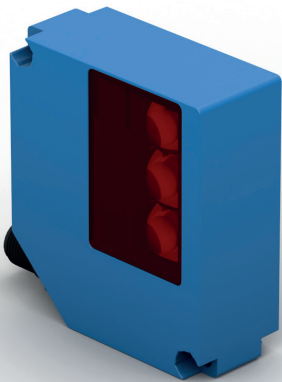


P1ELxxx

Retro-Reflex Sensor with Light Band



Operating Instructions

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1. General

1.1 Information Concerning these Instructions

- These instructions apply to the product with ID code P1ELxxx.
- They make it possible to use the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Local accident prevention regulations and national work safety regulations must be complied with as well.
- The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change. The current version can be found at www.wenglor.com in the product's separate download area.



NOTE!

The operating instructions must be read carefully before using the product and must be kept on hand for later reference.

1.2 Explanations of Symbols

- Safety precautions and warnings are emphasized by means of symbols and attention-getting words
- Safe use of the product is only possible if these safety precautions and warnings are adhered to

The safety precautions and warnings are laid out in accordance with the following principle:



Attention-Getting Word! Type and Source of Danger!

Possible consequences in the event that the hazard is disregarded.

- Measures for averting the hazard.

The meanings of the attention-getting words, as well as the scope of the associated hazards, are listed below.



DANGER!

This word indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.



WARNING!

This word indicates a hazard with a medium degree of risk which, if not avoided, may result in death or severe injury.



CAUTION!

This word indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.



ATTENTION!

This word draws attention to a potentially hazardous situation which, if not avoided, may result in property damage.



NOTE!

A note draws attention to useful tips and suggestions, as well as information regarding efficient, error-free use.

1.3 Limitation of Liability

- The product has been developed in consideration of the current state-of-the-art and applicable standards and guidelines. Subject to change without notice.
- A valid declaration of conformity can be accessed at www.wenglor.com in the product's separate download area.
- wenglor sensoric elektronische Geräte GmbH (hereinafter referred to as "wenglor") excludes all liability in the event of:
 - Non-compliance with the instructions
 - Use of the product for purposes other than those intended
 - Use by untrained personnel
 - Use of unapproved replacement parts
 - Unapproved modification of products
- These operating instructions do not include any guarantees from wenglor with regard to the described procedures or specific product characteristics.
- wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions, unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared.

1.4 Copyrights

- The contents of these instructions are protected by copyright law.
- All rights are reserved by wenglor.
- Commercial reproduction or any other commercial use of the provided content and information, in particular graphics and images, is not permitted without previous written consent from wenglor.

2. For Your Safety

2.1 Use for Intended Purpose

The product is based on the following functional principle:

Retro-reflex sensor with light band

The retro-reflex sensor with light band scans a significantly larger range than a retro-reflex sensor with a dot-shaped spot. As a result it's ideally suited for the reliable detection of objects with irregular shapes or varying sizes, for example polybags. The light barrier's light band is nearly collimated, making it very precise and homogenous. The sensor has a very small blind spot and detects objects as of emitter beam overlap of 4 mm within the overall range of detection. It's compact design permit installation in extremely small spaces, for example on the side panels of a conveyor system.

This product can be used in the following industry sectors:

- Special machinery manufacturing
- Heavy machinery manufacturing
- Logistics
- Automotive industry
- Food industry
- Packaging industry
- Pharmaceuticals industry
- Plastics industry
- Woodworking industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Steel industry
- Aviation industry
- Chemicals industry
- Alternative energy
- Raw materials extraction

2.2 Use for Other than the Intended Purpose

- Not a safety component in accordance with 2006/42/EC (Machinery Directive).
- The product is not suitable for use in potentially explosive atmospheres.
- The product may only be used with accessories supplied or approved by wenglor, or combined with approved products. A list of approved accessories and combination products can be accessed at www.wenglor.com on the product detail page.

DANGER!



Risk of personal injury or property damage in case of use for other than the intended purpose!

- Use for other than the intended purpose may lead to hazardous situations.
- Observe instructions regarding use for intended purpose.
-

2.3 Personnel Qualifications

- Suitable technical training is a prerequisite.
- In-house electronics training is required.
- Trained personnel must have uninterrupted access to the operating instructions.



DANGER!

Risk of personal injury or property damage in case of incorrect initial start-up and maintenance!

- Personal injury and damage to equipment may occur.
- Adequate training and qualification of personnel.

2.4 Modification of Products



DANGER!

Risk of personal injury or property damage if the product is modified!

- Personal injury and damage to equipment may occur. Non-observance may result in loss of the CE and/or UKCA marking and the guarantee may be rendered null and void.
- Modification of the product is impermissible.

2.5 General Safety Precautions



NOTE!

- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- In the event of possible changes, the respectively current version of the operating instructions can be accessed at www.wenglor.com in the product's download area.
- Read the operating instructions carefully before using the product.
- Protect the sensor against contamination and mechanical influences.

2.6 Laser Warnings

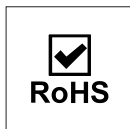


Laser Class 1 (EN 60825-1)

Applicable standards and safety regulations must be observed.

$T = 250 \mu s$, $t_p = 20 \mu s$, $\lambda = 650 \text{ nm}$, $P_p < 200 \mu W$

2.7 Approvals and protection class



3. Technical Data

		P1EL					
		100	101	200	201	300	301
Optical Data							
Range		2500 mm					
Light band height		27 mm		42 mm		54 mm	
Working range		0,35...2,5 m		0,35...2,5 m		0,4...2,5 m	
Light source		Laser (red)					
Wavelength		650 nm					
Laser Class (EN 60825-1)		1					
Smallest detectable part *		See "3.1 Smallest detectable part" on page 7					
Service life (ambient temp. = +25° C)		100000 h					
Max. permissible ambient light		10000 Lux					
Electrical Data							
Supply power		12...30 V DC					
Current consumption (operating voltage = 24 V)		< 30 mA					
Switching frequency		275 Hz		175 Hz		125 Hz	
Response time		1,8 ms		2,9 ms		4,0 ms	
Temperature range		-30...60 °C					
Switching Output voltage drop		< 2,5 V					
Switching output/switching current		100 mA					
Residual current switching output		< 50 µA					
Short circuit protection		yes					
Reverse polarity protection		yes					
Overload protection		yes					
Lockable		yes					
Protection class		III					
Mechanical Data							
Setting method		Teach-in					
Housing material		Plastic					
Degree of protection		IP67/IP68					
Lens cover		PMMA					
Output function	PNP NO	x		x		x	
	PNP NC		x		x		x
Connection		M12x1					
Connection Diagram No.		150	151	150	151	150	151
Suitable Mounting Technology No.		2					

3.1 Smallest detectable part

	P1EL100/101 & P1EL200/201		P1EL300/301	
Distance, sensor to reflector	0,35...1,6 m	1,6...2,5 m	0,4...1,6 m	1,6...2,5 m
Smallest detectable part	4 mm*	10 mm	4 mm*	10 mm

* The smallest detectable part depends on the utilized teach-in mode, sensor/reflector distance, and alignment to the reflector:
 Teach-in for interference-free detection: 5 mm
 Teach-in for precise detection: 4 mm

3.2 Switching distance

Achievable switching distance depends on the utilized reflector. Depending on the utilized sensor type, types Z90R007 through Z90R009 serve as reference reflectors. Other reflectors can also be used, which are shown in the following table along with their corresponding ranges.

Reflector	Range
ZRDF03K01	0,40...1,60 m
ZRDF10K01	0,40...1,60 m
Z90R004	0,40...1,60 m
Z90R005	0,40...1,60 m
Z90R007	0,35...2,50 m
Z90R008	0,35...2,50 m
Z90R009	0,35...2,50 m

Sensor	Reference Reflector
P1EL100, P1EL101	Z90R007
P1EL200, P1EL201	Z90R008
P1EL300, P1EL301	Z90R009

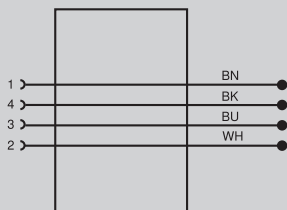
3.3 Complementary Products

wenglor can provide you with suitable connection technology for your product.

Suitable connection technology no.

2

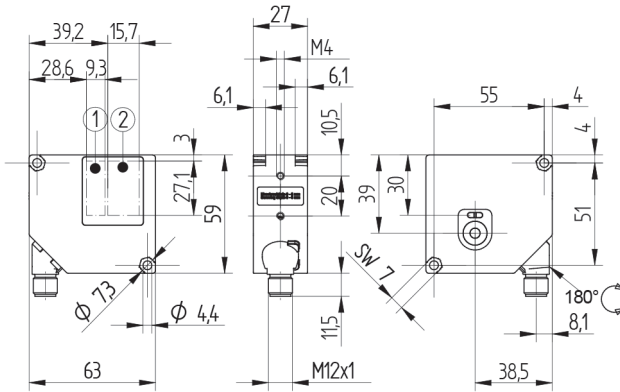
S02



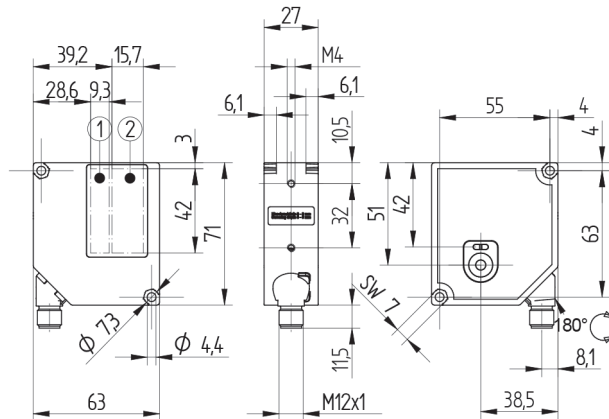
PNP-NPN converter BG7V1P-N-2M

3.4 Housing Dimensions

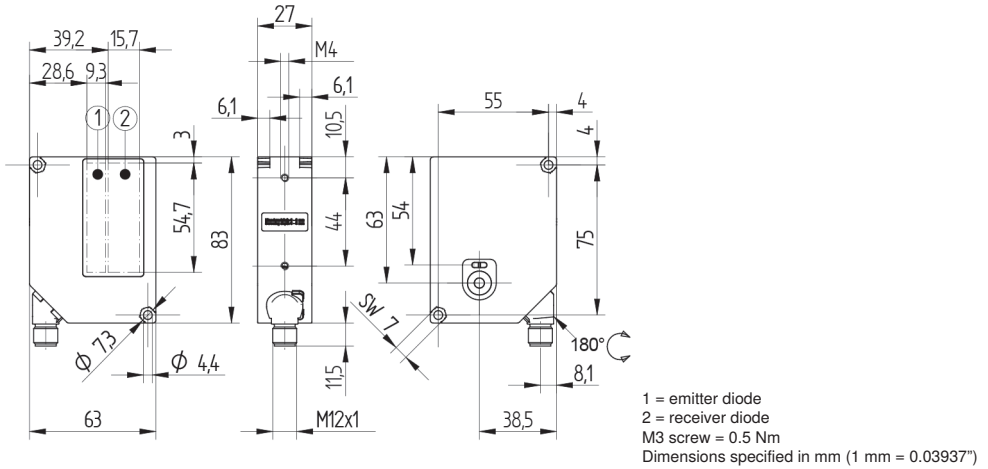
P1EL100, P1EL101



P1EL200, P1EL201

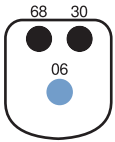


P1EL300, P1EL300



3.5 Control Panel

1E1



06 = teach-in key
 30 = switching status indicator / contamination warning
 68 = supply power indicator

3.6 Scope of Delivery

- Sensor
- Safety precautions
- Spacer sleeves Z1PE002

4. Transport and Storage

4.1 Transport

Upon receipt of shipment, the goods must be inspected for damage in transit. In the case of damage, conditionally accept the package and notify the manufacturer of the damage. Then return the device, making reference to damage in transit.

4.2 Storage

The following points must be taken into condition with regard to storage:

- Do not store the product outdoors.
- Store the product in a dry, dust-free place.
- Protect the product against mechanical impacts.
- Protect the product against exposure to direct sunlight.



ATTENTION!

Risk of property damage in case of improper storage!

The product may be damaged.

- Storage instructions must be complied with.
-

5. Installation and Electrical Connection

5.1 Installation

- Protect the product from contamination during installation.
- Observe all applicable electrical and mechanical regulations, standards, and safety rules.
- Protect the product against mechanical influences.
- Make sure that the sensor is mounted in a mechanically secure fashion.
- Specified torque values must be complied with (see Technical Data on [page 10](#)).

The following installation instructions must be observed in order to assure that the sensor can function correctly:

5.1.1 Reference Setup

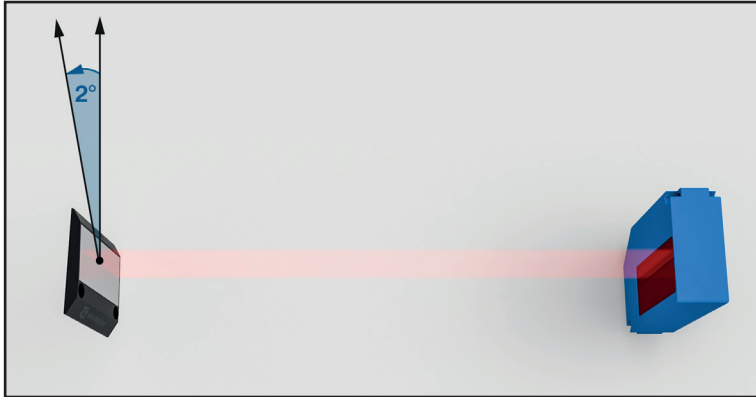
All sensor values are based on a reference setup which demonstrates the following characteristics:

- The P1ELxxx sensor and the conveyor belt's zero level (conveyor level) are arranged at a right angle to each other.
- The conveyor level doesn't fluctuate at all.
- The sensor is mounted such that the bottom edge of the emitted light band is at the conveyor level.
- The sensor's light band is parallel to the conveyor level (max. tolerance: +0/-2 mm).
- The utilized reflector is inclined 2° and captures the entire light band.

5.1.2 Lateral Reflector Inclination

Z90R007 through Z90R009 reflectors, which are laid out for the P1ELxxx, are inclined 2° due to their format and can be mounted without lateral tilting.

The reflectors additionally listed in section “3.2 Switching distance” on page 8 are not inclined and must therefore be mounted at an inclined angle of 2° ($\pm 0.5^\circ$). The direction in which the reflector is tilted depends on the installation situation and must correspond exactly to the illustration.



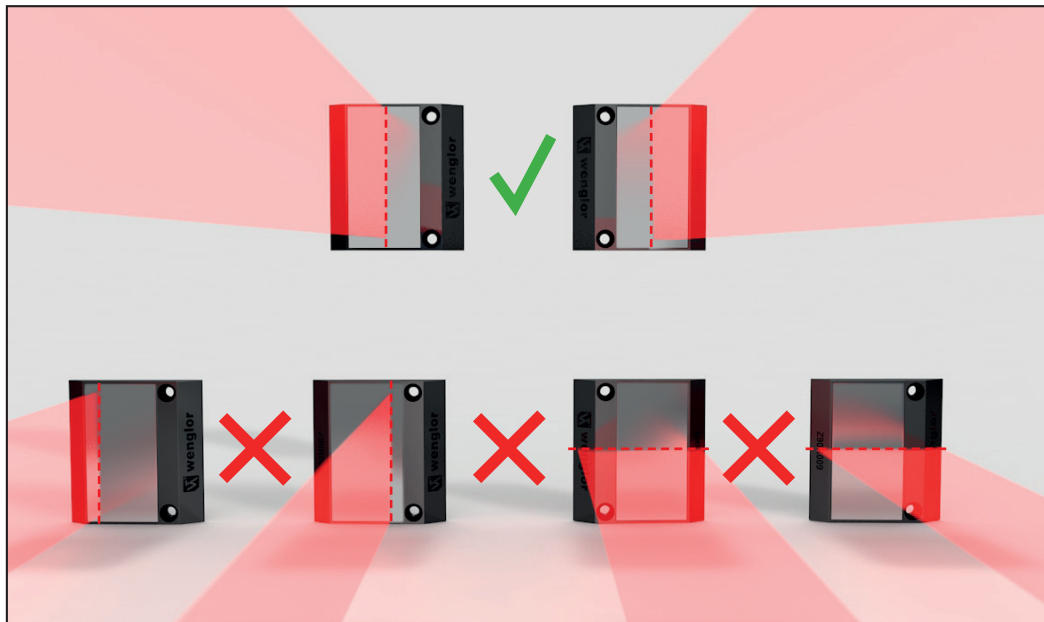
Installation situation 1



Installation situation 2

5.1.3 Aligning the Reflector

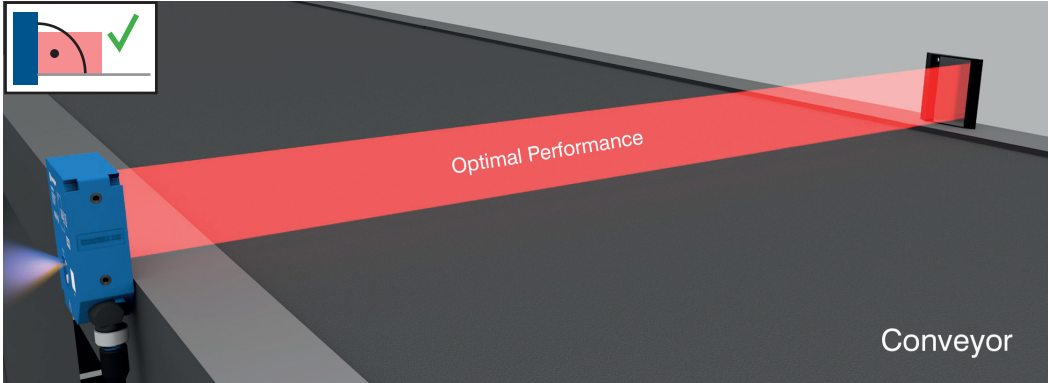
Z90R007 through Z90R009 reflectors must be mounted as shown in the following illustration. Make sure that the light band is centered on the reflector to ensure reliable detection of objects. Correct inclination of the surface of the reflector relative to the sensor is described in section [“5.1.2 Lateral Reflector Inclination”](#) on page 13.



5.1.4 Sensor Inclination

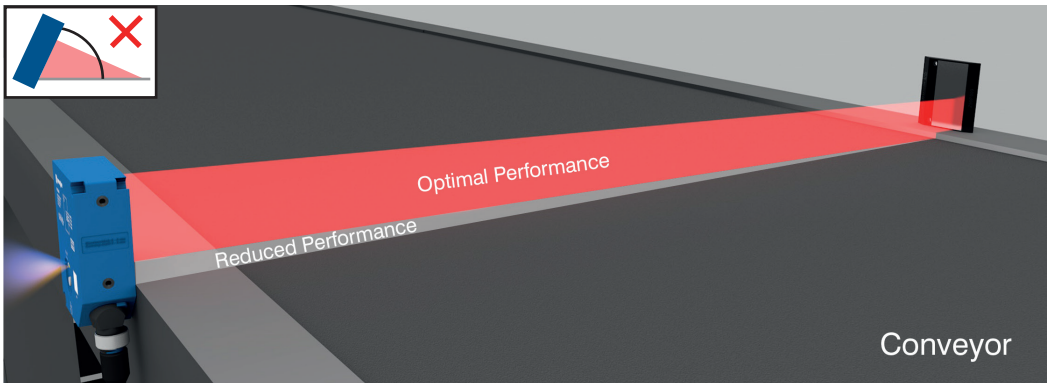
Deviation of the top edge of the light band should not exceed +0 to -2 mm of downward sloping to the conveyor plane in order to permit detection of the smallest object. Deviation amounting to more than this value leads to poor detection of small or flat objects.

Ideal Alignment

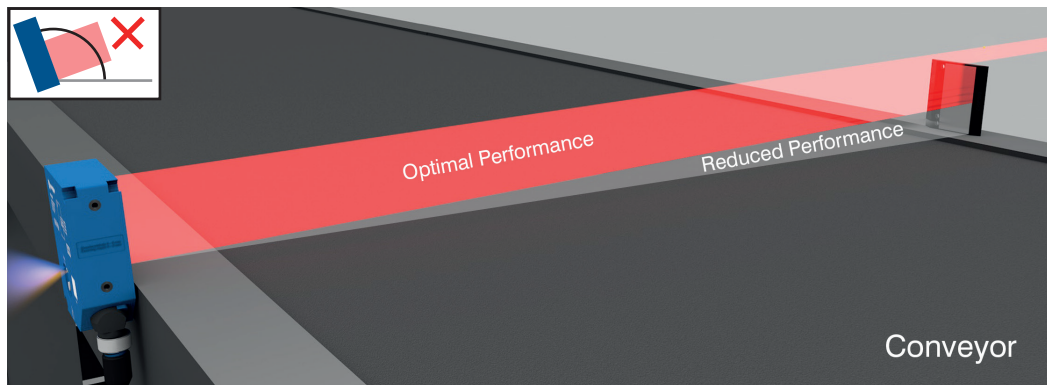


Incorrect Alignment

Excessive tilting of the sensor (> 2 mm downward sloping of the top edge of the light band) towards the conveyor plane results in an area with reduced detection of small objects which are in close proximity to the sensor.



Tilting the sensor away from the conveyor plane results in an area with reduced detection of small objects which are far away from the sensor, i.e. close to the reflector.



NOTE!

Ideal alignment can be easily determined by means of the band of light above the conveyor belt. First of all, height is determined from the conveyor belt to the uppermost point of the band of light directly on the sensor. Afterwards, height is determined from the conveyor belt to the uppermost point of the band of light on the reflector. Alignment is ideal when these two distances are identical.

wenglor recommends a sensor adjustment range with parallel upper light-band edge, or maximum downward sloping of the upper edge of the light band amounting to 2 mm within the corresponding working range.



ATTENTION!

Risk of property damage in case of improper installation!

The product may be damaged.

- Installation instructions must be complied with.



CAUTION!

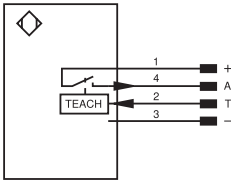
Risk of personal injury or property damage during installation!

Personal injury and damage to the product may occur.

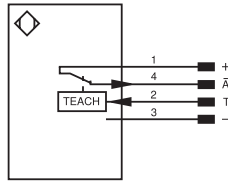
- A safe installation environment must be assured.

5.2 Electrical Connection

150



151



Legend

+	Supply Voltage +
-	Supply Voltage 0 V
~	Supply Voltage (AC Voltage)
A	Switching Output (NO)
Ā	Switching Output (NC)
V	Contamination/Error Output (NO)
∇	Contamination/Error Output (NC)
E	Input (analog or digital)
T	Teach Input
Z	Time Delay (activation)
S	Shielding
RxD	Interface Receive Path
TxD	Interface Send Path
RDY	Ready
GND	Ground
CL	Clock
E/A	Output/Input programmable
	IO-Link
PoE	Power over Ethernet
IN	Safety Input
Q5SD	Safety Output
Signal	Signal Output
BL_D+/-	Ethernet Gigabit bidirect. data line (A-D)
EN095422	Encoder 0-pulse 0-0̄ (TTL)

PT	Platinum measuring resistor
nc	not connected
U	Test Input
Ū	Test Input inverted
W	Trigger Input
W-	Ground for the Trigger Input
O	Analog Output
O-	Ground for the Analog Output
BZ	Block Discharge
AWV	Valve Output
a	Valve Control Output +
b	Valve Control Output 0 V
SY	Synchronization
SY-	Ground for the Synchronization
E+	Receiver-Line
S+	Emitter-Line
⊕	Grounding
SnR	Switching Distance Reduction
Rx+/-	Ethernet Receive Path
Tx+/-	Ethernet Send Path
Bus	Interfaces-Bus A(+)/B(-)
La	Emitted Light disengageable
Mag	Magnet activation
RES	Input confirmation
EDM	Contactor Monitoring

EN095422	Encoder A/Ā (TTL)
EN095422	Encoder B/B̄ (TTL)
ENa	Encoder A
ENb	Encoder B
AMIN	Digital output MIN
AMAX	Digital output MAX
AOK	Digital output OK
SY In	Synchronization In
SY OUT	Synchronization OUT
OLt	Brightness output
M	Maintenance
rsv	reserved
Wire Colors according to IEC 60757	
BK	Black
BN	Brown
RD	Red
OG	Orange
YE	Yellow
GN	Green
BU	Blue
VT	Violet
GY	Grey
WH	White
PK	Pink
GNYE	Green/Yellow

DANGER!



Risk of personal injury or property damage due to electric current!

Voltage conducting parts may cause personal injury or damage to equipment.

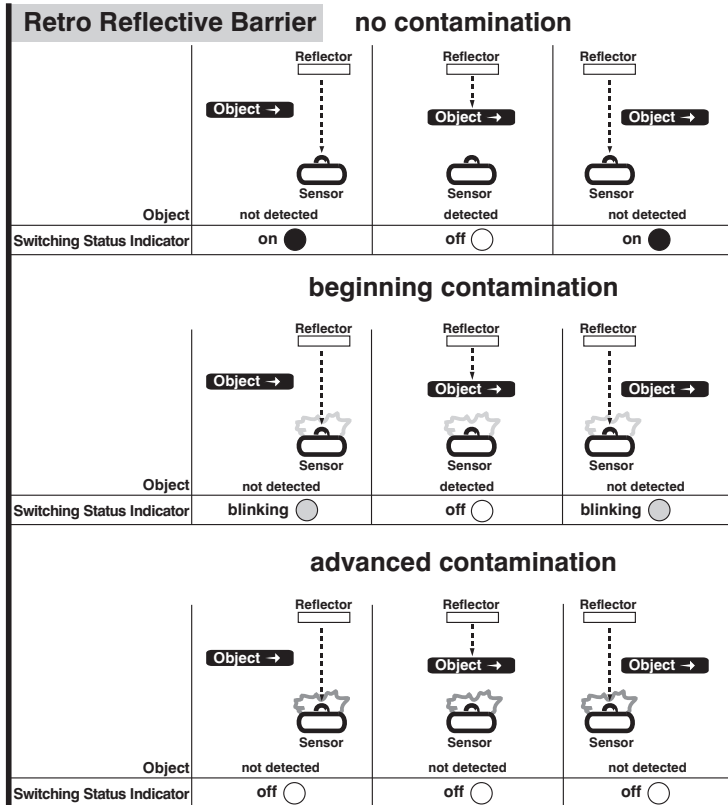
- The electric device may only be connected by appropriately qualified personnel.

5.3 Diagnostics

Causes for Triggering the Contamination Warning (blinking LED):

Display LED	Diagnosis/Cause	Elimination
Continuous blinking at approx. 2.5 Hz	Contamination	Carefully clean the optic cover and the reflector with a cloth.
	Aged emitter diode	Replace the sensor.
	Unreliable working range	Check distance to the sensor (see "3.2 Switching distance" on page 8).
Continuous blinking at approx. 5 Hz	Short-circuit	Check electrical wiring and eliminate the short-circuit.
	Hardware error	Replace the sensor.

Contamination Warning Flowcharts



Required action in case of fault:

NOTE!

- Shut down the machine.
- Analyze and eliminate the cause of error with the help of the diagnostics information.
- If the error cannot be eliminated, please contact wenglor's support department.
- Do not operate in case of indeterminate malfunctioning.
- The machine must be shut down if the error cannot be unequivocally clarified or reliably eliminated.



DANGER!

Risk of personal injury or property damage in case of non-compliance!

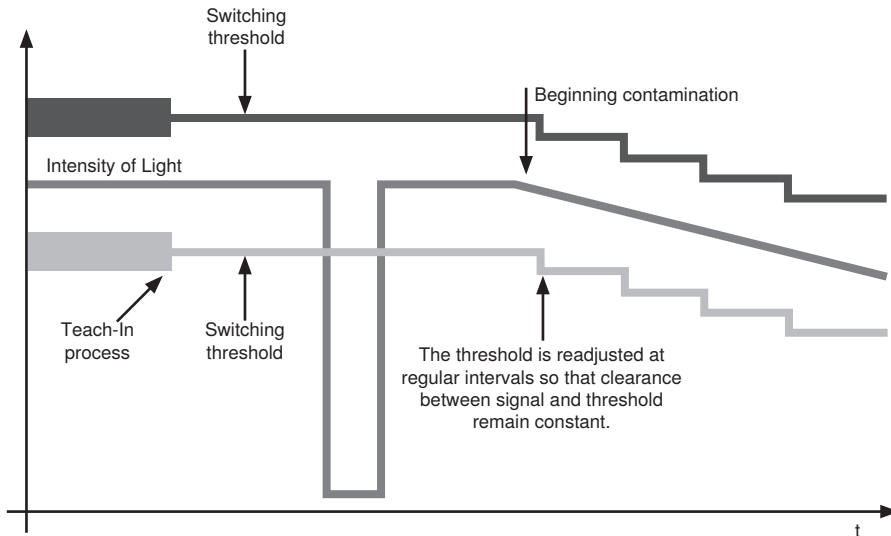
- The system's safety function is disabled. Personal injury and damage to equipment.
- Required action as specified in case of fault.

6. Functions Overview

6.1 Dynamic readjustment

The sensor automatically readjusts its switching threshold in the event of changing conditions such as contamination, temperature fluctuation or aging. This assures that the switching distance taught in by the user is maintained. If the adjustable range is exceeded, this is indicated by the contamination warning.

If the detection range is empty (no object within the light band), the system reacts to deviations from the reference value ascertained during the teach-in process and initiates an adjustment of the switching threshold in order to continue to ensure reliable sensor switching. The switching threshold is adjusted every 12 seconds as a maximum. The following illustration shows the dynamic readjustment in decreasing light intensity as an example. The dynamic readjustment behaves in exactly the same way in increasing light intensity.



7. Settings



NOTE!

It takes three minutes for the sensor to warm up. In order to assure interference-free operation, teach-in should not be conducted until after the warm-up phase.

7.1 Standard Teach

The sensor is taught in such that it demonstrates stable switching performance despite interference such as vibration. In this mode, the smallest part which can be detected is somewhat larger than in the precise detection mode.

- Install the sensor in accordance with the mounting instructions.
- Align the sensor to the reflector.
- Press and hold the teach-in key until switching status indicator A1 starts blinking slowly (2 Hz) after two seconds.
- Release the teach-in key.
- The switching threshold is taught in and the LED for A1 blinks twice in order to confirm successful teach-in.

7.2 Precision Teach – with Stationary Conveyor Belt

The sensor is taught in such that the detection of very small parts is possible. With the conveyor belt at a standstill, the sensor is set to a signal analysis phase which lasts for 10 seconds. The sensor's receive signals are analyzed during this time, on the basis of which the switching threshold is calculated.

- Install the sensor in accordance with the mounting instructions.
- Align the sensor to the reflector.
- Press and hold the teach-in key until switching status indicator A1 starts blinking rapidly (4 Hz) after five seconds.
- Release the teach-in key.
- Recording is started during which the LED continues to blink at a rate of 4 Hz.
- The calculated switching threshold is taught in and the LED for A1 blinks twice in order to confirm successful teach-in. If teach-in has not been successful, LED A1 blinks 4 times. If this is the case, the procedure must be repeated.

7.3 Dynamic Teach – with Running Conveyor Belt

The sensor is taught in such that, depending on the application, minimal thresholds can be set in order to detect smallest possible parts by means of this process. With running conveyor belt, the sensor is set to a signal analysis phase which lasts for 10 seconds. The application-specific receive signals are analyzed by the sensor during this time, on the basis of which the switching threshold is calculated. And thus application-specific receive signals do not result in erroneous sensors switching.

- Install the sensor in accordance with the mounting instructions.
- Align the sensor to the reflector.
- Press and hold the teach-in key until switching status indicator A1 starts blinking rapidly (4 Hz) after five seconds.
- Release the teach-in key.
- Recording is started during which the LED continues to blink at a rate of 4 Hz.
- The sensor analyzes the receive signals for 10 seconds, on the basis of which it calculates a precise switching threshold that's matched to the application.
- The calculated switching threshold is taught in and the LED for A1 blinks twice in order to confirm successful teach-in. If teach-in has not been successful, LED A1 blinks 4 times. If this is the case, the procedure must be repeated.

NOTE!



If the sensor is used at a very small distance above a conveyor belt, it's advisable to activate the belt during the recording phase. Height fluctuations, impacts, belt seams etc. are analyzed as a result and made use of when calculating the switching threshold. Erroneous switching due to the conveyor belt can be avoided in this way.

8. Maintenance Instructions

NOTE!



- This wenglor sensor is maintenance-free.
- Cleaning and inspection of the plug connections at regular intervals are advisable. After cleaning the sensor and/or reflector, the sensor may require a new teach-in process. This depends largely on the level of contamination in the application.
- Do not clean the sensor with solvents or cleansers which could damage the product.
- The product must be protected against contamination during initial start-up.

9. Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

10. Appendix

10.1 List of Abbreviations

Abbreviation	Meaning
Tu	Ambient temperature
Ub	Supply voltage
MTTFd	Mean Time to Dangerous Failure

10.2 Change Index, Operating Instructions

Version	Date	Description/Change
1.0.0	06.06.2019	Initial version of the operating instructions
1.1.0	02.03.2020	New section “6. Functions Overview” on page 19
1.2.0	20.05.2020	“6.1 Dynamic readjustment” on page 19
1.3.0	01.09.2020	Completion in section “6.1 Dynamic readjustment” on page 19 and “8. Maintenance Instructions” on page 21
1.4.0	10.11.2020	Completion in section “3. Technical Data” on page 7 and “5.1.3 Aligning the Reflector” on page 14
1.5.0	22.03.2023	Completion of new product types in section “3. Technical Data” on page 7

10.3 Declarations of Conformity

The declarations of conformity can be found on our website at www.wenglor.com in the product's download area.