EN

wenglor
the innovative family

PNBCxxx

High-Performance Distance Sensors

Operating Instructions

Available as PDF file only
Version: 1.1.0
Revision level: 19.07.2017
www.wenglor.com

EN

Table of Contents

EN

1. Use for Intended Purpose

This wenglor product is intended for use in accordance with the following functional principle:
High-Performance Distance Sensors
This product group includes high-performance sensors for measuring distance, which function in accordance with various principles in scanning mode operation. High-Performance Distance Sensors are especially fast or accurate, or have large working ranges. They're extremely well suited for demanding applications. Even black and glossy objects can be reliably detected. Ethernet technology is integrated into selected sensors.

2. Safety Precautions

2.1. Safety Precautions

- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Read the operating instructions carefully before using the product.
- Installation, initial start-up and maintenance of the product may only be carried out by qualified personnel.
- Tampering with or modifying the product is impermissible.
- Protect the product from contamination during initial start-up.
- Not a safety component in accordance with the EU machinery directive

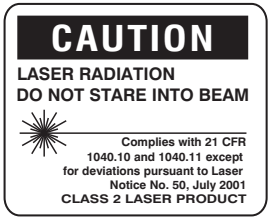
2.2. Laser/LED Warnings

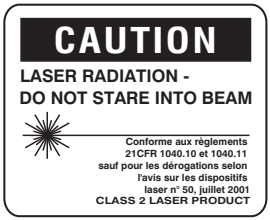
Laser Class 2
EN60825-1

Laser Class 2 (EN 60825-1)

Applicable standards and safety regulations must be observed.
The accompanying laser warnings must be attached.
Do not look into the laser beam.

Caution: Use of control and/or adjusting devices other than those specified here, as well as the execution of other procedures, may result in hazardous exposure to laser radiation.





3. EC Declaration of Conformity

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

4. Technical Data

	PNBC001	PNBC002	PNBC003	PNBC004
Optical Characteristics				
Working range [mm]	20…24	25…35	40 to 60	58 to 108
Measuring range	4 mm	10 mm	20 mm	50 mm
Resolution	0.06 µm	0.15 µm	0.3 µm	0.8 µm
Linearity error	2 µm	5 µm	10 µm	25 µm
Type of Light	Laser (red)	Laser (red)	Laser (red)	Laser (red)
Wavelength	658 nm	658 nm	658 nm	658 nm
Service life (ambient temp. = +25° C)	100,000 hours	100,000 hours	100,000 hours	100,000 hours
Laser class (EN 60825-1)	2	2	2	2
Max. allowable extraneous light	10,000 lux	10,000 lux	10,000 lux	10,000 lux
Spot diameter	< 0.15 mm	< 0.20 mm	< 0.25 mm	< 0.35 mm
Electrical Characteristics				
Supply power	10 to 30 V DC	10 to 30 V DC	10 to 30 V DC	10 to 30 V DC
Current consumption (operating voltage = 24 V)	280 mA	280 mA	280 mA	280 mA
Switching frequency	15 kHz	15 kHz	15 kHz	15 kHz
Response time	<33 µs	<33 µs	<33 µs	<33 µs
Output rate	10...30000/s	10...30000/s	10...30000/s	10...30000/s
Temperature drift	0.2 µm/K	0.5 µm/K	1 µm/K	2.5 µm/K
Temperature range	–10 to 40° C	–10 to 40° C	–10 to 40° C	–10 to 40° C
Storage temperature	–20 to 70° C	–20 to 70° C	–20 to 70° C	–20 to 70° C
Number of switching outputs	4	4	4	4
Voltage drop at switching output	< 1.5 V	< 1.5 V	< 1.5 V	< 1.5 V
Switching output switching current	100 mA	100 mA	100 mA	100 mA
Can be switched to NC or NO operation	Yes	Yes	Yes	Yes
PNP / NPN / push-pull	Yes	Yes	Yes	Yes
Analog output	0 to 10 V/4 to 20 mA	0 to 10 V/4 to 20 mA	0 to 10 V/4 to 20 mA	0 to 10 V/4 to 20 mA
Short-circuit proof	Yes	Yes	Yes	Yes
Reverse polarity protected	Yes	Yes	Yes	Yes
Overload Protection	Yes	Yes	Yes	Yes
Teach-in-Modus	VT/FT	VT/FT	VT/FT	VT/FT
Interface	Ethernet TCP/IP	Ethernet TCP/IP	Ethernet TCP/IP	Ethernet TCP/IP
Transmission speed	100 Mbit/s	100 Mbit/s	100 Mbit/s	100 Mbit/s
Protection class	III	III	III	III
Webserver	Yes	Yes	Yes	Yes
Mechanical Characteristics				
Setting method	Teach-in	Teach-in	Teach-in	Teach-in
Housing material	Aluminum	Aluminum	Aluminum	Aluminum
Protection	IP 67	IP 67	IP 67	IP 67

Connector type	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin
Ethernet connector type	M12× 1, 4-pin	M12×1, 4-pin	M12×1, 4-pin	M12×1, 4-pin
Lens cover	Glass	Glass	Glass	Glass

	PNBC005	**PNBC006**	**PNBC007**	**PNBC008**
Optical Characteristics				
Working range [mm]	90…190	200…400	250…650	200…1000
Measuring range	100 mm	200 mm	400 mm	800 mm
Resolution	1.5 µm	3.1 µm	6.1 µm	12.2 µm
Linearity error	50 µm	100 µm	200 µm	375 µm
Type of Light	Laser (red)	Laser (red)	Laser (red)	Laser (red)
Wavelength	658 nm	658 nm	658 nm	658 nm
Service life (ambient temp. = +25° C)	100,000 hours	100,000 hours	100,000 hours	100,000 hours
Laser class (EN 60825-1)	2	2	2	2
Max. allowable extraneous light	10,000 lux	10,000 lux	10,000 lux	10,000 lux
Spot diameter	< 0.75 mm	< 0.90 mm	< 1.20 mm	< 1.60 mm
Electrical Characteristics				
Supply power	10 to 30 V DC	10 to 30 V DC	10 to 30 V DC	10 to 30 V DC
Current consumption (operating voltage = 24 V)	280 mA	280 mA	280 mA	280 mA
Switching frequency	15 kHz	15 kHz	15 kHz	15 kHz
Response time	<33 µs	<33 µs	<33 µs	<33 µs
Output rate	10...30000/s	10...30000/s	10...30000/s	10...30000/s
Temperature drift	5 µm/K	10 µm/K	20 µm/K	37.5 µm/K
Temperature range	–10 to 40° C	–10 to 40° C	–10 to 40° C	–10 to 40° C
Storage temperature	–20 to 70° C	–20 to 70° C	–20 to 70° C	–20 to 70° C
Number of switching outputs	4	4	4	4
Voltage drop at switching output	< 1.5 V	< 1.5 V	< 1.5 V	< 1.5 V
Switching output switching current	100 mA	100 mA	100 mA	100 mA
Can be switched to NC or NO operation	Yes	Yes	Yes	Yes
PNP / NPN / push-pull	Yes	Yes	Yes	Yes
Analog output	0 to 10 V/4 to 20 mA	0 to 10 V/4 to 20 mA	0 to 10 V/4 to 20 mA	0 to 10 V/4 to 20 mA
Short-circuit proof	Yes	Yes	Yes	Yes
Reverse polarity protected	Yes	Yes	Yes	Yes
Overload Protection	Yes	Yes	Yes	Yes
Teach-in-Modus	VT/FT	VT/FT	VT/FT	VT/FT
Interface	Ethernet TCP/IP	Ethernet TCP/IP	Ethernet TCP/IP	Ethernet TCP/IP
Transmission speed	100 Mbit/s	100 Mbit/s	100 Mbit/s	100 Mbit/s
Protection class	III	III	III	III
Webserver	Yes	Yes	Yes	Yes

Mechanical Characteristics				
Setting method	Teach-in	Teach-in	Teach-in	Teach-in
Housing material	Aluminum	Aluminum	Aluminum	Aluminum
Protection	IP67	IP67	IP67	IP67
Connector type	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin
Ethernet connector type	M12×1, 4-pin	M12×1, 4-pin	M12×1, 4-pin	M12×1, 4-pin
Lens cover	Glass	Glass	Glass	Glass

4.1. Measuring rate

Determination of the measuring rate on various surfaces with an angle of incidence of 90°

	PNBC001	PNBC002	PNBC003	PNBC004
Object color				
white	30 kHz	30 kHz	30 kHz	30 kHz
gray	30 kHz	30 kHz	30 kHz	30 kHz
black	1 kHz	27 kHz	27 kHz	12 kHz

	PNBC005	PNBC006	PNBC007	PNBC008
Object color				
white	30 kHz	30 kHz	25 kHz	25 kHz
gray	30 kHz	30 kHz	20 kHz	18 kHz
black	12 kHz	10 kHz	6 kHz	5 kHz

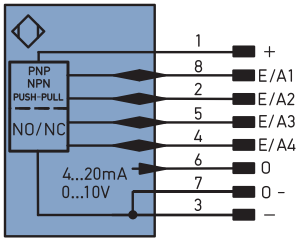
Values measured on OPTEKA Digital Color & White Balance Grey Card Set

Degree of remission: white: 90%
gray: 18%
black: 6%

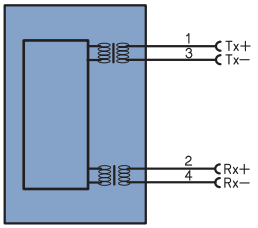
NOTE!
These are typical measured values which may vary depending on surface characteristics and angle of incidence.

4.2. Wiring Diagram

134



004



Legend

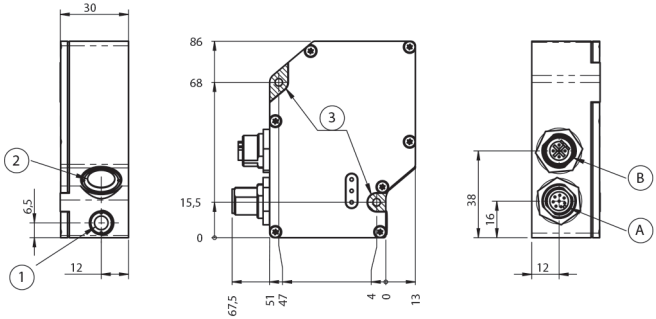
+	Supply Voltage +
–	Supply Voltage 0 V
~	Supply Voltage (AC Voltage)
A	Switching Output (NO)
Ā	Switching Output (NC)
V	Contamination/Error Output (NO)
V̄	Contamination/Error Output (NC)
E	Input (analog or digital)
T	Teach Input
Z	Time Delay (activation)
S	Shielding
RxD	Interface Receive Path
TxD	Interface Send Path
RDY	Ready
GND	Ground
CL	Clock
E/A	Output/Input programmable
	IO-Link
PoE	Power over Ethernet
IN	Safety Input
OSSD	Safety Output
Signal	Signal Output
BI_D +/-	Ethernet Gigabit bidirect. data line (A-D)
EN RS422	Encoder 0-pulse 0-0̄ (TTL)
PT	Platinum measuring resistor
nc	not connected
U	Test Input
Ū	Test Input inverted
W	Trigger Input
O	Analog Output
O–	Ground for the Analog Output
BZ	Block Discharge
AMV	Valve Output
a	Valve Control Output +
b	Valve Control Output 0 V
SY	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
EN RS422	Encoder A/Ā (TTL)
EN RS422	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

Wire Colors according to DIN IEC 757

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

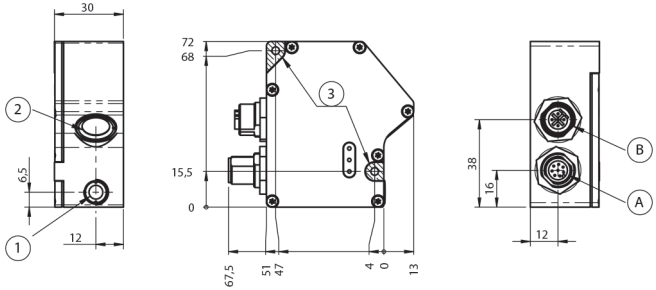
4.3. Housing Dimensions

PNBC001



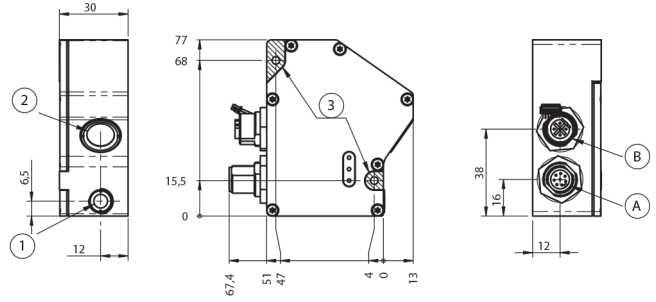
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC002



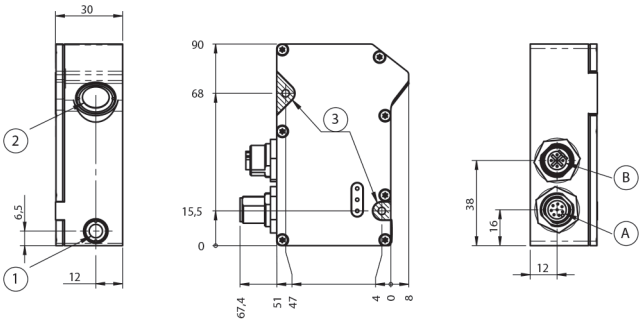
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC003



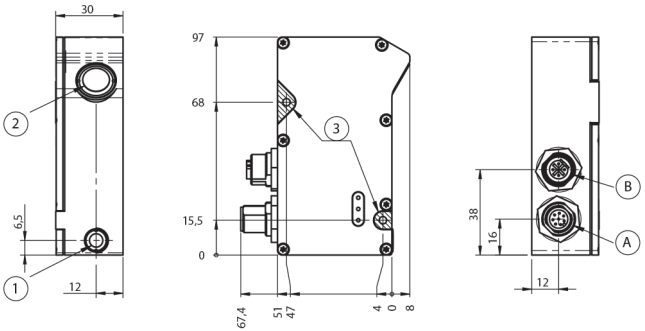
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC004



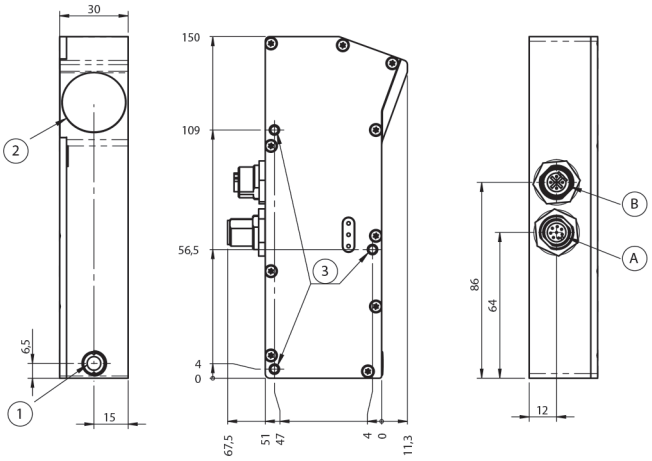
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC005



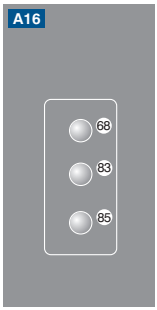
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC006/007/008



1 = Emitter Diode
2 = Receiving Diode
3 = M4 on both sides

4.4. Control Panel



68 = Supply Power Indicator
83 = Signal
Link/Act LED

Designation	Status	Function
Power	Green	Operating voltage on
	Off	Operating voltage off
Signal	Green	Signal strength OK, sensor ready to measure
	Blinking green	Weak signal, unreliable measurement results
	Red	No signal, sensor contaminated and/or overranging
Link/Act	Yellow	Links available
	Blinking yellow	Communication

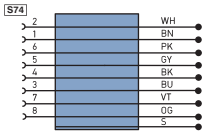
4.5. Complementary Products

wenglor offers Connection Technology for field wiring.

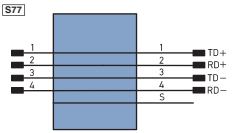
Suitable mounting technology no. 550

Suitable connection technology no.

89



51



Switch ZAC51xN01

5. System Overview

Connector Cables

M12, 8-pin to open end	
ZAS89R201	2 m
ZAS89R501	5 m
ZAS89R601	10 m
ZAS89R701	20 m
ZAS89R202 (angled)	2 m
ZAS89R502 (angled)	5 m
ZAS89R602 (angled)	10 m

Connection Cable

M12, 8-pin	
BG88SG88V2-06M	0,6 m
BG88SG88V2-2M	2 m

Connection Cable

M12, 4-pin to RJ45	
ZAV51R202	2 m
ZAV51R602	10 m

M12, 4-polig	
ZAV51R201	2 m
ZAV51R601	10 m

Mounting System

ZNBZ001
ZNBZ002

Protective Window Holder

Available for each model

Cooling Module

ZNBK001
ZNBK002

Protective Window Set

Available in glass or plastic
for each protective window holder

Legend

Required Accessories

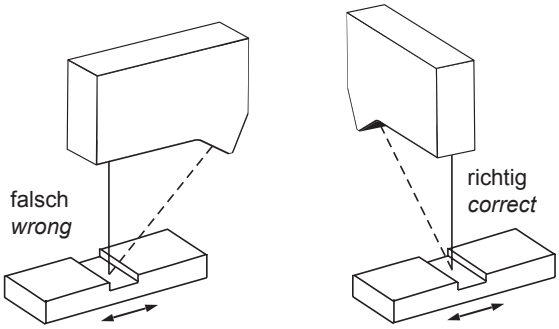
Optional Accessories

6. Installation Instructions

During use of the sensor, applicable electrical and mechanical regulations, standards and safety precautions must be adhered to. The sensor must be protected against mechanical influences.

When installing the sensor it must be ensured that direct eye contact with the laser beam is avoided. The laser warning must be plainly visible.
When installing the sensor it must be ensured that the measuring beam is exactly perpendicular to the surface to be measured in order to assure accurate measurement results. Tilting results in a geometrically longer measuring path.

Moving or Striped Objects
If moving or striped objects will be measured, the sensor head should be mounted with its long side perpendicular to the motion of direction or the stripes. In this way, better measurement results can be achieved in the corners because shadowing is avoided:



6.1. Default Settings

	PNBCxxx
IP address	192.168.0.225
Subnet mask	255.255.0.0
Evaluation method	COG
Average filter	0 (corresponds to the off state)
Sampling rate	Auto
Output rate	10 kHz
Laser	Auto
Offset	0.0 mm
Analog mode	4 to 20 mA
E1	Ext. teach-in: O3
E2	Ext. teach-in: O4
A3	Switching output: PNP / NO
A4	Switching output: PNP / NO
Input load: 2 mA	On
Input	Operating voltage active
Teach-in mode	Foreground teach-in

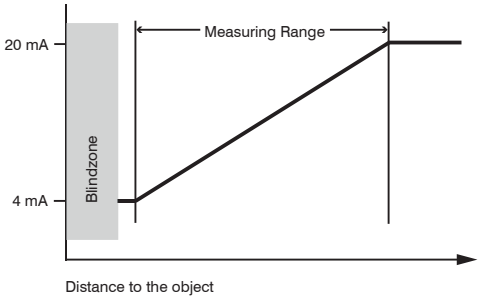
7. Initial Start-Up

Two connector plugs are integrated in to the sensor's housing. The 8-pin plug supplies the sensor with +24 V operating voltage, whereas communication for parameters configuring and process data is conducted via the 4-pin socket. We recommend the exclusive use of Ethernet switches in order to optimize data communication.

Please note: If Gigabit Ethernet cards are used, the polarity of the Tx and Rx conductors might not be correctly detected. Connecting sensors directly may result in complications. With an Ethernet crossover cable (cross-link), the sensor functions flawlessly via a PC network card. As an alternative, a commercially available 100 Mbit Ethernet switch can also be used.

8. Function Descriptions

PNCB High-Performance Distance Sensors work with a high resolution CMOS line array and determine distance by means of an angular measurement at a sampling rate of up to 30 kHz. The sensor is equipped with integrated electronics and no additional controller is required as a result.
Ascertained distance values are read out as process data via the interface and at the analogue output with16-bit resolution.



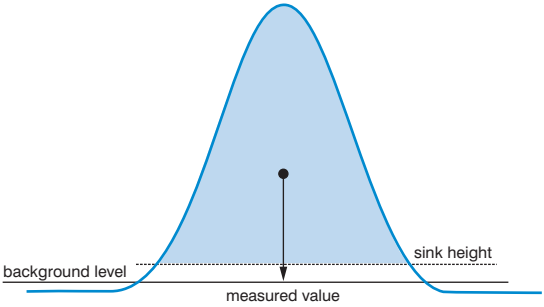
The diffusely reflected light from the measuring point is decisive for the measurement. Inadequate intensity of the remitted light is indicated by an LED signal lamp on the sensor's control panel. In the event of minimal remission, the sensor automatically reduces its sampling and output rates, in order to provide accurate measurement results. Signal strength is indicated on the website as a percentage (see "Status Display" in section "9.1. Page Layout (website)" on page 22).
Not only does the laser spot produce an illuminated pixel on the CMOS line array, it also generates an intensity curve which is distributed over several pixels. This intensity curve is called the peak, and ideally it's steep at both ends, monotonically non-decreasing and symmetrical. The curve depends on distance, internal optics and the surface of the object to be measured. The evaluation method is decisive with regard to attainable measuring accuracy. Some surfaces require an evaluation method which is especially suited to them.

The following peak evaluation methods (algorithms) are available:

8.1. Evaluation method

8.1.1. Center of Gravity (Cog)

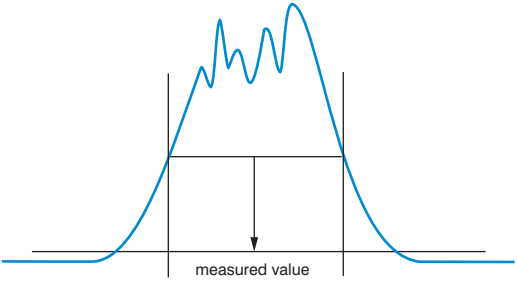
The Cog evaluation method calculates the peak's center of gravity, whose×-coordinate is the sought crude result. The peak has to be separated from the "sink" for the purpose of center of gravity analysis, which necessitates calculation of the so-called sink height.



Sink height is the mean value of all pixel intensities and is thus somewhat higher than the background level. All pixels to the left and to the right of the maximum, whose intensity is greater than the sink height, are used in order to calculate the center of gravity. With 16-bit resolution, the measured values are highly precise thanks to this evaluation method.

8.1.2. Edge Evaluation

In this evaluation method, the peak's edges are evaluated. The advantage of this evaluation method is the fact that the peak's asymmetrical crests, caused for example by speckle effects resulting from a sheet metal panel, are excluded from the evaluation.



With edge evaluation as well, the measured values achieve highly precise 13-bit resolution.

8.2. Measuring Accuracy and Error Influence

8.2.1. Calibration Report

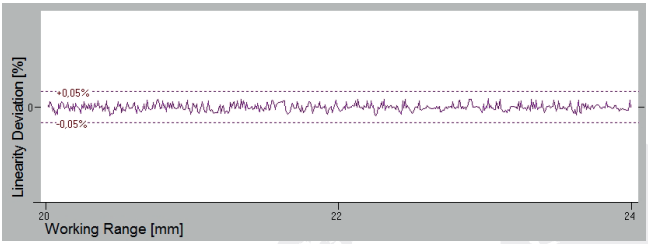
A calibration report is included with the sensor, which graphically represents linearity error as a percentage for the measured value on a matte white surface.

The following is an example of a calibration report:

wenglor
the innovative family

Calibration Protocol

Order Number: PNBC001
Serial Number: 000001
MAC Address: 00:07:AB:F0:0C:AB



Measurement Conditions:

Measuring Range	4 mm
Working Range	20...24 mm
Measured Surface	White Surface
Evaluation Method	COG
Temperature	20° C (+/-1° C)
Laser Class	2 (max 1.0 mW)

Differences to the above data can appear due to:

1. Target material and surface
2. Target geometry
3. Sensor mounting
4. Temperature fluctuation during the measurement
5. Strong circulation of warm air between sensor and tar get

Further statements in the datasheet and the operati on instructions are valid.

Inspector: be
Date: 05.05.2017

8.2.2. Surface Material

Possible objects to be measured include all sorts of materials such as metal, plastic, ceramic, rubber and paper. Suitability for use only needs to be tested individually for highly reflective surfaces and liquids.

8.2.3. Surface Damage on the Object to be Measured

A scratch on the surface of the object to be measured which runs perpendicular to the axis of the lens may cause stronger light emissions, whose maxima are located next to the center of the spot. An incorrect distance is simulated as a result.
If a moving object is involved, the mean (integral) measured value remains constant when the damaged surface is scanned, i.e. the positive and negative edges cancel each other out due to the damage.
Undesired deflection can be minimized by selecting a suitable average filter.

8.2.4. Extraneous Light

When installing the sensor it must be assured that no direct or reflected sunlight can shine into the receiver optics. Where difficult applications are involved, this “extraneous light” may interfere with measured value recording. The measuring point should be correspondingly shaded in such cases.

8.2.5. Changes in Remission

The sensors are equipped with luminous intensity control which is automatically adjusted to the level of remission from the object to be measured. If remission from the surface changes during measurement, the sensor compensates for any fluctuation. By selecting a fixed sampling rate, measured values remain accurate even if surface remission changes.

8.2.6. Dependence of Measurement on Angle

Measurement is minimally dependent on angle if the sensor is not aligned at a right angle to the object to be measured. Tilting the sensor results in a greater distance to the object. This change in distance can be set to zero by means of a corresponding offset shift.

9. Settings

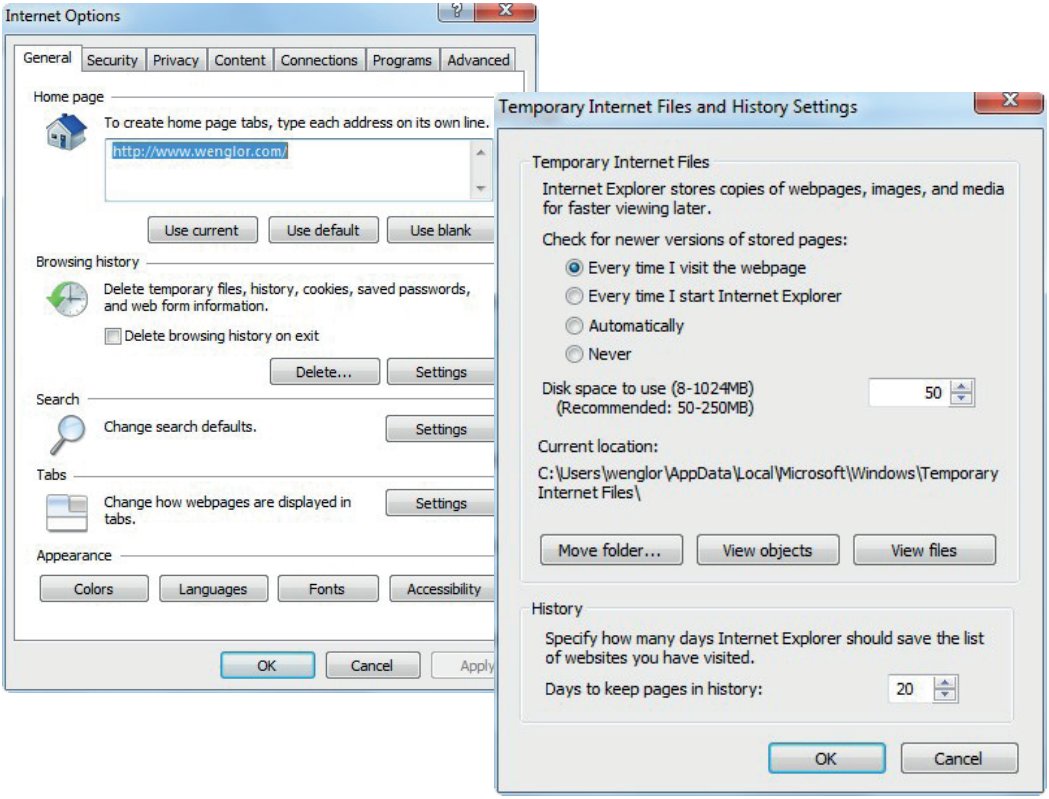
There are several different ways to enter settings to the device:

- Via the integrated website, with which PNBC Sensors are equipped. This website functions independent of the operating system and the sensor can be configured via a standard browser.
- The web-based configuration interface is not required for normal operation with a controller (the default IP address is listed in section “6.1. Default Settings” on page 15).
- With the help of w-Teach configuration and display software which is available for download from www.wenglor.com
- Using the function block for simplified incorporation of PNBC Sensors into an S7 controller – also available for as a download

Settings are explained below based on the descriptive example provided by the website which is integrated into the sensor.

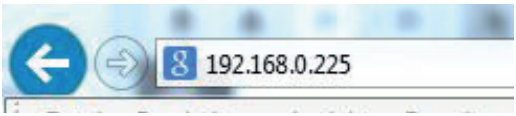
Attention:
If the sensor is connected to a controller, the settings which have been selected via the website are overwritten by the controller.

Accessing the Website
Start the web browser. Enter the sensor’s manually selected IP address to the address line in your browser and press the enter key. In order to ensure that the browser displays the current settings on the website, the website has to be automatically reloaded whenever changes are made. This setting must be changed in a browser-specific manner which is described here using the Internet Explorer as an example. Select **Every time I visit the webpage** under **Tools → Internet options → General → Settings**. Otherwise, changes might not be correctly displayed via the website.



In order to be able to access the product's website (in this example the PNBC002), the IP address must be entered to the browser's address line as described.

Default IP address: 192.168.0.225



The initial page appears with general information concerning the connected sensor.

9.1. Page Layout (website)

The website is subdivided into the following areas:

① **Language selection**
The website can be changed from English (default language) to other languages with the language selection function.

② **Status display**
Current status messages are displayed:

Measured value:	Displays the current distance between the edge of the sensor's housing and the object.
I/O1…I/O4:	Indicates the switching status of the respective input or output.
Sampling rate:	Displays the current sampling rate.
Signal strength:	Indicates the intensity of received light. If luminous intensity is too low, the object is either outside of the measuring range or the emitted light setting is not high enough.
Temperature:	Displays current temperature inside the sensor housing. Depending on how the sensor is mounted, this temperature is 10 to 15° C above ambient temperature. "OK" appears next to the value in order to indicate that the sensor is being operated within its specified values. If the specified temperature limit is exceeded, "Too hot" appears instead.
Encoder:	Displays the current encoder value.

③ **Page content**
Depending on which category is selected in the menu at the left-hand side of the page, respective page content appears here.

④ **Category selection**
The settings are subdivided into the following categories:

- **General device information:** Overview page with general information regarding the sensor as a display without any setting options.
- **Device settings:**
  – The sensor's network settings (see section 9.2)
  – The sensor's measured value settings (see section 9.2)
  – General settings (see section 9.2)
- **I/O settings:** Settings for the digital inputs and outputs (see section 9.3)

9.2. Device Settings (website)

1. Network settings
The IP address and the addresses for the subnet mask and the gateway can be changed in the respective fields. Changes are activated by entering the "admin" password and by restarting the device. Please make sure that the selected subnet mask is actually available within the network. Otherwise you might not be able to find the sensor in the network.

2. Measured value settings
Evaluation method: functions description (see section "8. Function Descriptions" on page 16)
Average filter: Adjustable, rolling average filter from 1 to 1000 measured values
– The smaller the selected value, the faster the measured value reacts to jumps.

– The larger the selected value, the more smoothed the measured value becomes.

Sampling rate: Possible settings include “Auto” (the sampling rate is adjusted automatically) or “= output rate” (sampling rate = output rate). Values can be selected within a range of 900 to 30,000 Hz as well.

Output rate: Values can be selected within a range of 10 to 30,000 Hz. The measured values are compiled individually as an Ethernet data packet at the selected rate.
Example: Using the “extended continuous measurement” evaluation method with 150 distance values and a selected output rate of 1 kHz (corresponds to 1 ms), you get the entire data packet every 150 ms.

Laser: Laser power adjustable from 0.1 to 1.0 mW, or automatic

Offset: If desired, a zero-point offset can be entered here.

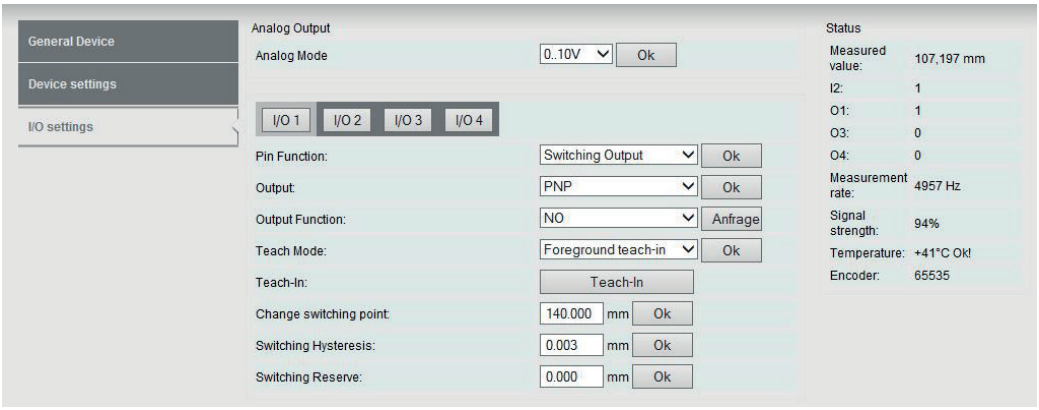
Screening Grid: When activated, the effects of the screening grid on the measured distance value and linearity are compensated for by this option.

3. General settings

Encoder reset: Resets the encoder input to zero.

Default values: Resets all values to their default settings.
Exception: network settings

9.3. I/O Settings (website)



1. Analog output

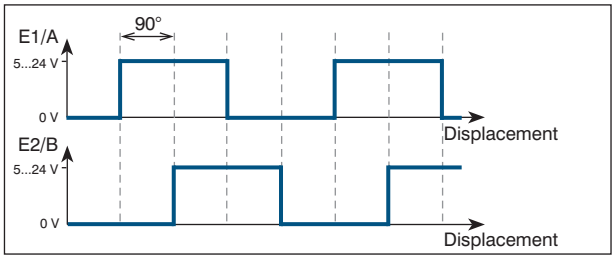
Selection of 0 to 10 V or 4 to 20 mA

2. I/O settings

Various pin functions can be selected for the individual inputs/outputs.
Depending on the selected setting, context menus offer corresponding selection options.

Pin function:

- Switching output: The selected output functions as a switching output.
- External teach-in: One of the sensor’s switching inputs can be taught in anew by applying an electrical signal to this input.



- Encoder E1+E2: A 2-channel rotary encoder with HTL square-wave signal must be used. Channel A is displaced 90° relative to channel B. It must be assured that a shielded cable is used in order to avoid possible interference or crosstalk between the conductors.
- Encoder reset: The encoder is reset to “0”.
- Laser off: The laser can be switched on or off by activating the input load or the input voltage.

Output:

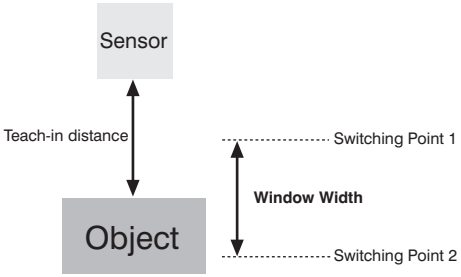
- PNP output: The load or the analysis module is connected between the minus pole (reference) and the output. When switched, the output is connected to the plus pole via an electronic switch. A PNP output can also be equipped with a pull-down resistor.
- NPN output: The load or the analysis module is connected between the plus pole (reference) and the output. When the sensor is switched, the output is connected to the minus pole via an electronic switch. An NPN output can also be equipped with a pull-up resistor.
- Push-pull: alternate PNP and NPN switching

Output function:

- The output can be configured as NO (normally open) or NC (normally closed).

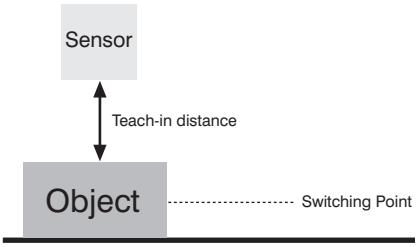
Teach-in mode:

- Teach-in: a function by means of which the sensor is caused to automatically calculate and save future settings based upon momentarily acquired values by pressing a button or applying a control signal.
- FT teach-in mode (window teach-in): There are two switching points in the case of window teach-in. The distance between the two switching points is called the window. The size of the window is designated window width. The sensor is switched when an object is within the window.



- VT teach-in mode (foreground teach-in): Teach-in is performed while the sensor is aligned to the object.

The switching distance is then automatically set to a distance which is slightly greater than the clearance between the sensor and the object. The sensor is thus switched for all objects whose distance to the sensor is equal to or less than the distance to the object used for the teach-in procedure.



- Change switching point: Shifts the switching point to the entered distance. In the case of foreground teach-in this is the teach-in distance described above, and in the case of window teach-in it's the distance to the middle of the window.
- Hysteresis: Describes the distance between the switch-on and switch-off points. Due to the highly stable measured values provided by this range of sensors, hysteresis can be set very low – even down to 0.000 mm. This setting may be advisable in certain applications where an average filter is used.
- Switching reserve: Clearance between the teach-in distance and the sensor's switching point. Switching reserve ensures reliable object detection even in the case of slightly fluctuating distances between the objects and the sensor.
- Window size: see window "teach-in".

2 mA input load:
Input load is set to 2 mA as a default value, but it can be switched off in the dropdown menu (e.g. if the PLC has a high-impedance PNP output).

Input setting:
Operating voltage active: Pending tasks are executed when input voltage is on.
Operating voltage inactive: Pending tasks are executed when input voltage is off.

10. Maintenance Instructions

- This wenglor sensor is maintenance-free.
- It is advisable to clean the lens and the display, and to check the plug connections at regular intervals.
- Do not clean with solvents or cleansers which could damage the product.

11. 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.

12. Appendix

12.1. Change Index, Operating Instructions

Version	Date	Description/Change	Associated product, hardware and firmware versions
1.0.0	26.03.2017	Initial version of the operating instructions	PNBC product version: 1.0.0 PNBC hardware version: 3.3.0 PNBC firmware version: 3.30.6
1.1.0	05.07.2017	• Expansion: measuring rate table • Expansion: Ethernet wiring diagram • Update: symbols explanation • Update: supplementary products • Expansion: system overview • Expansion: “compensation when using screening grids” • Update: calibration report • Update: website	PNBC product version: B / 1.30 PNBC hardware version: 3.4.0 PNBC firmware version: 3.50.1