wenglor
the innovative family

Operating Instructions
P1MW001
Contrast Sensor

EN

Translation of the original operating instructions
Subject to change without notice
Available as PDF file only
Version 1.2
www.wenglor.com

Table of Contents

1 General

1.1 Information Concerning these Instructions

- These instructions 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.

INFORMATION

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

1.2 Explanation of Symbols

- Safety precautions and warnings are emphasized by means of symbols and signal 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:

SIGNAL 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 signal words, as well as the scope of the associated hazards, are listed below:

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

INFORMATION

Information draws attention to useful tips and suggestions, as well as information on efficient, error-free use.

1.3 Limitation of Liability

- The product has been developed in consideration of the current state-of-the-art technology, as well as 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 spare 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

Contrast sensors detect the finest contrast differences on a wide range of materials and surfaces. Print marks can be detected against any background, regardless of brightness or color values, and objects can be detected based on their contrast differences. Highest contrast resolutions are generated by long-life white light LED or red laser light.

This Product Can Be Used in the Following Industry Sectors:

- Special-purpose mechanical engineering
- Heavy mechanical engineering
- 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 energies
- 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 be used only with accessories supplied or approved by wenglor, or in combination with approved products. A list of approved accessories and combination products can be found 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 who use the product must have (permanent) 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. Noncompliance may result in loss of the CE and/or UKCA mark and voiding of the warranty.

→ Modification of the product is not permitted

2.5 General Safety Precautions

INFORMATION

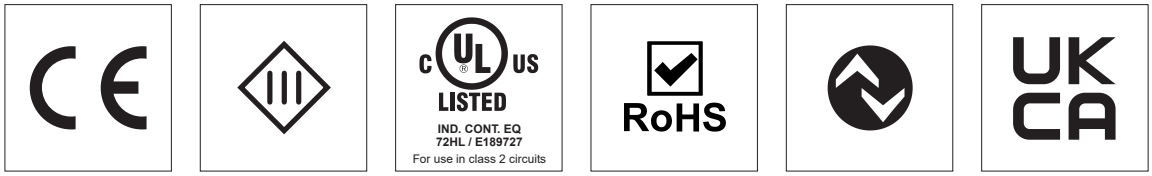
These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.

In the event of possible changes, the current version of the operating instructions can be found at www.wenglor.com in the product's separate download area.

Read the operating instructions carefully before using the product.

Protect the sensor against contamination and mechanical influences.

2.6 Approvals and protection classes

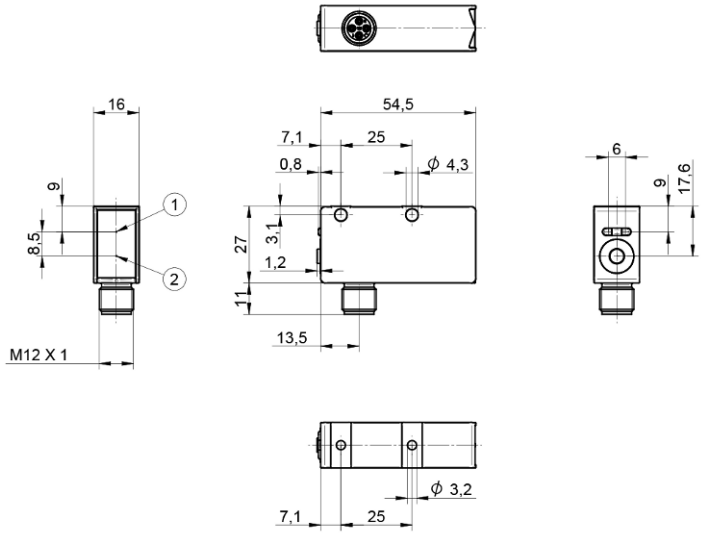


3 Technical Data

3.1 General data

	P1MW001
Optical data	
Working Range	10...30 mm
Working Distance	20 mm
Resolution (Gray Scale)	20
Switching Hysteresis	< 2 %
Light Source	White Light
Wavelength	400...700 nm
Service Life (T = +25 °C)	100000 h
Max. Ambient Light	10000 Lux
Light Spot Diameter	2 × 2.5 mm
Electrical data	
Supply Voltage	10...30 V DC
Supply Voltage with IO-Link	18...30 V DC
Current Consumption (Ub = 24 V)	< 30 mA
Switching Frequency	14 kHz
Response Time	50 µs
Off-Delay	20 ms
Temperature Drift	< 5 %
Temperature Range	-25...60 °C
Switching Output Voltage Drop	< 2.5 V
PNP Switching Output/Switching Current	100 mA
Short Circuit Protection	yes
Reverse Polarity Protection	yes
Overload Protection	yes
Lockable	yes
Teach Mode	
Interface	IO-Link V1.1
Baud Rate	COM2
Protection Class	III
Mechanical data	
Setting Method	Teach-In
Housing Material	Plastic, ABS/GF
Optic Cover	Plastic, PMMA
Degree of Protection	IP67 IP68
Connection	M12 × 1; 4-pin
Output functions	
Output	PNP
Circuit	NO

3.2 Housing Dimensions

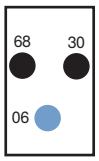


1 Transmitter Diode
2 Receiver Diode
Screw M4 = 1 Nm

Dimensions in mm (1 mm = 0.03937 inch)

3.3 Control panel

A 48



30 = Switching Status/Contamination Warning
68 = Power LED
06 = Teach Button

3.4 Complementary Products

wenglor offers you the right connection and mounting technology as well as other accessories for your product. You can find this at www.wenglor.com on the product details page at the bottom.

3.5 Scope of delivery

- Sensor
- Safety precaution

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 consideration 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.

NOTICE

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.
- Relevant electrical and mechanical regulations, standards, and safety rules must be observed.
- Protect the product from mechanical impact.
- Ensure that the sensor is mechanically secure.
- Torque values must be observed (see section Technical Data [▶ 7]).

NOTICE

Risk of property damage in case of improper installation!

The product may be damaged!

→ Comply with installation instructions.

⚠ CAUTION

Risk of personal injury or property damage during installation!

Personal injury and damage to the product may occur.

→ Ensure a safe installation environment.

5.2 Adjustment

When adjusting sensors, note the following instructions so that the most stable object detection can be achieved:

- Adjust the sensor at the working distance so that a sharp image of the light spot is created.
- The sensor is aligned parallel to the print mark.
- For glossy surfaces, the sensor should be aligned at an angle of approx. 10° to the surface.

5.3 Electrical Connection

- Wire the sensor in accordance with the connection diagram.
- Switch on the supply voltage (see section Technical Data [▶ 7])
- If using IO-Link, connect the sensor to 18...30 V DC.
- If not using IO-Link, connect the sensor to 10...30 V DC.

⚠ 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 be connected by appropriately qualified personnel only.

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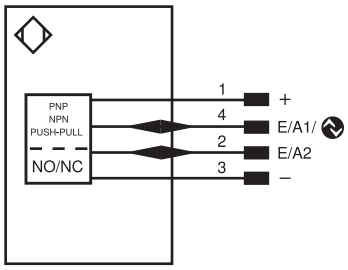
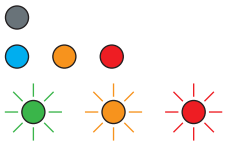


Legend					
+	Supply Voltage +	PT	Platinum measuring resistor	ENARS422	Encoder A/Ā (TTL)
–	Supply Voltage 0 V	nc	Not connected	ENBRS422	Encoder B/B̄ (TTL)
~	Supply Voltage (AC Voltage)	U	Test Input	ENA	Encoder A
A	Switching Output (NO)	Ū	Test Input inverted	ENB	Encoder B
Ā	Switching Output (NC)	W	Trigger Input	AMIN	Digital output MIN
V	Contamination/Error Output (NO)	W–	Ground for the Trigger Input	AMAX	Digital output MAX
V̄	Contamination/Error Output (NC)	O	Analog Output	AOK	Digital output OK
E	Input (analog or digital)	O–	Ground for the Analog Output	SY In	Synchronization In
T	Teach Input	BZ	Block Discharge	SY OUT	Synchronization OUT
R	Reset input	AMV	Valve Output	OLT	Brightness output
Z	Time Delay (activation)	a	Valve Control Output +	M	Maintenance
S	Shielding	b	Valve Control Output 0 V	rsv	Reserved
RxD	Interface Receive Path	SY	Synchronization	Wire Colors according to DIN IEC 60757	
TxD	Interface Send Path	SY–	Ground for the Synchronization	BK	Black
RDY	Ready	E+	Receiver-Line	BN	Brown
GND	Ground	S+	Emitter-Line	RD	Red
CL	Clock	⏚	Grounding	OG	Orange
E/A	Output/Input programmable	SnR	Switching Distance Reduction	YE	Yellow
	IO-Link	Rx+/–	Ethernet Receive Path	GN	Green
PoE	ower over Ethernet	Tx+/–	Ethernet Send Path	BU	Blue
IN	Safety Input	Bus	Interfaces-Bus A(+)/B(–)	VT	Violet
OSSD	Safety Output	La	Emitted Light disengageable	GY	Grey
Signal	Signal Output	Mag	Magnet activation	WH	White
BI_D+/–	Ethernet Gigabit bidirect. data line (A-D)	RES	Input confirmation	PK	Pink
EN0 RS422	Encoder 0-pulse 0/0̄ (TTL)	EDM	Contactor Monitoring	GNYE	Green/Yellow

5.4 Diagnosis

display	Status LED	Meaning
Power LED		Sensor ready for operation
		No voltage supply available
		**Warning** The LED for the switching status indicator remains in operation
		**Error** The LED for the switching status indicator is not functioning
		**teach-in error**
		**Localization** Localization function active, the LED for the switching status indicator remains in operation.
switching status indicator		Switching output active
		Switching output not active
		teach-in process



= Not lit
= Permanently lit
= Flashes

5.5 Troubleshooting

Warnings

Possible cause	Remedy
Signal warning	• Reduce distance between sensor and object • Adjust angle between sensor and object • Remove contamination
Temperature too high	• Mount mounting bracket as cooling plate • Reduce load on outputs

Error

Possible cause	Remedy
Short circuit	• Check the wiring and eliminate the short circuit
Temperature error	• Disconnect the sensor from the supply voltage and allow it to cool down • Mount mounting bracket as cooling plate • Reduce load at the outputs
Undervoltage	• Voltage is outside the permissible range, see section Technical Data [▶ 7]
teach-in error	• Reset sensor via IO-Link
Device error	• Disconnect the sensor from the supply voltage and restart it • Replace sensor

INFORMATION

Behavior in case of error:

1. Shut down the machine.
2. Analyze and rectify the cause of the error using the diagnostic information.
3. If the error cannot be rectified, contact wenglor support.
4. Do not operate the machine if the error behavior is unclear.
5. The machine must be taken out of service if the error cannot be clearly identified or reliably rectified.

⚠ DANGER

Risk of personal injury or property damage if not observed!

The safety function of the system is disabled. Damage to personnel and equipment.

→ Behavior in case of error as specified.

6 Settings

The sensor can be set via teach-in, IO-Link and wTeach2. The different setting options are outlined below.

6.1 Configuration with Push of Button / Teach-In

This section describes the settings that can be configured directly on the sensor using the button.

6.1.1 Two-point teach-in

With two-point teach-in, the sensor learns two different contrast values—first the mark, then the background. The optimum switching threshold is automatically calculated from both values.

- Mount the sensor according to the mounting instructions.
- Align the sensor with the mark to be detected.
- Hold down the teach-in key until the switching status indicator A1 begins to flash slowly (2 Hz) after 2 seconds.
- Release the teach-in key.
- The LED continues to flash slowly at 2 Hz.
- Align the sensor with the background.
- Press and hold the teach-in key again for 2 seconds.
- Release the teach-in key.
- The intensity value with the calculated switching threshold is taught in and LED A1 lights up for 1 second to
- confirm successful teach-in.
- If the teach-in was not successful, this is indicated by the LED A1 flashing rapidly (8 Hz). The process must be repeated.

The switching output A1 switches on when the measured intensity corresponds to the first taught value (mark) and switches off again when the intensity corresponds to the second value (background).

NOTICE

The teach-in key is disabled when jump detection is activated. The switching status indicator A1 lights up red. The teach-in mode can be changed via IO-Link.

NOTICE

Error message if contrast is too low

If the contrast between the mark and the background is insufficient, LED A1 flashes continuously at a high frequency (8 Hz) and the teach-in is not saved.

→ Repeat the process with a higher contrast difference between the mark and the background.

6.1.2 Dynamic teach-in

With this function, the intensity values of the mark and the background are continuously recorded while the material moves in the sensor field. The sensor automatically calculates the optimum switching threshold from the recorded signal curve.

- Mount the sensor according to the mounting instructions and switch on the supply voltage.
- Press and hold the teach-in key. After approx. 5 seconds, the switching status indicator A1 flashes rapidly (4 Hz).
- Release the teach-in key. The sensor is now in the recording phase (A1 continues to flash at 4 Hz).

- Pass material with contrast marking through the sensor's detection range. The sensor detects the contrast change between the mark and the background.
- Press the teach-in key again to end the learning phase.
- The switching threshold is calculated automatically. A1 lights up for 1 second to confirm successful teach-in.

NOTICE

The teach-in key is disabled when jump detection is activated. The switching status indicator A1 lights up red. The teach-in mode can be changed via IO-Link.

NOTICE

Error message if contrast is too low

If the contrast between the mark and the background is insufficient, LED A1 flashes continuously at a high frequency (8 Hz) and the teach-in is not saved.

→ Repeat the process with a higher contrast difference between the mark and the background.

INFORMATION

The duration of the dynamic teach-in can be adjusted via IO-Link.

6.2 Setting via IO-Link and wTeach2

The sensors can exchange parameters and process data via IO-Link. The parameters can be used to make many additional settings on the device. The process data transmit cyclical data and condition monitoring.

To this end, the sensor is connected to a suitable IO-Link master (see product detail page/complementary products). The interface protocol and the IODD can be found at www.wenglor.com in the download area for the respective product.

For information on installing and connecting the wTeach2 software and its structure, as well as information on the general functions, see the wTeach2 operating instructions. They can be found online in the download area at www.wenglor.com under order number DNNF005.

7 Function Description

The functions described in the following section can be set via wTeach or IODD via IO-Link.

7.1 Sensor Functions

Function	Possible settings	Default setting
Localization	The sensor's supply voltage indicator can be set to flash green. This makes it easy to locate the sensor in a system. **On** The supply voltage for the LED flashes green. **Off** LEDs in normal operation.	Off
Key disabling	The teach-in key can be locked to protect the sensor against accidental adjustment. **Unlocked** Operation possible via the teach-in key **Locked** Operation via teach-in key not possible	Unlocked
Emitted light	The transmit LED of the sensor can be switched on or off. **On** Transmit LED on **Off** Transmit LED off The sensor no longer supplies a measured value. **Note!** • If the emitted light LED is switched off, the sensor behavior corresponds to the status “No signal.”	On
Filter	The interference filter can be used to increase measurement reliability in the event of temporary interference. A higher filter level allows the interfering signals to be ignored. If changes happen suddenly, the response time is extended. This extension of the response time depends on the filter level and the mode used. The maximum switching frequency can be reached only with minimum filter selection **Minimum** **Medium** **Maximum**	Minimum
Hysteresis	The hysteresis is the difference between the switch-on and switch-off point and can be set in 3 stages. **Minimum** **Medium** **Maximum**	Minimum

7.2 Input/Output Functions (E/A)

7.2.1 Pin function

The pin function is used to define the function of pins A1 and E/A2, as these can be used for different functions.

Function	Possible settings	Default settings
A1	**switching output** The switching point SSC1 is assigned to the switching output. **error output** The error output switches when one of the assigned errors occurs, see table "Status messages." **Warning output** The warning output switches when one of the assigned warnings occurs, see table "Status messages".	switching output
E/A2	**error output** The error output switches when one of the assigned faults occurs, see table Status Message Function **Warning output** The warning output switches when one of the assigned warnings occurs, see table Status Message Function **teach-in input** The output can be set using the same procedure as with the teach-in key (see section Setup via Teach-In Key). An activated input corresponds to a pressed teach-in button. **Antivalent switching output** The switching output switches antivalent to switching output A1. **Deactivated** The pin is deactivated.	teach-in input

7.2.2 Output Functions

The output functions are used to set the physical outputs.

Digital outputs

Function	Possible settings	Default
PNP/NPN/push-pull	**PNP** The load or analysis module is connected between the negative pole (reference) and the output. When the sensor switches, the output is connected to the positive pole via an electronic switch. The switching signal is maintained when a pull-down resistor is connected. **NPN** The load or the analysis module is connected between the positive pole (reference) and the output. When the sensor switches, the output is connected to the negative pole via an electronic switch. The switching signal is maintained when a pull-up resistor is connected. **push-pull** PNP and NPN are switched alternately.	PNP
Normally closed/normally open	**NO** Light switching (normally open) The output is closed when the condition has been met, depending on the setting (switching point, warning, error). **NC** Dark switching The output is open when the condition has been met, depending on the setting (switching point, warning, error).	NO

Function	Possible settings	Default
On-delay	**0…10,000 ms**	0 ms
Off-delay	**0…10,000 ms**	0 ms
Impulse	**0…10.000 ms**	0 ms

7.2.3 Input Functions

The input functions are used to set the physical inputs.

Function	Possible settings	Default
Input mode	**Supply voltage active** Function is triggered as soon as supply voltage is applied to the input. **Supply voltage inactive** Function is triggered as soon as 0 V is applied to the input or the input is opened.	Supply voltage active

7.2.4 Switching Point Functions (SSC1)

The switching point functions are used to set the switching point. This is assigned to output A1.

Function	Possible settings	Default
teach-in mode	**Two-point teach-in** First, the mark is taught in, then the background. **dynamic teach-in** The switching threshold between the object and the background is automatically taught in. The process can take place during ongoing operation. **Jump detection** The system does not switch to an absolute measured value, but to a jump in the measured value that occurs between two measurements.	Two-point teach-in
Configuration mode	**Auto** The following parameters are automatically learned during a teach-in. **Manual** The parameters can also be changed manually. If settings are changed manually, the setting changes to Manual.	Auto
Light intensity	The light intensity of the emitted light can be adjusted. **High** **Med** **Low**	High
Mark type	**Dark** Dark contrast marking on light background **Bright** Bright contrast marking on dark background	Dark
Sensitivity	In teach-in mode Two-point teach-in Sensitivity defines how close the switching point is to the signal. For example, if there is a difference of 500 between the background and the mark, 10% sensitivity corresponds to 50. This means that the switching point would be 50 digits above the signal of the print mark.	20

Function	Possible settings	Default
	5…90	
Switching point	The switching point corresponds to the switching threshold of the contrast value and is defined in digits. **0…1023**	
dynamic teach-in	Dynamic teach-in duration **10...600**	60
Dynamic teach-in strategy	It is determined whether the mark to be recognized is dark or light. **Light** **Dark**	Dark
Teach-in status	Displays the status of the current teach-in process.	
Jump height min	In teach-in mode Jump detection The minimum jump height defines the jump in the measured value at which a jump event is to be detected. 10...1000	30
Jump direction	In teach-in mode Jump detection **Positive** A jump is detected when the measured value jumps to a higher value, i.e., the contrast value becomes brighter. **Negative** A jump is detected when the measured value jumps to a lower value, i.e., the contrast value becomes darker. **Both** A jump is detected for both positive and negative.	Positive
Jump pulse duration	In teach-in mode Jump detection **0 = hold** The output remains active until the next jump in the opposite direction is detected. When a jump is detected, the output is activated with the corresponding pulse length.	0
Cycle offset	In teach-in mode Jump detection The cycle offset specifies the time-shifted reference measured value with which the current measured value is to be compared in order to detect the jump. 10...5000 Cycles	2000
Maximum detected jump height	The maximum detected signal jump is shown in digits in order to make it easier to set the jump height. The maximum measurement can be reset in order to read a new maximum.	

8 Maintenance Instructions

NOTICE

This wenglor product is maintenance-free.

Cleaning and inspection of the plug connections at regular intervals are advisable.

Do not clean the product with solvents or cleaning agents that 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 Declarations of Conformity

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