→ For encoder setup, see page 30, chapter 8.2.
→ For the menu structure, see page 75, chapter 18.

Check the following points:

- The encoder type set on the pattern sensor must match the type of connected encoder. “HTL” or “TTL” are available as options.
  - Set encoder type for the sensor: → See Table 6 on page 31, “EncTyp” parameter .
  - Encoder type of the connected encoder: → See data sheet.
- The encoder type set on the pattern sensor must match the bar width of the encoder. → See page 31, Table 6, “EncRes” parameter.
  Calculate the encoder resolution in accordance with the following section.

Determining the encoder resolution

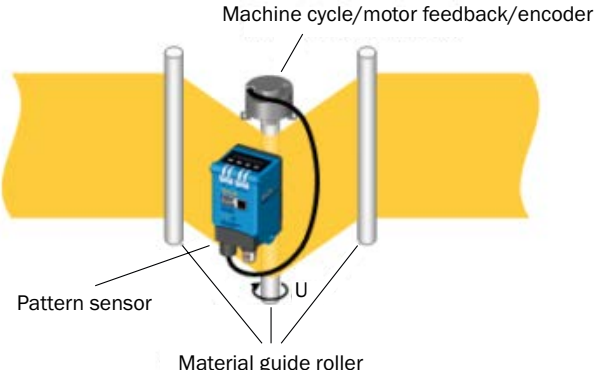


Fig. 39: Encoder mounting

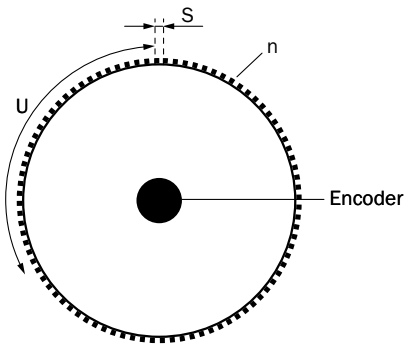


Fig. 40: Determining the encoder resolution

Calculate the encoder resolution (EncRes) using the following formula:

S = U/n

S: encoder resolution

U: outer scope of the role

n: number of encoder bars for 360 °

Checking function

Check for correct function and thereby correct wiring via the displayed encoder position.
→ See page 46, Table 11, “EncPos” parameter.

- CW direction (clockwise):
  Counter increases in the raster of the encoder resolution
- CCW direction (counter-clockwise):
  Counter decreases in the raster of the encoder resolution

13.2.2 Errors caused by mounting or teaching-in

Teach quality is too low

If the teach-in quality is too low, fewer than 3 bars flash in the display. Fewer than 3 bars are displayed as Quality of Teach-in in SOPASair.

Check the individual items according to the following table.

Cause/Item to be checked	Thorough check	Troubleshooting
Material is highly glossy.	Check sensor distance and angle. → page 21, chapter 6.2.	If necessary, do not use the specified distance and angle. For example, tilt the sensor more or less.
The sensor is not installed at the correct height. Sensor does not detect the printed area correctly. For example, a pattern area with significant label edge features is not detected or the contrast is too low.	Read out and check the teach-in image using SOPASair. → See page 51, Fig. 30.	Correct sensor height. → See page 21, chapter 6.2.
The taught-in pattern length is too long or too short. The taught-in pattern area must be larger than 15 mm or be maximum the object length in Single object or the repeat length in Endless material.	The messages “Wrn11” and “Wrn15” are displayed in the “Monitr” menu (ErrCod sub-menu). Check teach-in length. → page 46, Table 11, “TeaLen” and “ActLen” parameters.	• Redo teach-in and note the permissible area for the format length while doing so.
The material was not moved correctly in front of the sensor throughout the teach-in process.	Read out and check the teach-in image using SOPASair. → See page 57, Fig. 28.	Perform teach-in again. Ensure that the material is not slanted, rippled, or moved in front of the sensor at the wrong angle during the teach-in process. → See page 21, Fig. 10.
The rotational direction during the teach-in process does not match the set encoder direction. For a correct signal, the rotational direction during the teach-in process and the set encoder direction must match.	Check rotational direction via the “EncPos” parameter in the “Monitr” menu. The numerical value must change. A “+” must be displayed before the numerical value. The “+” indicates that the rotational direction during the teach-in process and the current encoder direction match. A “-” indicates that the two directional rotations do not match. The switching output Q is LOW.	Perform teach-in again. Move the material in the other rotational direction.

Cause/Item to be checked	Thorough check	Troubleshooting
Teach-in quality is poor. Reference positions are bunched together in one place instead of being distributed equally across the format length.	• Are there enough distinctive features in the teach-in pattern (sufficient contrast)? • Is the sensor lens dirty (contamination will result in reference positions being positioned incorrectly)? • Are some pixels overexposed (are some areas of the sensor image very bright)?	• If the pattern being used does not have very many features, all of the reference points will be distributed across these few features. Poor distribution results in poor teach-in quality. The better the distribution, the more reliable detection will be. • Contamination of the front screen/ lens of the sensor can lead to reference points being distributed to positions where the teach-in material contains no features. Clean the sensor and repeat the teach-in process. • Overexposure leads to contrast variations in the affected parts of the image. These high contrasts cause the sensor to locate its reference points in these positions. However, since these overexposures can never be reproduced, the detection function will not be reliable. Check the tilt angle of the sensor to avoid direct reflections. Repeat the teach-in process.

Table 14: Errors caused by mounting or teaching-in

13.2.3 Errors caused by the system

Check the individual items according to the following table.

Cause/Item to be checked	Example	Troubleshooting
Material slippage is too great.	Bad material transport, consequently the encoder signal does not correspond to the path covered	
Material stretch is too great.	Driving force is not uniform and material is flexible	
Image features are not identical. Details of the formats differ.	The image features are in the same place, but there is a change in the writing.	Replace the material. Perform teach-in again.
Material with a large surface area is used and the background is irregular; e.g., contaminated.	The guide roller is contaminated.	Clean guide roller. Perform teach-in again.
The system's EMC radiated emission is too high.	Strong stray radiation in the vicinity, e.g from frequency converter.	• Check the wiring. → page 23, chapter 7.2. • Always use shielded and twisted cables for the sensor. → For pre-assembled cables, see page 71, chapter 16.1.

Table 15: Errors caused by the system

13.2.4 Errors caused by the network connection and SOPASair

NOTE!

We recommend having your network administrator connect the pattern sensor to the network.

Check the individual items according to the following table.

Cause/Item to be checked	Thorough check	Troubleshooting
The sensor is not connected to a network with a network cable.	• The “Link” LED must light up on the sensor (Ethernet connection OK). • The “Act” LED must light up on the sensor (data transmission).	
The IP configuration of the sensor is not correct.	Check the IP configuration on the sensor. → See page 48, chapter 10.	
The SOPASair network setting are not correct.	Check the following information on the “IP communication” page (menu path: Network assistant > “IP communication” page). → See also page 50, chapter 11.2.	
After entering a new IP address, the supply voltage of the sensor was not switched off, then back on (restart). The sensor does not adopt the new IP address until after the sensor is restarted.	Check the IP configuration on the sensor. → See page 38, chapter 9.4.6, “IP Adr” parameter.	After checking the IP configuration, switch the supply voltage off and then back on.
The IP configuration is not compatible with the existing network.	• Check IP address configuration, sub-network mask and gateway. → See page 48, chapter 10. • Check whether the sensor was correctly integrated in your IP network with the “ping” diagnosis tool. The sensor must answer with an Echo ICMP package (Echo Request). The “Activity” LED must light up on the sensor.	Contact your network administrator.
SOPASair Net Scan Timeout too weak for the connected network.	Check value for Scantimeout [ms] parameter. Factory setting is 500 [ms]. Path: Network configuration > IP configuration > Extended.	Increase value for Scantimeout [ms] parameter, e.g. 4000.

Table 16: Errors caused by the network connection and SOPASair

13.3 Returns

To enable efficient processing and allow us to determine the cause quickly, please include the following when making a return:

- Details of a contact person
- A description of the application
- A description of the error that occurred

13.4 Disposal

Please observe the following when disposing of the device:

- Do not dispose of the device in domestic refuse.
- Dispose of the device according to the relevant country-specific regulations.

14 Repairs

Repairs may only be carried out by the manufacturer. Any interruption or modification of the sensor will invalidate the manufacturer warranty.

15 Technical data

NOTE!

You can download, save, and print the relevant data sheet for your pattern sensor, including technical data, dimensions, and connection diagrams from "www.sick.com/PS30".

15.1 Dimensions

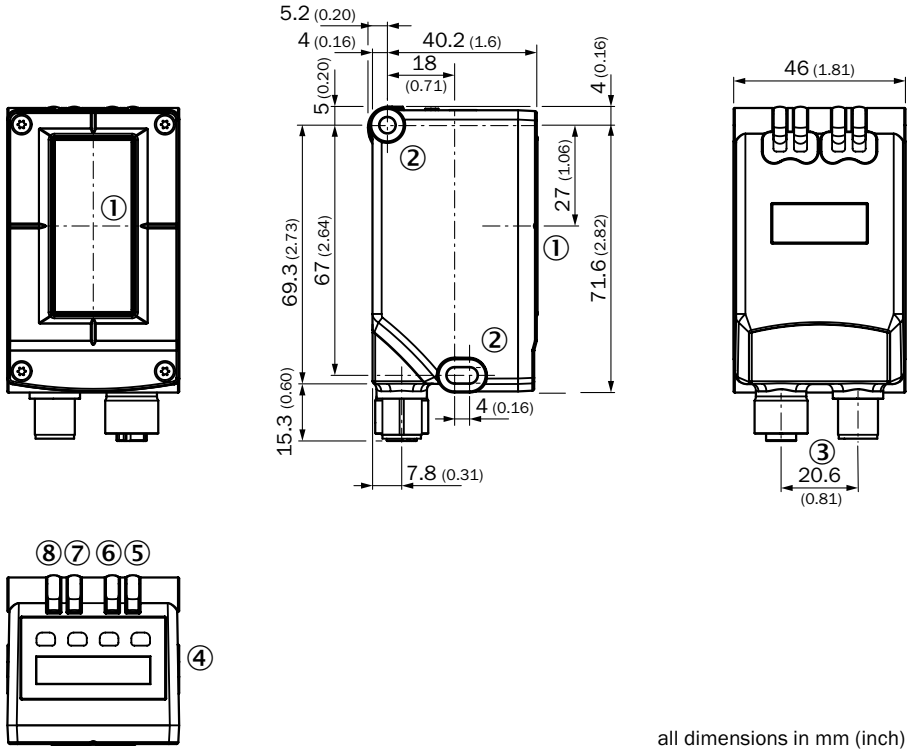


Fig. 41: PS30 pattern sensor dimensions

1 *Center of the optical axis*
2 *Fixing hole, Ø 4.2 mm*
3 *M12 male connector, 12-pin/M12 female connector, 4-pin with 90° rotation*
4 *Display and pushbuttons*
5 *Function indicator (green) "on"*
6 *Function indicator (yellow) "Q"*
7 *Function indicator (green) "Link"*
8 *Function indicator (yellow) "Act"*

15.2 Optics/Features

Light sender [1]	LED, white
Wavelength	400 nm to 700 nm
Light spot size	65 mm x 3 mm
Sensing distance	20 mm
Sensing range tolerance	± 2,5 mm
Setting	Start-stop teach-in, start-length teach-in
Format length (min.)	15 mm
Format length (max.)	1000 mm
Format height (min.)	10 mm
Tolerance lateral movement	± 5 mm
Initialization time	< 10 s
Reproducibility [2]	0.15 mm (at 5 m/s) or 0.3 mm (at 10 m/s) (depending on set sensor resolution)
Storage time (ET)	≥ 2 s, non-volatile memory

1) Average service life 100,000 h at T_U = +25 °C.

2) Static error 2 σ

Table 17: Optics/Features

15.3 Supply

Supply voltage U_V [1]	12 V DC ... 30 V DC
Power consumption (without load)	< 6 W
Residual ripple	< 5 V_{ss} within the permissible supply voltage U_V (must not undercut or exceed U_V tolerances)

1) Limit values: Max. 8 A for operation in a short-circuit protected network.

Table 18: Supply

15.4 Inputs

Input, teach-in (ET)	• PNP • Teach: U = 12 V ... < U_V • Run: U < 2 V
Input, blanking input (AT) [1]	• PNP • Blanked: U = 12 V ... < U_V • Free-running: U < 2 V

Circuit protection	U_V connections, reverse polarity protected, interference-pulse suppression

1) Blanking out of identical image areas

Table 19: Inputs

15.5 Outputs

Switching output (Q_{out})	PNP • HIGH = U_V – ≤ 2 V, switching signal for 5 mm • LOW < 0.5 V
Circuit protection	Output Q_{out}, short-circuit protected
Maximum output current	< 100 mA (sum I_{out} = Q + $status_{OUT}$)

Table 20: Outputs

15.6 Interfaces

Ethernet TCP/IP	Configuration interface

Table 21: Interfaces

15.7 Encoder

Encoder resolution	100 µm ... 600 µm (in 1 µm)
Encoder input	• Differential: 4.5 V ... 5.5 V / TTL / RS-422 • Single ended: 12 V ... 30 V / HTL / push-pull

Table 22: Encoder

15.8 Ambient conditions

Protection class	III, for operation with safety extra-low voltage (SELV/PELV)
Electromagnetic compatibility	EN 61000-6-2, EN 55011, Class A
Ambient temperature range	–10 °C ... +55 °C
Storage temperature range	–20 °C ... +75 °C
Ambient light immunity	30,000 lx
Enclosure rating	IP 65
Enclosure protection type in accordance with UL:	Enclosure type 1
Max. movement speed	10 m/s
Vibration resistance (sine)	EN60068-2-6

Noise	EN60068-2-64
Shock resistance/Impact load	EN 60086-2-27

Table 23: Ambient conditions

15.9 Structural design

Dimensions	→ See page 67, chapter 15.1.
Weight	325 g
Materials	Housing: metal, aperture plates: plastic
Connections [1)]	• M12 male connector, 12-pin • Ethernet connection M12, 4-pin
Display	6-digit with a 5 x 7 dot matrix

1) Use twisted and shielded cables.

Table 24: Structural design

16 Accessories

16.1 Connection technology

16.1.1 Female cable connectors with cables

Description	M12 female cable connector, 12-pin, straight, 5 m, shielded, twisted-pair wires
Type	DOL-1212-G05MAS02
Order no.	6042754

Description	M12 female cable connector, 12-pin, angled, 5 m, shielded, twisted-pair wires
Type	DOL-1212-W05MAS02
Order no.	6044109

16.1.2 Connection cable

Description	M12 connection cable. 12-pin, male connector straight/female connector angled, 5 m, shielded, twisted-pair wires
Type	DSL-1212-G05MAS02
Order no.	6045234

16.1.3 Ethernet cables

Description	Ethernet cable, 4-core, shielded, M12 male connector, straight, 4-pin (D-coded) / RJ 45 male connector, 8-pin, 5 m
Type	Connection cable (male connector-male connector)
Order no.	6034415

Description	Ethernet cable, 4-core, shielded, M12 male connector angled, 4-pin (D-coded) / RJ 45 male connector, 8-pin, 5 m
Type	Connection cable (male connector-male connector)
Order no.	6039488

16.2 Mounting systems

16.2.1 Universal clamp plate

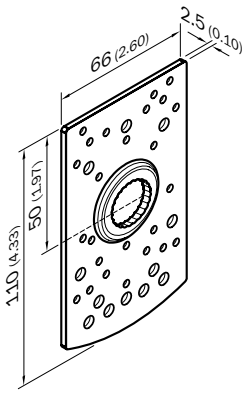


Fig. 42: Universal clamp plate

Description	Plate N04 for universal clamp, zinc-coated steel, including universal clamp and mounting hardware
Type	BEF-KHS-N04
Order no.	2051610

16.2.2 Mounting rods

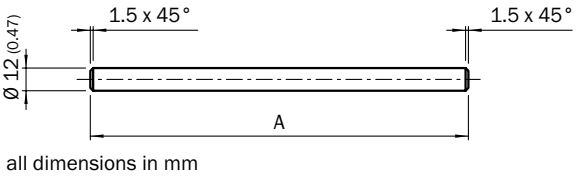
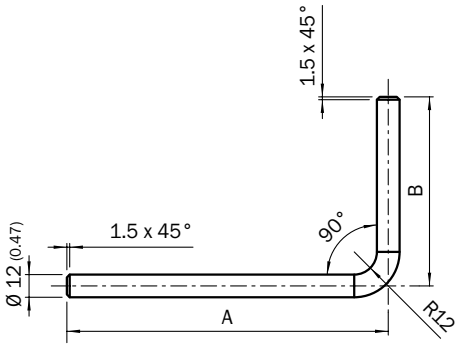


Fig. 43: Mounting rod, straight

Description	Mounting rod, straight, 200 mm, zinc-coated steel, without mounting hardware
Type	BEF-MS12G-A
Order no.	4056054



all dimensions in mm

Fig. 44: Mounting rod, L-shaped

Description	Mounting rod, L-shaped, 250 mm x 250 mm, zinc-coated steel, without mounting hardware
Type	BEF-MS12L-B
Order no.	4056053

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Registration date: Th. Oct 17, 2002 9:13:13 pm UTC

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18 Menu structure

18.1 “Setup” menu

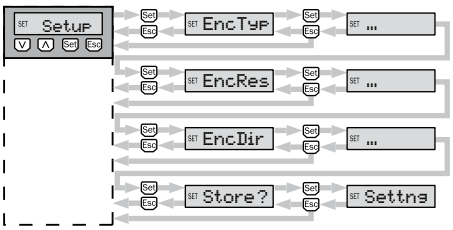

Fig. 45: “Setup” menu

→ *See page 29, chapter 8 “Commissioning”.*

18.2 “Monitr” menu

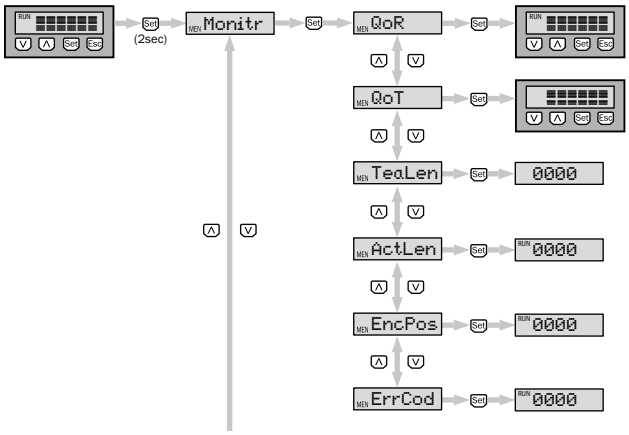

Fig. 46: “Monitr” menu

→ *See page 46, chapter 9.6 “Monitoring” menu.*

18.3 “Teach” menu

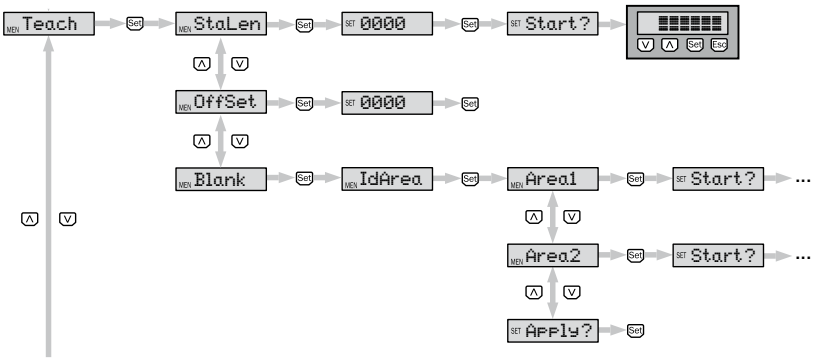

Fig. 47: “Teach” menu

→ *See page 40, chapter 9.5 “Teach” menu.*

18.4 “Setting” menu

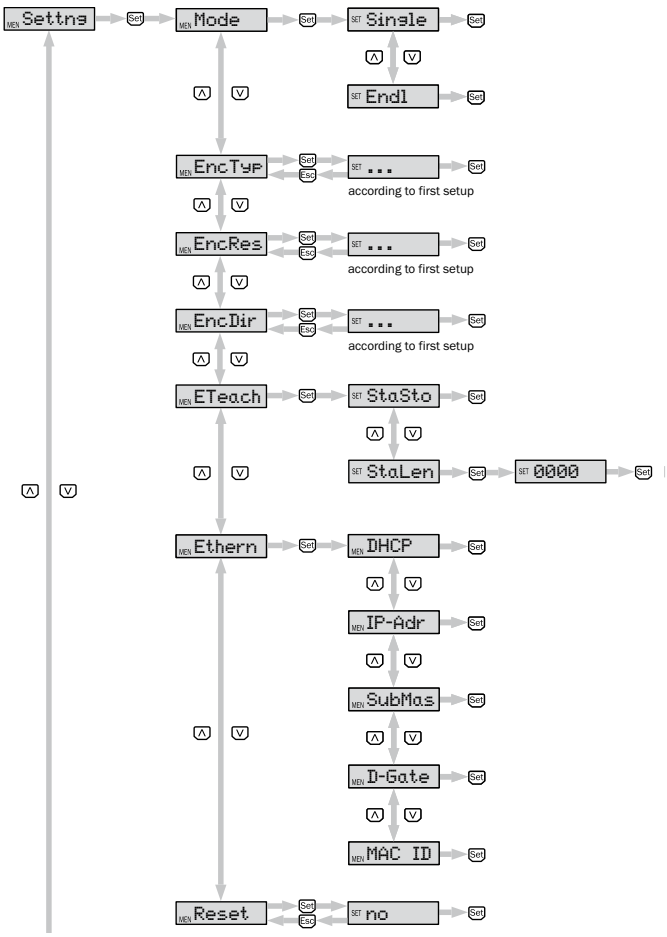

Fig. 48: “Setting” menu

→ *See page 34, chapter 9.4. “Setting” menu*

18.5 “Info” menu

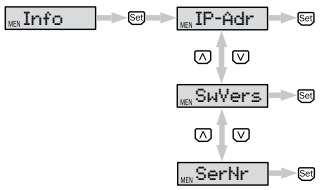

Fig. 49: “Info” menu

→ *See page 47, chapter 9.7 “Infor” menu.*

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