EN

PNBCxxx

Laser Distance Sensors High-Precision

Operating Instructions

Available as PDF file only
Status: 23.08.2022
Version: 1.5.2
www.wenglor.com

EN

Table of Contents

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
1.2.0	24.09.2019	• Laser warnings (EN 60825-1:2014)	PNBC product version: B / 1.30 PNBC hardware version: 3.4.0 PNBC firmware version: 3.50.1
1.2.1	29.09.2020	• Addition to analog output (see section 9.3) • Adaption of supply voltage	PNBC product version: B / 1.30 PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.6
1.3.0	18.05.2021	• Implementation of PNBC Interface Protocol • Extension Error Output	PNBC product version: C PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.8
1.4.0	21.07.2021	• Adaption data format	PNBC product version: C PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.8
1.4.1	08.12.2021	• Adaption of general information of operating instructions	PNBC product version: C PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.8
1.5.0	15.06.2022	• Added data in section 4	PNBC product version: C PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.8
1.5.1	01.08.2022	• Update of legend in section 4.2	PNBC product version: C PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.8
1.5.2	23.08.2022	• Adaption Laser Warnings (see section 3.6)	PNBC product version: C PNBC hardware version: 3.5.0 PNBC firmware version: 3.50.8

2. General

2.1 Information Concerning these Instructions

- These instructions enable safe and efficient use of the following products:
  » **PNBCxxx**
- 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.

2.2 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.

2.3 Limitation of Liability

- The product has been developed taking into account the state of the art as well as the applicable standards and guidelines.
- We reserve the right to make technical changes.
- A valid declaration of conformity can be found at www.wenglor.com in the download area of the product.
- wenglor sensoric elektronische Geräte GmbH (hereinafter "wenglor") accepts no liability for:
  - » failure to observe the operating manual,
  - » unsuitable or improper use of the product,
  - » excessive use, incorrect or negligent treatment of the product,
  - » incorrect installation or commissioning,
  - » use of untrained personnel,
  - » use of unauthorized spare parts or
  - » Improper or unauthorized changes, modifications or repair work to the products.
- This operating manual does not contain any guarantees/warrantees from wenglor with regard to the processes described or certain product properties.
- wenglor assumes no liability with regard to printing errors or other inaccuracies contained in this operating manual, unless it can be proven that wenglor was aware of the errors at the time the operating manual was created.

2.4 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.

3. For Your Safety

3.1 Use for Intended Purpose

This wenglor product is intended for use in accordance with the following functional principle:

Laser Distance Sensor High-Precision

This product group includes Laser Distance Sensors High-Precision for measuring distance, which function in accordance with various principles in scanning mode operation. Laser Distance Sensors High-Precision 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.

3.2 Use for Other than the Intended Purpose

- The product is not a safety component in accordance with the EG Machinery Directive.
- The product is not suitable for use in potentially explosive atmospheres.

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.
- Instructions regarding use for intended purpose must be observed.

3.3 Personnel Qualifications

- Suitable technical training is a prerequisite.
- In-house electronics training is required.
- Trained personnel who use the product must have uninterrupted access to the operating instructions.
- Valid laser protection requirements must always be adhered to.

Attention!
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.

3.4 Modification of Products

Attention!
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 marking and the guarantee may be rendered null and void.
- Modification of the product is impermissible.

3.5 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 separate download area.
- Read the operating instructions carefully before using the product.
- The sensor must be protected against contamination and mechanical influences.

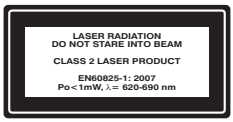
3.6 Laser/LED Warnings

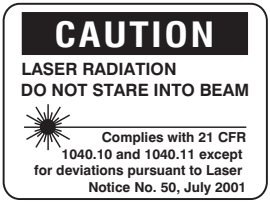
LASER CLASS 2
EN60825-1

Laser Class 2 (EN 60825-1)
Observe all applicable standards and safety precautions.
The enclosed laser warning lables must be attached and visible at all time.
Do not stare into beam.

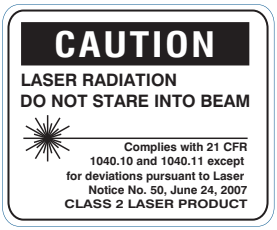
Attention!
If other operating or adjustment devices than those specified here are used or other procedures are carried out, this can lead to dangerous exposure to radiation.

3.6.1 Warnings According to Standard EN 60825-1:2007

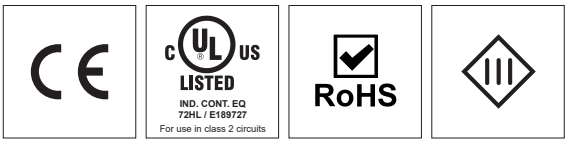




3.6.2 Warnings According to Standard EN 60825-1:2014



3.7 Approvals and protection class



NOTE!
Several sensors do not have a UL certification. Please see datasheet of the sensor.

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 deviation	2 µm	5 µm	10 µm	25 µm
Light source	Laser (red)	Laser (red)	Laser (red)	Laser (red)
Wavelength	658 nm	658 nm	658 nm	658 nm
Service life (T = +25° C)	100,000 hours	100,000 hours	100,000 hours	100,000 hours
Laser class (EN 60825-1)	2	2	2	2
Max. ambient light	10,000 lux	10,000 lux	10,000 lux	10,000 lux
Light spot diameter	< 0.15 mm	< 0.20 mm	< 0.25 mm	< 0.35 mm
Electrical Characteristics				
Supply voltage	15 to 30 V DC	15 to 30 V DC	15 to 30 V DC	15 to 30 V DC
Current consumption (Ub=24V)	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
Switching output voltage drop	< 1.5 V	< 1.5 V	< 1.5 V	< 1.5 V
Switching output/switching current	100 mA	100 mA	100 mA	100 mA
Switching input low level	0,8...2 V	0,8...2 V	0,8...2 V	0,8...2 V
Switching input high level	1,5...2,5 V	1,5...2,5 V	1,5...2,5 V	1,5...2,5 V
Switching input resistance	> 24 kΩ *	> 24 kΩ *	> 24 kΩ *	> 24 kΩ *
Surge strength (EN 60947-1)	1 kV	1 kV	1 kV	1 kV
Switchable to NC/NO	Yes	Yes	Yes	Yes
Configurable to PNP / NPN / push-pull	Yes	Yes	Yes	Yes
Analog output	0...10 V/4...20 mA	0...10 V/4...20 mA	0...10 V/4...20 mA	0...10 V/4...20 mA
Short-circuit protection	Yes	Yes	Yes	Yes
Reverse polarity protection	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
Baud rate	100 Mbit/s	100 Mbit/s	100 Mbit/s	100 Mbit/s
Protection class	III	III	III	III
Webserver	Yes	Yes	Yes	Yes

	PNBC001	PNBC002	PNBC003	PNBC004
Mechanical Characteristics				
Setting method	Teach-in	Teach-in	Teach-in	Teach-in
Housing material	Aluminum	Aluminum	Aluminum	Aluminum
Degree of protection	IP 67	IP 67	IP 67	IP 67
Connection	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin
Type of connection Ethernet	M12× 1, 4-pin	M12×1, 4-pin	M12×1, 4-pin	M12×1, 4-pin
Optic cover	Glass	Glass	Glass	Glass

* only valid if input load is switched off

	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 deviation	50 µm	100 µm	200 µm	375 µm
Light source	Laser (red)	Laser (red)	Laser (red)	Laser (red)
Wavelength	658 nm	658 nm	658 nm	658 nm
Service life (T = +25° C)	100,000 hours	100,000 hours	100,000 hours	100,000 hours
Laser class (EN 60825-1)	2	2	2	2
Max. ambient light	10,000 lux	10,000 lux	10,000 lux	10,000 lux
Light spot diameter	< 0.75 mm	< 0.90 mm	< 1.20 mm	< 1.60 mm
Electrical Characteristics				
Supply voltage	15 to 30 V DC	15 to 30 V DC	15 to 30 V DC	15 to 30 V DC
Current consumption (Ub=24V)	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
Switching output voltage drop	< 1.5 V	< 1.5 V	< 1.5 V	< 1.5 V
Switching output/switching current	100 mA	100 mA	100 mA	100 mA
Switching input low level	0,8...2 V	0,8...2 V	0,8...2 V	0,8...2 V
Switching input high level	1,5...2,5 V	1,5...2,5 V	1,5...2,5 V	1,5...2,5 V
Switching input resistance	> 24 kΩ *	> 24 kΩ *	> 24 kΩ *	> 24 kΩ *
Surge strength (EN 60947-1)	1 kV	1 kV	1 kV	1 kV
Switchable to NC/NO	Yes	Yes	Yes	Yes
Configurable to PNP / NPN / push-pull	Yes	Yes	Yes	Yes

	PNBC005	PNBC006	PNBC007	PNBC008
Analog output	0...10 V/4...20 mA	0...10 V/4...20 mA	0...10 V/4...20 mA	0...10 V/4...20 mA
Short-circuit protection	Yes	Yes	Yes	Yes
Reverse polarity protection	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
Baud rate	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
Degree of protection	IP67	IP67	IP67	IP67
Connection	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin	M12×1, 8-pin
Type of connection Ethernet	M12×1, 4-pin	M12×1, 4-pin	M12×1, 4-pin	M12×1, 4-pin
Optic cover	Glass	Glass	Glass	Glass

* only valid if input load is switched off

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

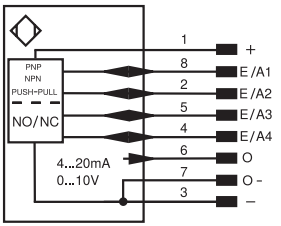
Values measured on OPTEKA Digital Color & White Balance Grey Card Set

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

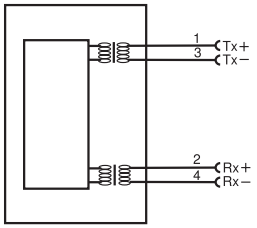
NOTE!
These are typical measured values which may vary depending on surface characteristics and angle of incidence.

4.2 Wiring Diagram

134



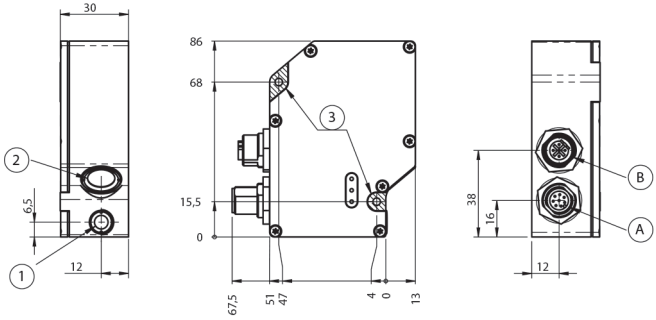
004



Legend					
+	Supply Voltage +	nc	Not connected	ENBRS422	Encoder B/B̄ (TTL)
–	Supply Voltage 0 V	U	Test Input	ENA	Encoder A
~	Supply Voltage (AC Voltage)	Ū	Test Input inverted	ENB	Encoder B
A	Switching Output (NO)	W	Trigger Input	AMIN	Digital output MIN
Ā	Switching Output (NC)	W–	Ground for the Trigger Input	AMAX	Digital output MAX
V	Contamination/Error Output (NO)	O	Analog Output	AOK	Digital output OK
V̄	Contamination/Error Output (NC)	O–	Ground for the Analog Output	SY In	Synchronization In
E	Input (analog or digital)	BZ	Block Discharge	SY OUT	Synchronization OUT
T	Teach 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
Bl_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
PT	Platinum measuring resistor	ENARS422	Encoder A/Ā (TTL)		

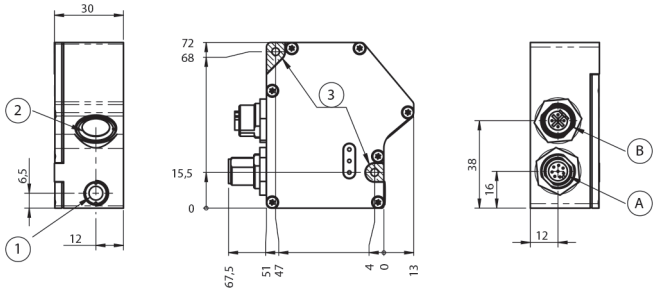
4.3 Housing Dimensions

PNBC001



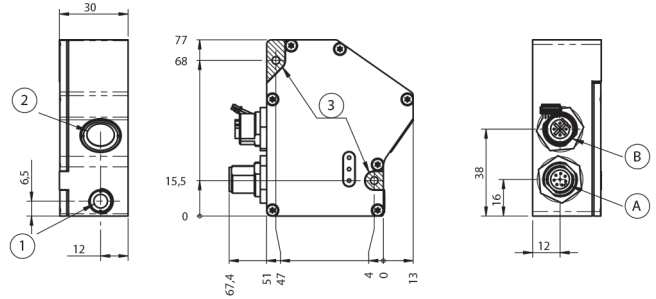
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC002



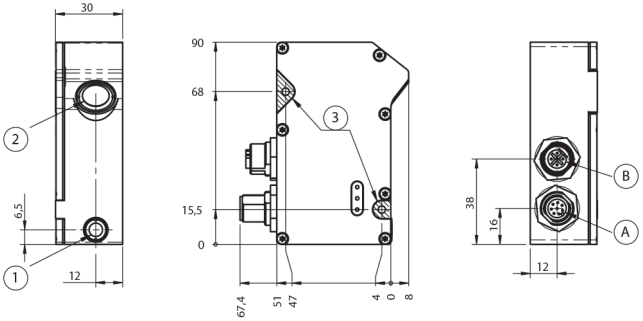
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC003



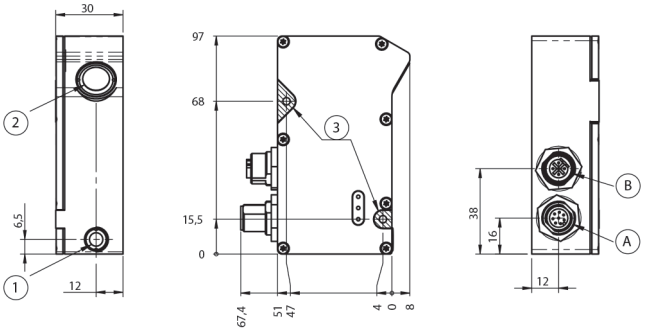
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC004



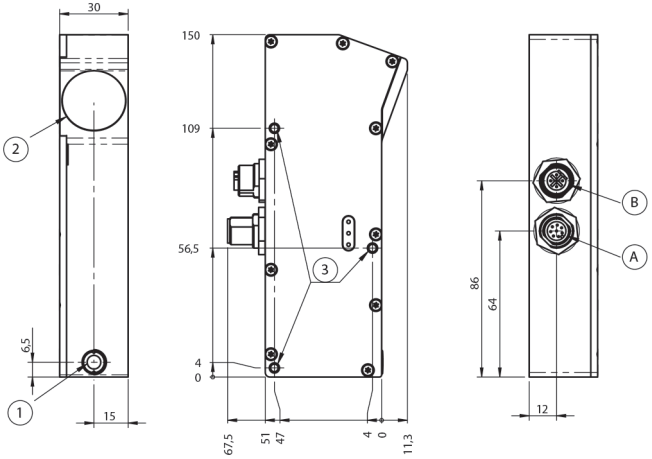
1 = Emitter Diode
2 = Receiving Diode
3 = Bearing Surface with M4 on Both Sides

PNBC005



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

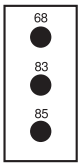
PNBC006/007/008



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

4.4 Control Panel

A16



68 = Supply Power Indicator
83 = Signal
85 = 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

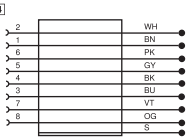
4.5 Complementary Products

wenglor offers Connection Technology for field wiring.

Suitable mounting technology no. 341
Suitable connection technology no.

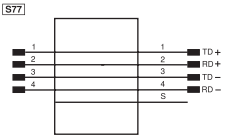
89

S74



51

S77



Switch ZAC51xN01
Cooling unit
Screening Grid Retainer
Screening Grids
Software wTeach2 DNNF005

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

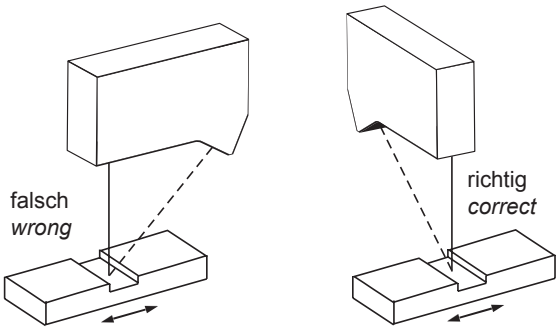
Optional Accessories

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

Description	Default value
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

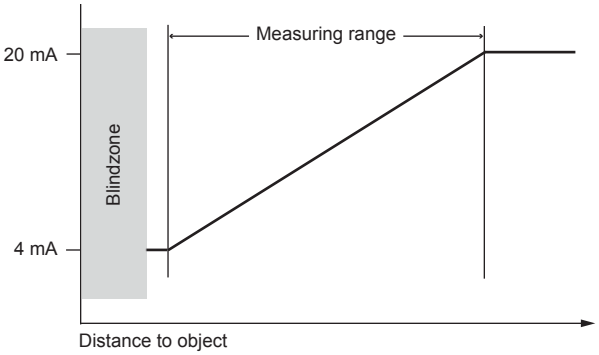
7. Initial Start-Up

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.

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 (crosslink), 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 Laser Distance Sensors High-Precision 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.

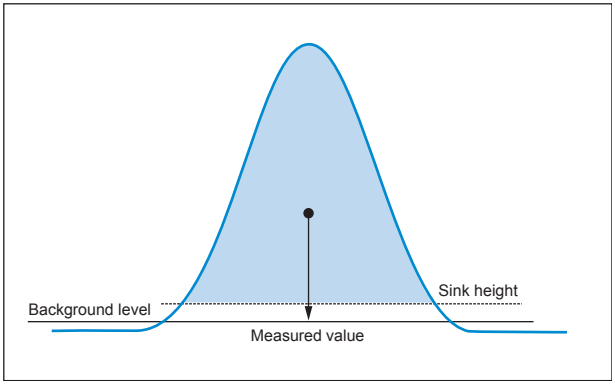


The diffusely reflected light from the measuring point is decisive for the measurement. Inadequate intensity of the remitted light is indicated by an LED signal lamp on the sensor's control panel. In the event of minimal remission, the sensor automatically reduces its sampling and output rates, in order to provide accurate measurement results. Signal strength is indicated on the website as a percentage (see "Status Display" in section 9.1).
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.

8.1 Evaluation method

8.1.1 Center of Gravity (Cog)

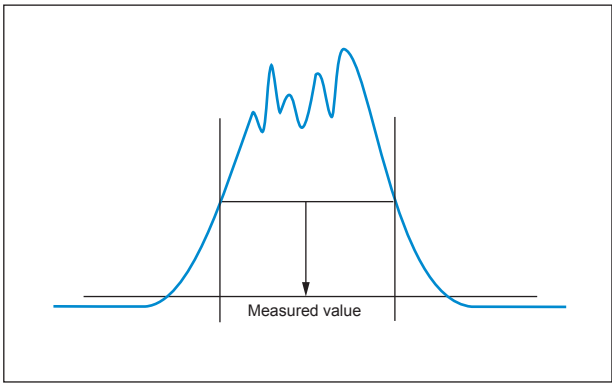
The Cog evaluation method calculates the peak's center of gravity, whose×-coordinate is the sought crude result. The peak has to be separated from the "sink" for the purpose of center of gravity analysis, which necessitates calculation of the threshold.



The threshold 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 threshold, 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

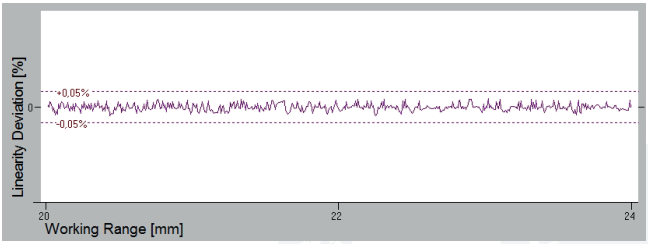
A calibration report is included with the sensor, which graphically represents linearity error as a percentage for the measured value on a matte white surface.

The following is an example of a calibration report:

Calibration Protocol

wenglor
the innovative family

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

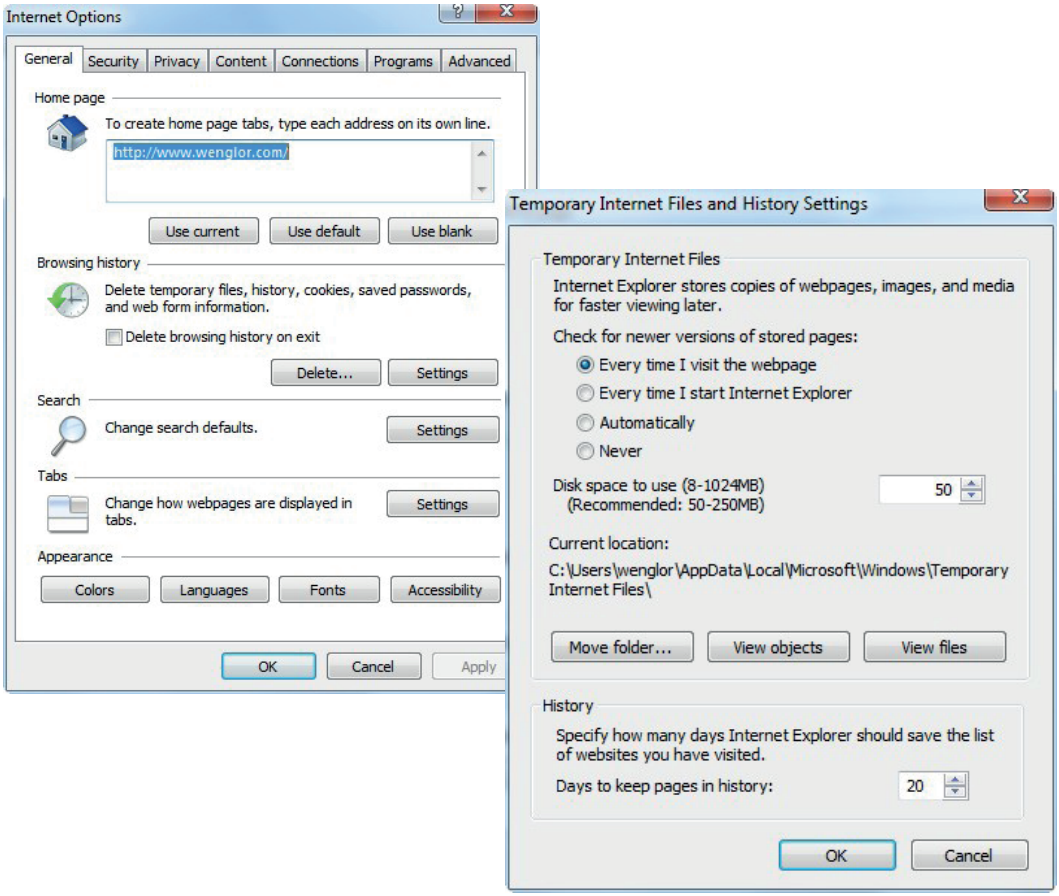
There are several different ways to enter settings to the device:

- 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).
- 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.

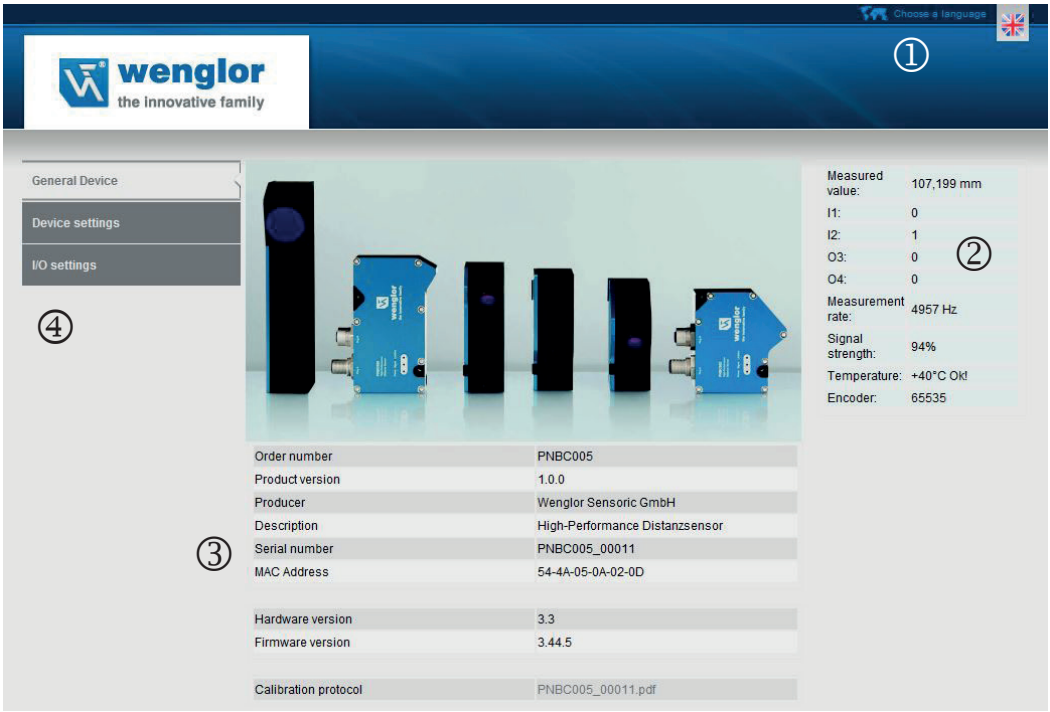

Internet Options
General
Security
Privacy
Content
Connections
Programs
Advanced
Home page
To create home page tabs, type each address on its own line.
http://www.wenglor.com/
Use current
Use default
Use blank
Browsing history
Delete temporary files, history, cookies, saved passwords, and web form information.
Delete browsing history on exit
Delete...
Settings
Search
Change search defaults.
Settings
Tabs
Change how webpages are displayed in tabs.
Settings
Appearance
Colors
Languages
Fonts
Accessibility
OK
Cancel
Apply
Temporary Internet Files and History Settings
Temporary Internet Files
Internet Explorer stores copies of webpages, images, and media for faster viewing later.
Check for newer versions of stored pages:
Every time I visit the webpage
Every time I start Internet Explorer
Automatically
Never
Disk space to use (8-1024MB)
(Recommended: 50-250MB)
50
Current location:
C:\Users\wenglor\AppData\Local\Microsoft\Windows\Temporary Internet Files\
Move folder...
View objects
View files
History
Specify how many days Internet Explorer should save the list of websites you have visited.
Days to keep pages in history:
20
OK
Cancel

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

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.
Measuring rate	Displays the current measuring rate.
Signal strength	Indicates the intensity of received light. If luminious intensity is too low (<2 %), 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 **NOTE!** If the sensor's temperature is too high (>50 °C), the information "Too hot" is also displayed. In this case it is recommended to either cool the sensor or to mount it in such a way that the heat is better dissipated.
Encoder	Displays the current encoder value.

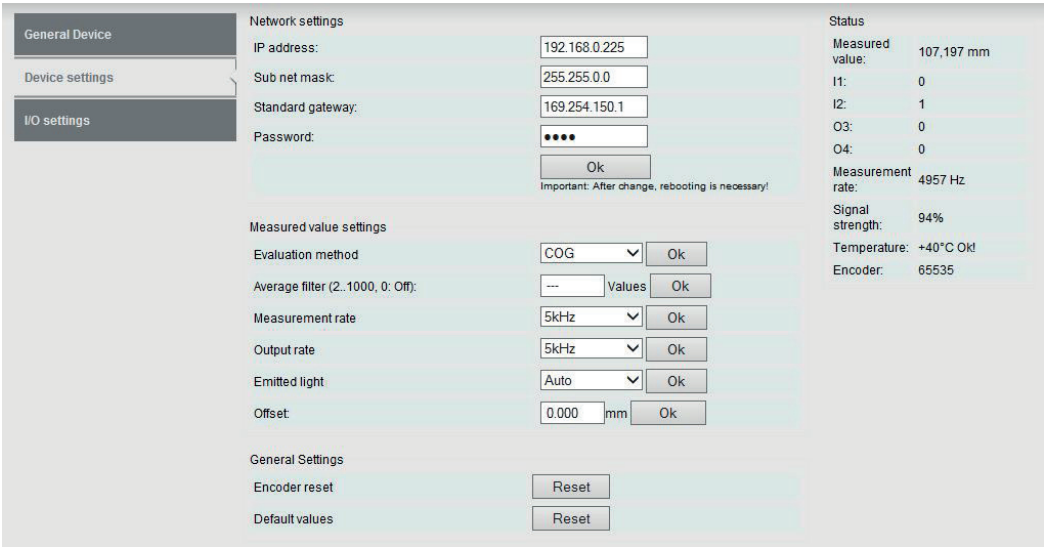
③ Page content

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

General device	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)



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.

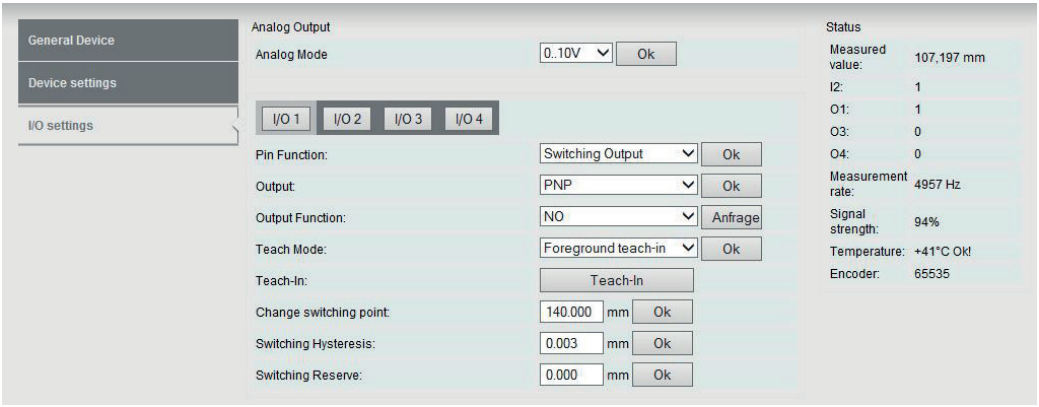
Measured value settings:

Evaluation method	Functions description (see section 8)
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 indiviually 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 by this option.

General settings:

Encoder reset	Resets the encoder input to zero
Default values	Resets all values to their default settings (exception: network settings)

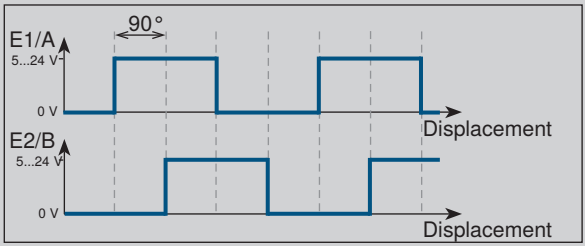
9.3 I/O Settings (website)



Analog output:
Selection of 0...10 V or 4...20 mA. Is the analog output used as a voltage source, the connected load should be 1 kΩ. Is the analog output configured as current output, the connected load should be 400 Ω.

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 operates as a swiching output
External teach-in	The switching input can be taught in again by applying an electrical signal
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.
Error output	The output switches when the selected intensity is exceeded or not reached or when the target is outside the measuring range. **NOTE!** The set threshold values for the intensity are not identical to the specification of the signal strength in the status display (see section 9.1).

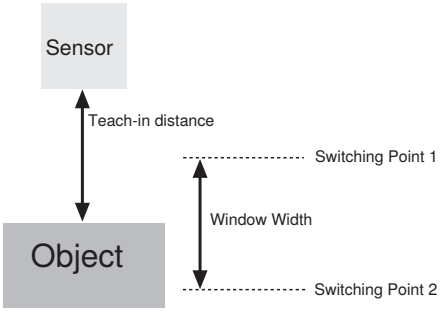
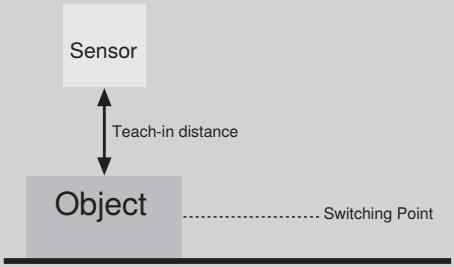
Output

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. A NPN output can also be equipped with a pull-up resistor.
Push-pull	Alternate PNP and NPN switching

Output function

NO	The output is configured as normally open
NC	The output is configured as 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 currently recorded 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 described as 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 larger than the clearance between the sensor and the object. So the sensor switches when the distance between sensor and object is smaller or equal to 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.

Switching 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. Interface Protocol

This section describes the structure and the function of the TCP commands for controlling and configuring the Laser Distance Sensor High-Precision PNBCxxx.
The commands are send via the port 3000. After opening the port, the sensor transmits data packets without any further prompting.
Further information regarding the header and the data format can be found in section 10.5.
It is advisable to stop measurement before configuring the parameters.
Upper and lower case letters must be observed.

10.1 General Measuring Commands

10.1.1 Selecting the “Continuous Distance Measurement” Data Format

Command	`set_measure_start<CR>`
Response	Data stream (see section 10.5.1)
Description	Starts the “Continuous Distance Measurement” data stream (distance data).

10.1.2 Selecting the “Extended Continuous Measurement” Data Format

Command	`set_ext_measure_start<CR>`
Response	Data stream (see section 10.5.2)
Description	Starts the “Extended Continuous Measurement” data stream (distance, intensity and encoder data).

10.1.3 Selecting the Data Format for Peak Data

Command	`set_peak<CR>`
Response	Data stream (see section 10.5.3)
Description	A peak is transmitted.

10.1.4 Stopping the Measurement

Command	`set_measure_stop<CR>`
Response	No response
Description	All measurement and transmission of measurement data is stopped.

10.1.5 Reply Mode

Command	`set_reply_echo_activate<CR>` `set_reply_echo_deactivate<CR>`
Response	Only in case of “reply echo activate”: `OK:reply_echo_activate<CR>`
Description	All commands are acknowledged (default setting: mode deactivated).

10.2 Sensor Settings

10.2.1 Setting the IP Address

Command	set_ip_addr=192.168.0.225<CR>
Response	In reply echo mode: OK:ip_addr=192.168.0.225<CR>
Description	The new address becomes active after restarting the sensor.

10.2.2 Setting the Subnet Mask Address

Command	set_netmask_addr=255.255.0.0<CR>
Response	In reply echo mode: OK:net_mask=255.255.0.0<CR>
Description	The new subnet mask becomes active after restarting the sensor.

10.2.3 Setting the Gateway Address

Command	set_gateway_addr=192.168.0.1<CR>
Response	In reply echo mode: OK:gateway_addr=192.168.0.1<CR>
Description	The new gateway address becomes active after restarting the sensor.

10.2.4 Reset the Network Settings to Default Values

Command	set_activate_network_default<CR>
Response	In reply echo mode: OK:activate_network_default<CR>
Description	Reset of IP address, gateway and subnet mask to default values.

10.2.5 Select the Evaluation Method

Command	set_calc_mode=x<CR>
Response	In reply echo mode: OK:calc_mode=x<CR>
Description	The peak evaluation method can be selected with this command. Possible values for “x” include: 2: COG (default setting) 5: Edge

10.2.6 Adjusting the Average Filter

Command	`set_avg_filter_cnt=x<CR>`
Response	In reply echo mode: `OK:avg_filter_cnt=x<CR>`
Description	The rolling average can be generated based on a value between 2 and 1 000. 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. Possible values for “x” include: 0: off (default setting) 1: off 2...1000

10.2.7 Setting the Output Rate

Command	`set_freq=x<CR>`
Response	In reply echo mode: `OK:freq=x<CR>`
Description	The output rate is set in Hertz (default setting: 10000 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 1000 Hz (corresponds to 1 ms), you get the entire data packet every 150 ms. Possible values for “x” include: 10...30,000

10.2.8 Setting the Sampling Rate

Command	`set_meas_freq=x<CR>`
Response	Im reply echo mode: `OK:meas_freq=x<CR>`
Description	The sampling rate is set in Hertz. Possible values for “x” include: 0: The sampling rate corresponds to the output rate 900...30,000

10.2.9 Setting Regulation of Laser Power and the Sampling Rate

Command	`set_regulator=x<CR>`
Response	In reply echo mode: `OK:regulator=x<CR>`
Description	Regulation of the measuring rate and laser power is set here. Possible values for “x” include: 0: Automatic sampling rate regulation AND laser power regulation (default setting) 1: Automatic sampling rate, laser power manually adjustable 2: Automatic laser power, sampling rate manually adjustable 3: Laser power and sampling rate manually adjustable In case of laser power regulation and sampling rate regulation, the sensor automatically selects the setting which results in the best intensity. Depending on the application, either sampling rate or laser power regulation is preferable. If constant measurement times are desired, automatic laser power regulation should be selected. If constant laser power is desired, sampling rate regulation is more suitable.

10.2.10 Protective Screen Compensation

Command	`set_compensation_activate<CR>` `set_compensation_deactivate<CR>`
Response	No response
Description	Activation/deactivation of protective screen compensation

10.2.11 Setting Laser Power

Command	`set_laser=x<CR>`
Response	In reply echo mode: `OK:laser=x<CR>`
Description	Laser power can be adjusted in 1/10 mW steps. Possible values for “x” include: Auto (default setting) 1 (0.1 mW)...10 (1 mW) This setting is only active in case of manual laser power regulation (see section 10.2.9)

10.2.12 Adjusting Offset

Command	`set_digout_offset=x<CR>`
Response	In reply echo mode: `OK:digout_offset=x<CR>`
Description	A zero-point offset can be entered here as a 16-bit value (default setting: 0.000). Possible values for “x” include: -30,000...30,000 Conversion of digital offset to offset in mm: $\boldsymbol{Offset[mm] = \frac{x}{65536} \times measuring\ range\ [mm]}$

10.2.13 Encoder Reset

Command	`set_clear_encoder<CR>`
Response	In reply echo mode: `OK:clear_encoder<CR>`
Description	This command resets the internal encoder counter to zero.

10.2.14 Encoder Counter Right Shift

Command	`set_enc_right_shift=x<CR>`
Response	In reply echo mode: `OK:enc_rshift=x<CR>`
Description	The scaling factor of the encoder input can be set with this command. Possible values for “x” include: 1: Every 2nd encoder pulse is counted 2: Every 4th encoder pulse is counted (default setting) ⋮ 8: Every 256th encoder pulse is counted

10.2.15 Switching the Laser On/Off

Command	`set_activate_laser<CR>` `set_deactivate_laser<CR>`
Response	In reply echo mode: `OK:activate_laser<CR>` `OK:deactivate_laser<CR>`
Description	The laser is switched on or off by means of TCP commands (default setting: laser on). The pin setting is always dominant and cannot be changed by the input command.

10.2.16 Reset to Default Values

Command	`set_activate_default<CR>`
Response	In reply echo mode: `OK:activate_default<CR>`
Description	Returns all settings to their default values. Exception: network settings.

10.3 I/O Settings

10.3.1 Selecting the Analog Mode

Command	`set_anaout_mode=x<CR>`
Response	In reply echo mode: `OK:anaout_mode=x<CR>`
Description	Selects the analog mode. Possible values for “x” include: 1: 0...10 V 8: 4...20 mA (default setting)

10.3.2 Setting the Pin Function

Command	`set_usrio1_pin_function=x<CR>`
	`set_usrio2_pin_function=x<CR>`
	`set_usrio3_pin_function=x<CR>`
	`set_usrio4_pin_function=x<CR>`

Response	Im Reply-Echo-Mode (e.g. I/O1): `OK:usr_io1_pin_function=x<CR>`
Description	Sets the pin function. Possible values for “x” include: 1: Switching output 2: External teach-in input for O1 3: External teach-in input for O2 4: External teach-in input for O3 5: External teach-in input for O4 6: Encoder input (I1+I2) 7: Encoder reset input 10: Laser off input 11: Error output

10.3.3 Selecting the Output Mode

Command	`set_usrio1_output_mode=x<CR>`
	`set_usrio2_output_mode=x<CR>`
	`set_usrio3_output_mode=x<CR>`
	`set_usrio4_output_mode=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_output_mode=x<CR>`
Description	Sets the output mode. Possible values for “x” include: 1: PNP 2: NPN 3: Push-pull

10.3.4 Setting the Output Function

Command	`set_usrio1_output_function=x<CR>`
	`set_usrio2_output_function=x<CR>`
	`set_usrio3_output_function=x<CR>`
	`set_usrio4_output_function=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_output_function=x<CR>`
Description	Configures the output function. Possible values for “x” include: 1: Normally open (NO) 2: Normally closed (NC)

10.3.5 Teaching the Switching Distance (Teach-in)

Command	`set_usrio1_teach_in=x<CR>`
	`set_usrio2_teach_in=x<CR>`
	`set_usrio3_teach_in=x<CR>`
	`set_usrio4_teach_in=x<CR>`

Response	In reply echo mode (e.g. I/O3): `OK:usr_io3_switch_dist_mm=87.614<CR>`
Description	A function by means of which the sensor is caused to automatically calculate and save future settings based on momentarily acquired values by pressing a button or applying a control signal. **NOTE!** The pin function of the respective output must be configured as a switching output.

10.3.6 Selecting the Teach-In Mode

Command	`set_usrio1_teach_mode=x<CR>`
	`set_usrio2_teach_mode=x<CR>`
	`set_usrio3_teach_mode=x<CR>`
	`set_usrio4_teach_mode=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_teach_mode=x<CR>`
Description	Sets the teach-in mode. Possible values for “x” include: 1: Foreground teach-in (default setting) 2: Window teach-in Foreground teach-in: Teach-in is performed while the sensor is aligned to the object. The teach-in distance is set automatically, so that the sensor switches as soon as the distance between the sensor and the object is less than or equal to the previously taught in distance. Window teach-in: There are two switching points in the case of window teach-in. The distance between the two switching points is the window width. The sensor switches when the object is within the window.

10.3.7 Setting the Switching Point

Command	`set_usrio1_switch_dist_mm=x<CR>`
	`set_usrio2_switch_dist_mm=x<CR>`
	`set_usrio3_switch_dist_mm=x<CR>`
	`set_usrio4_switch_dist_mm=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_switch_dist_mm=x<CR>`
Description	The switching point is shifted to the entered distance. In the case of foreground teach-in, this is the teach-in distance (see section 10.3.6), while in the case of window teach-in, it is the distance to the middle of the window. The value selected for “x” must lie within the working range. Example: 22.123 (specified in mm) **NOTE!** Decimal points must be used for non-whole numbers - not decimal commas.

10.3.8 Setting Hysteresis

Command	`set_usrio1_hysteresis_mm=x<CR>`
	`set_usrio2_hysteresis_mm=x<CR>`
	`set_usrio3_hysteresis_mm=x<CR>`
	`set_usrio4_hysteresis_mm=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_hysteresis_mm=x<CR>`
Description	Hysteresis describes the distance between the switch-on and switch-off points. Possible values for “x” include: 0...1/4 of measuring range Example: 0.030 (specified in mm) **NOTE!** Decimal points must be used for non-whole numbers - not decimal commas.

10.3.9 Setting Switching Reserve

Command	`set_usrio1_switch_res_mm=x<CR>`
	`set_usrio2_switch_res_mm=x<CR>`
	`set_usrio3_switch_res_mm=x<CR>`
	`set_usrio4_switch_res_mm=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_switch_res_mm=x<CR>`
Description	Switching reserve describes the 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. Possible values for "x" include: 0...1/4 of measuring range Example: 0.120 (specified in mm) Switching reserve can only be set for foreground teach-in. **NOTE!** Decimal points must be used for non-whole numbers - not decimal commas.

10.3.10 Setting Window Width

Command	`set_usrio1_window_size_mm=x<CR>`
	`set_usrio2_window_size_mm=x<CR>`
	`set_usrio3_window_size_mm=x<CR>`
	`set_usrio4_window_size_mm=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_window_size_mm=x<CR>`
Description	Sets the window width (see section 10.3.6 ➝ window teach-in). The entered value must be smaller than the sensor's measuring range. Example: 0.100 (specified in mm) **NOTE!** Decimal points must be used for non-whole numbers - not decimal commas.

10.3.11 Setting Input Load

Command	`set_usrio1_input_load=x<CR>`
	`set_usrio2_input_load=x<CR>`
	`set_usrio3_input_load=x<CR>`
	`set_usrio4_input_load=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_input_load=x<CR>`
Description	Sets the input load. Possible values for "x" include: 1: Input load active (2 mA; default setting) 2: Input load inactive

10.3.12 Setting the Input Function

Command	`set_usrio1_input_function=x<CR>`
	`set_usrio2_input_function=x<CR>`
	`set_usrio3_input_function=x<CR>`
	`set_usrio4_input_function=x<CR>`

Response	In reply echo mode (e.g. I/O1): `OK:usr_io1_input_function=x<CR>`
Description	Configures the input function. Possible values for “x” include: 1: Operating voltage active (pending tasks are executed when input voltage is on, default setting) 2: Operating voltage inactive (pending tasks are executed when input voltage = 0 V)

10.3.13 Setting Packet Length

Command	`set_packet_size=x<CR>`
Response	In reply echo mode: `OK:packet_size=x<CR>`
Description	The desired number of distance values per packet can be selected here. Possible values for “x” include: 1...450 (continuous measurement) 1...150 (extended continuous measurement) The entered value remains valid until the data format is changed. The values are then reset to the default values (150/450).

10.4 Query Commands

10.4.1 Querying the IP Address

Command	`get_ip_addr<CR>`
Response	Example: `OK:ip_addr=192.168.0.225<CR>`
Description	The IP address is read out.

10.4.2 Querying the Subnet Mask Address

Command	`get_net_mask<CR>`
Response	Example: `OK:net_mask=255.255.0.0<CR>`
Description	The subnet mask address is read out.

10.4.3 Querying the Gateway Address

Command	`get_gateway<CR>`
Response	Example: `OK:gateway_addr=169.254.150.1<CR>`
Description	The gateway address is read out.

10.4.4 Querying the MAC Address

Command	`get_mac_address<CR>`
Response	Example: `OK:mac_address=0007ABF00CAB<CR>`
Description	The MAC address is read out.

10.4.5 Querying the Hardware Version

Command	`get_hwversion<CR>`
Response	Example: `OK:hw_version=3.0.0<CR>`
Description	The hardware version is read out.

10.4.6 Querying the Description

Command	`get_description<CR>`
Response	`OK:description=High_Performance_Distance_Sensor<CR>`
Description	The description is read out. Blanks are replaced by underlines!

10.4.7 Querying the Manufacturer

Command	`get_manufacturer<CR>`
Response	`OK:manufacturer=wenglor_sensoric_GmbH<CR>`
Description	The manufacturer is read out. Blanks are replaced by underlines!

10.4.8 Querying the Order Number

Command	`get_name<CR>`
Response	Example: `OK:name=PNBC005<CR>`
Description	The order number is read out.

10.4.9 Querying the Serial Number

Command	`get_serial<CR>`
Response	Example: `OK:serial=001020<CR>`
Description	The serial number is read out.

10.4.10 Querying the Product Version

Command	`get_pversion<CR>`
Response	Example: `OK:pversion=1.0.0<CR>`
Description	The product version is read out.

10.4.11 Querying the Setting for the Evaluation Mode

Command	`get_calc_mode<CR>`
Response	Example: `OK:calc_mode=2<CR>`
Description	The selected evaluation method is read out. Possible values include: 2: COG 5: Edge

10.4.12 Querying the Average Filter

Command	`get_avg_filter_cnt<CR>`
Response	Example: `OK:avg_filter_cnt=345<CR>`
Description	The average filter is read out. Possible values include: 0: off 1: off 2...1000

10.4.13 Quering the Output Rate

Command	`get_freq<CR>`
Response	Example: `OK:freq=26667<CR>`
Description	The output rate is read out. Possible values include: 10...30,000 The output rate is read out in Hertz.

10.4.14 Quering the Sampling Rate

Command	`get_meas_freq<CR>`
Response	Example: `OK:meas_freq=26667<CR>`
Description	The sampling rate (inverse value of exposure time) is read out. Possible values include: 900...30,000 The sampling rate is read out in Hertz.

10.4.15 Quering Regulation of Laser Power and the Sampling Rate

Command	`get_regulator<CR>`
Response	Example: `OK:regulator=0<CR>`
Description	The settings for laser power and sampling rate are read out. Possible values include: 0: Automatic sampling rate regulation AND laser power regulation 1: Automatic sampling rate, laser power manually adjustable 2: Automatic laser power, sampling rate manually adjustable 3: Laser power and sampling rate manually adjustable

10.4.16 Quering Laser Power

Command	`get_laser<CR>`
Response	Beispiel: `OK:laser=10<CR>`
Description	Laser power is read out in 1/10 mW. Possible values include: 1 (0.1 mW)...10 (1 mW)

10.4.17 Quering the Encoder Right Shift Setting

Command	`get_enc_rshift<CR>`
Response	Example: `OK:enc_rshift=2<CR>`
Description	The scaling factor of the encoder input is read out. Possible values include: 1: Every 2nd encoder pulse is counted 2: Every 4th encoder pulse is counted : : 8: Every 256th encoder pulse is counted

10.4.18 Quering the Analog Mode

Command	`get_anaout_mode<CR>`
Response	Example: `OK:anaout_mode=1<CR>`
Description	The analog output setting is read out. Possible values include: 1: 0...10 V 8: 4...20 mA

10.4.19 Quering the Pin Function

Command	`get_usrio1_pin_function<CR>`
	`get_usrio2_pin_function<CR>`
	`get_usrio3_pin_function<CR>`
	`get_usrio4_pin_function<CR>`

Response	Example: `OK:usr_io1_pin_function=1<CR>`
Description	The pin function setting is read out. Possible values include: 1: Switching output 2: External teach-in input for O1 3: External teach-in input for O2 4: External teach-in input for O3 5: External teach-in input for O4 6: Encoder input (I1+I2) 7: Encoder reset input 10: Laser off input 11: Error Output

10.4.20 Quering the Output Mode

Command	`get_usrio1_output_mode<CR>`
	`get_usrio2_output_mode<CR>`
	`get_usrio3_output_mode<CR>`
	`get_usrio4_output_mode<CR>`

Response	Example: `OK:usr_io1_output_mode=1<CR>`
Description	The output mode is read out. Possible values include: 1: PNP 2: NPN 3: Push-pull

10.4.21 Quering the Output Function

Command	`get_usrio1_output_function<CR>`
	`get_usrio2_output_function<CR>`
	`get_usrio3_output_function<CR>`
	`get_usrio4_output_function<CR>`

Response	Example: `OK:usr_io1_output_function=1<CR>`
Description	The output function is read out. Possible values include: 1: Nomally open 2: Normally closed

10.4.22 Quering Switching Distance

Command	`get_usrio1_switch_dist_mm<CR>`
	`get_usrio2_switch_dist_mm<CR>`
	`get_usrio3_switch_dist_mm<CR>`
	`get_usrio4_switch_dist_mm<CR>`

Response	Example: `OK:usr_io1_switch_dist_mm=75.5<CR>`
Description	The switching distance is read out.

10.4.23 Quering the Teach-in Mode

Command	`get_usrio1_teach_mode<CR>`
	`get_usrio2_teach_mode<CR>`
	`get_usrio3_teach_mode<CR>`
	`get_usrio4_teach_mode<CR>`

Response	Example: `OK:usr_io1_teach_mode=2<CR>`
Description	The teach-in mode is read out. Possible values include: 1: Foreground teach-in 2: Window teach-in

10.4.24 Quering Hysteresis

Command	get_usrio1_hysteresis_mm<CR> get_usrio2_hysteresis_mm<CR> get_usrio3_hysteresis_mm<CR> get_usrio4_hysteresis_mm<CR>
Response	Example: OK:usr_io1_hysteresis_mm=0.120<CR>
Description	Hysteresis is read out in mm.

10.4.25 Quering Switching Reserve

Command	get_usrio1_switch_res_mm<CR> get_usrio2_switch_res_mm<CR> get_usrio3_switch_res_mm<CR> get_usrio4_switch_res_mm<CR>
Response	Example: OK:usr_io1_switch_res_mm=0.188<CR>
Description	The clearance between the teach-in distance and the sensor's switching point is read out in mm.

10.4.26 Quering Window Width

Command	get_usrio1_window_size_mm<CR> get_usrio2_window_size_mm<CR> get_usrio3_window_size_mm<CR> get_usrio4_window_size_mm<CR>
Response	Example: OK:usr_io1_window_size_mm=12.755<CR>
Description	Window width is read out in mm.

10.4.27 Quering Input Load

Command	get_usrio1_input_load<CR> get_usrio2_input_load<CR> get_usrio3_input_load<CR> get_usrio4_input_load<CR>
Response	Example: OK:usr_io1_input_load=1<CR>
Description	Input load status is read out. Possible values include: 1: Input load active (2 mA) 2: Input load inactive

10.4.28 Quering the Input Function

Command	get_usrio1_input_function<CR> get_usrio2_input_function<CR> get_usrio3_input_function<CR> get_usrio4_input_function<CR>
Response	Example: OK:usr_io1_input_function=1<CR>
Description	The input function is read out. Possible values include: 1: Operating voltage active 2: Operating voltage inactive (= 0 V active)

10.4.29 Quering the Input Status

Command	(e.g. I/O1): get_usr_io1<CR>
Response	Example: OK:usr_io1=1<CR>
Description	Reads out the input status at the pin. Possible values include: 0 and 1

10.4.30 Quering the Input/Output Status of All Inputs/Outputs

Command	get_usr_allinputs<CR>
Response	OK:usr_io_allinputs=0110<CR>
Description	Reads out the status of all inputs/outputs in the following order: IO4, IO3, IO2 and IO1. Possible values include: 0 and 1. The following applies to the example included above: IO4: 0 (inactive) IO3: 1 (active) IO2: 1 (active) IO1: 0 (inactive)

10.4.31 Quering Packet Length

Command	get_packet_size<CR>
Response	OK:packet_size=120<CR>
Description	The number of measured values per data format is read out. Possible values include: In the event of continuous measurement: 1...450 (continuous measurement) 1...150 (extended continuous measurement)

10.5 Header and Data Format

After opening port 3000, the sensor transmits data packets in the selected data format (exception: peak data, see section 10.5.3).

The following data formats are possible:

- Continuous distance measurement (default setting)
- Extended continuous measurement
- Peak data

The header and the data are distributed to two TCP/IP packages of roughly the same size. In the case of a header with 94 bytes and a data volume of 900 bytes (for a total of 994 bytes), the first package contains 496 bytes and the second package 498. The header is always at the beginning of the package and is followed by the data.

The data layout is described in the following tables. The respective data format is identified by means of the “Data Format” field.

Example: If a value of 17520 appears in the “Data Format” field, this corresponds to continuous distance measurement.

Each data packet is laid out so that the header is transmitted first. This is followed by the actual data (see table below). The data can be identified and allocated on the basis of the indentification value.

All values are little-endian, i. e. the least significant byte comes first.

In the case of zero-terminated strings, the entry ends with the first “0”. The last value must be a ‘0’ at the latest, i. e. one less byte is available for the entry. All zero-terminated strings are read out in ASCII code.

10.5.1 Continuous Distance Measurement

This data format should be used for processes which do not require an encoder.
All measured distance values are transmitted uninterruptedly.

Designation	Offset [bytes]	Length [bytes]	Type	Read-out/Comment
Data format	0	4	unsigned int	17520
Internal	4	24		
Order number (zero-terminated)	28	12	string	PNBC002*
Serial number (zero-terminated)	40	12	string	001000*
Software version (zero-terminated)	52	10	string	V2.11*
Operating time counter in ms	62	4	unsigned int	1467*
Measuring range lower limit in mm	66	2	unsigned short	25*
Measuring range in mm	68	2	unsigned short	10*
Laser power in 0.1 mW	70	2	unsigned short	1...10
Sampling rate in Hz	72	2	unsigned short	900...30,000
Temperature in the sensor in °C	74	1	unsigned char	35*
Evaluation method	75	1	unsigned char	2, 5
Laser power/sampling rate regulation	76	1	unsigned char	0...3
EncRightShift	77	1	unsigned char	0...8
Status (see section 10.5.4)	78	1	unsigned char	0...255
Internal	79	8		
I/Ox status, laser (see section 10.5.4)	87	1	unsigned char	0...255
Output rate in Hz	88	2	unsigned short	10...30,000
Average filter	90	2	unsigned short	0...1000
Offset	92	2	signed short	–30,000...+30,000
Number of distance values per packet	94	2	unsigned short	1...450
Distance 1 (see section 10.5.4) Distance 2 ⋮ Distance 450	96 98 ⋮ 994	2		0...65,535

*) Example values

10.5.2 Extended Continuous Measurement (Distance, Intensity, Encoder)

This data format should be selected when an encoder is used in the application.
In this case, intensity and the encoder value (encoder counter in the PNBC Sensor) are transmitted for each individual measurement in addition to distance values. This makes it possible to obtain an actual position value synchronous to the distance values.

Designation	Offset [bytes]	Length [bytes]	Type	Read-out/Comment
Data format	0	4	unsigned int	17536
Internal	4	24		
Order number (zero-terminated)	28	12	string	PNBC002*
Serial number (zero-terminated)	40	12	string	001000*
Software version (zero-terminated)	52	10	string	V2.11*
Operating time counter in ms	62	4	unsigned int	1467*
Measuring range lower limit in mm	66	2	unsigned short	25*
Measuring range in mm	68	2	unsigned short	10*
Laser power in 0.1 mW	70	2	unsigned short	1...10
Sampling rate in Hz	72	2	unsigned short	900...30,000
Temperature in the sensor in °C	74	1	unsigned char	35*
Evaluation method	75	1	unsigned char	2, 5
Laser power/sampling rate regulation	76	1	unsigned char	0...3
EncRightShift	77	1	unsigned char	0...8
Status (see section 10.5.2)	78	1	unsigned char	0...255
Internal	79	8		
I/Ox status, laser (see section 10.5.4)	87	1	unsigned char	0...255
Output rate in Hz	88	2	unsigned short	10...30,000
Average filter	90	2	unsigned short	0...1000
Offset	92	2	signed short	–30,000...+30,000
Number of distance, intensity and encoder values per packet	94	2	unsigned short	1...150
Distance 1 (see section 10.5.4) Intensity 1 (see section 10.5.4) Encoder 1 (see section 10.5.4) : : Distance 150 Intensity 150 Encoder 150	96 98 100 : : 990 992 994	6	unsigned short	 0...65,535 0...4,095 0...65,535

*) Example values

10.5.3 Peak Data

This data format is suitable for diagnosis purposes.
All 1024 pixel intensities of the sensor's CMOS line array are transmitted.
This data format is not retained after a restart. The sensor is automatically reset to the previously selected format.

Designation	Offset [bytes]	Länge [bytes]	Type	Read-out/Comment
Data format	0	4	unsigned int	17488
Internal	4	24		
Order number (zero-terminated)	28	12	string	PNBC002*
Serial number (zero-terminated)	40	12	string	001000*
Software version (zero-terminated)	52	10	string	V2.11*
Operating time counter in ms	62	4	unsigned int	1467*
Measuring range lower limit in mm	66	2	unsigned short	25*
Measuring range in mm	68	2	unsigned short	10*
Laser power in 0.1 mW	70	2	unsigned short	1...10
Sampling rate in Hz	72	2	unsigned short	900...30,000
Temperature in the sensor in °C	74	1	unsigned char	35*
Evaluation method	75	1	unsigned char	2, 5
Laser power/sampling rate regulation	76	1	unsigned char	0...3
EncRightShift	77	1	unsigned char	0...8
Status (see section 10.5.4)	78	1	unsigned char	0...255
Internal	79	8		
I/Ox status, laser (see section 10.5.4)	87	1	unsigned char	0...255
Distance in digits	88	2	unsigned short	0...65,535
Intensity in digits	90	2	unsigned short	0...4,095
Encoder value in digits	92	2	unsigned short	0...65,535
Number of intensity values per packet	94	2	unsigned short	1,024
Intensity pixel 1 Intensity pixel 2 : : Intensity pixel 1024	96 98 : : 2142	2	unsigned short	0...4,095

*) Example values

10.5.4 Description of the Measurement Data

Status:
The status is represented as a 7-bit value:

7	6	5	4	3	2	1	0

Bit 0: Out of range error: intensity or distance is outside of the valid working range
Bit 1: Internal peak memory overflow error
Bit 2: Sensor FIFO overflow: CPU processing is unable to keep up with the measurement data
Bit 3...7: = 0

I/Ox and Laser Status:
The statuses of the inputs/outputs and the laser are represented as 7-bit values

7	6	5	4	3	2	1	0

Bit 0: Status of I/O1
Bit 1: Status of I/O2
Bit 2: Status of I/O3
Bit 3: Status of I/O4
Bit 7: Laser status: 1 = On; 0 = Off

Distance as Bit:
Distance is represented as a 16-bit value:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0...15: Measured distance value (0...65,535)

The following formula is used to obtain the value displayed on the website:

Measured value in mm = (distance in bits × sensor measuring range in mm / 65,536) + lower working range limit in mm

Example (PNBC005): Measured value = 35,721 × 100 mm / 65,536 + 90 mm = 144.5 mm

Intensity Value:
The intensity value is represented as a 16-bit value:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 to 11: Intensity value (=peak value; 0...4095)
Bit 12: Reserved (=0)
Bit 13: Reserved (=0)
Bit 14: Error bit: intensity too low or too high
Bit 15: Error bit: distance outside of working range

The following formula for converting the digital value into a percentage is used to obtain the signal strength displayed on the website:

Signal strength as percentage = intensity value/16

If the intensity value is higher than 1600 the signal strength is limited to 100 %.

Encoder Value:
The encoder value is represented as a 16-bit value:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 to 15: Encoder value (0...65,535)

A converted value in mm cannot be provided here because conversion depends on the utilized encoder and how it is installed.

11. 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.

12. 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.

13. EU Declaration of Conformity

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