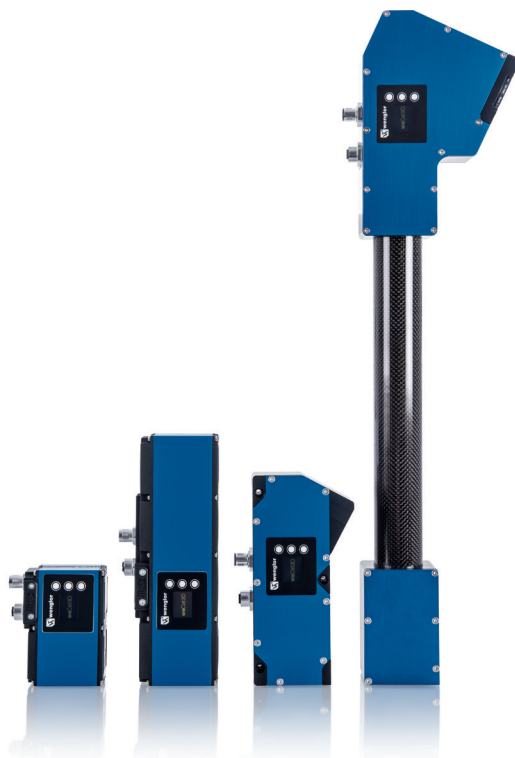


EN

weCat3D MLSL & MLWL

2D/3D Profile Sensors



Operating Instructions

Translation of the Original Operating Instruction
Subject to change without notice
Available as PDF version only
Status: 25/03/2020
Version: 1.7.2
www.wenglor.com

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1. General

1.1 Information Concerning these Instructions

- These instructions apply to the weCat3D product series.
- They make it possible to use the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Local accident prevention regulations and national work safety regulations must be complied with as well.
- The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change. The current version can be found at www.wenglor.com in the product's separate download area.



NOTE!

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

1.2 Explanations of Symbols

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

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



ATTENTION-GETTING WORD

Type and Source of Danger!

Possible consequences in the event that the hazard is disregarded.

- Measures for averting the hazard.

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



DANGER!

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



WARNING!

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



CAUTION!

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



ATTENTION:

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

**NOTE!**

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

1.3 Limitation of Liability

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

1.4 Copyrights

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

2. For Your Safety

2.1 Use for Intended Purpose

The product is based on the following functional principle:

2D/3D Profile Sensors project a laser line (1) onto the object to be detected (2) and generate an accurate, linearized height profile with an internal camera (3) which is set up at a triangulation angle (4).

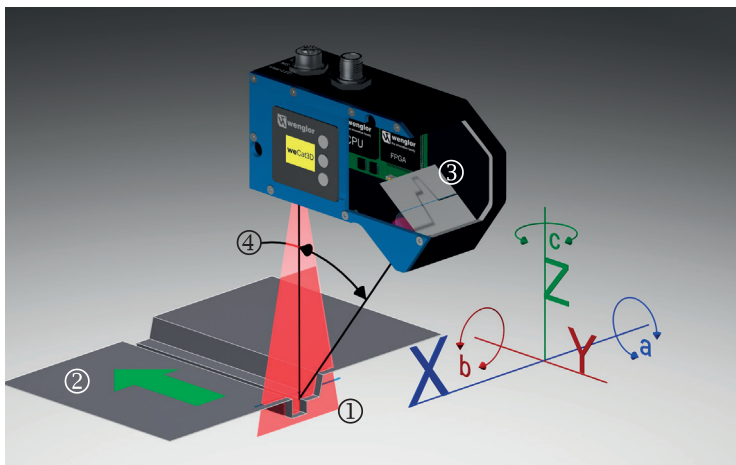
Thanks to its uniform, open interface, the weCat3D series can be incorporated by means of the DLL (Windows)/so (Linux) or the GigE Vision standard without an additional control unit. Alternatively, wenglor offers its own software packages for implementing your application. Individualized selection from a great variety of working ranges, laser classes and light types (red and blue light) ensures maximized flexibility for two and three-dimensional object detection.

The weCat3D range of sensors is subdivided into two performance classes: weCat3D MSL and weCat3D MLWL. Whereas the weCat3D MSL provides for high performance in standard applications with its compact design, the weCat3D MLWL assures maximized, top performance.

The weCat3D MSL is distinguished by minimal weight and a space-saving housing. Up to 3.6 million measuring points per second, an output rate of up to 4000 Hz, measuring ranges X from 27 to 1350 mm, high resolution (down to 22 μm in measuring range X and down to 3.3 μm in working distance Z) deliver outstanding performance.

The weCat3D MLWL is distinguished by previously unparalleled performance characteristics: up to 12 million measuring points per second, an output rate of up to 6000 Hz, measuring ranges X from 30 to 1300 mm and high resolution (down to 17 μm in measuring range X and down to 2.0 μm in working distance Z) impressively demonstrate the breathtaking high performance and precision of this product range.

2.1.1 Function Principle



- ① = Laser line
- ② = Object
- ③ = Integrated camera
- ④ = Triangulation angle

This product can be used in the following industry sectors:

- Special machinery manufacturing
- Heavy machinery manufacturing
- Logistics
- Automotive industry
- Food industry
- Packaging industry
- Plastics industry
- Woodworking industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Steel industry
- Printing industry
- Construction industry
- Other

2.2 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.
-

2.3 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.
-

2.4 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.
-

2.5 General Safety Precautions

NOTE!


















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














2.6 Laser/LED Warnings

Warning labels are included with the products depending on laser class and type of light. The respective warning labels must be attached to the system in a plainly visible fashion.

2.6.1 Warnings According to Standard EN 60825-1:2007

Laser Class	IEC EN 60825-1	FDA/CFR
Laser Class 1M (EN 60825-1) Applicable standards and safety regulations must be observed.	 	Not applicable
Laser Class 2M red (EN 60825-1) Applicable standards and safety regulations must be observed.	 	CAUTION LASER RADIATION DO NOT STARE INTO BEAM  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, July 2001
Laser Class 2M blue (EN 60825-1) Applicable standards and safety regulations must be observed.	 	CAUTION LASER RADIATION DO NOT STARE INTO BEAM  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, July 2001
Laser Class 3R red (EN 60825-1) Applicable standards and safety regulations must be observed. The laser outlet is identified on the device.	 	DANGER LASER RADIATION - AVOID DIRECT EYE EXPOSURE  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, July 2001 400 - 650 nm < 5 mW CLASS IIIa LASER PRODUCT
Laser Class 3R blue (EN 60825-1) Applicable standards and safety regulations must be observed. The laser outlet is identified on the device.	 	DANGER LASER RADIATION - AVOID DIRECT EYE EXPOSURE  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, July 2001 400 - 650 nm < 5 mW CLASS IIIa LASER PRODUCT
Laser Class 3B blue (EN 60825-1) Applicable standards and safety regulations must be observed. The laser outlet is identified on the device.	 	DANGER LASER RADIATION - AVOID DIRECT EXPOSURE TO THE BEAM  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, July 2001 400 - 650 nm < 500 mW CLASS IIIb LASER PRODUCT

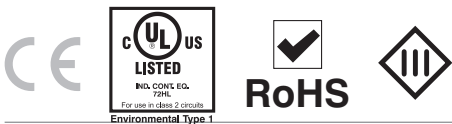
2.6.2 Warnings According to Standard EN 60825-1:2014

Laser Class	IEC EN 60825-1	FDA/CFR
Laser Class 1M (EN 60825-1) Applicable standards and safety regulations must be observed.		Not applicable
Laser Class 2M red (EN 60825-1) Applicable standards and safety regulations must be observed.		
Laser Class 2M blue (EN 60825-1) Applicable standards and safety regulations must be observed.		
Laser Class 3R red (EN 60825-1) Applicable standards and safety regulations must be observed. The laser outlet is identified on the device.		
Laser Class 3R blue (EN 60825-1) Applicable standards and safety regulations must be observed. The laser outlet is identified on the device.		
Laser Class 3B blue (EN 60825-1) Applicable standards and safety regulations must be observed. The laser outlet is identified on the device.		

2.6.3 weCat and Extended Source

Sensors included in the weCat3D series use line lasers. A line laser is an extended source. As a result, the C_6 factor (see IEC EN 60825-1:2014) must be taken into account when evaluating the laser class. Due to the fact that C_6 is greater than or equal to 1, the maximum permissible exposure value (MPE) for thermic retinal hazard is increased by a factor of C_6 , assuming that angular extension of the source (measured at the observer's eye) is greater than α_{min} , where α_{min} is equal to 1.5 mrad. And thus as compared with a collimated laser beam, maximum output radiation can be higher for the same laser class.

2.7 Approvals and protection class



3. Technical Data

Order No.	MLSL	MLWL
Technical Data		
Electrical Data		
Supply Voltage	18...30 V	
Current consumption (Ub = 24 V) ¹	300 mA	300 mA
Measuring rate	200...4 000 Hz	175...6 000 Hz
Measuring rate (subsampling)	800... 4 000 Hz ²	350...6 000 Hz ³
Temperature range	0...45 °C	
Storage temperature	–20...70 °C	
Number of I/Os	4	
Switching Output Voltage Drop	< 1,5 V	
Switching Output/Switching Current	100 mA	
Can be switched to NC or NO operation	yes	
PNP / NPN / push-pull	yes	
Short-circuit proof	yes	
Reverse polarity protected	yes	
Overload-proof	yes	
Interface	Ethernet TCP/IP	
Transmission speed	100/1000 MBit/s	
Protection class	III	
Integrated web server	yes	
Mechanical Data		
Housing	Aluminum/Plastic	Aluminum
Degree of Protection	IP67	
Connection Type	M12×1; 12-pin.	
Ethernet connector type	M12×1; 8-pin.	
External 24 V laser shutdown ⁴	M12×1, 8-pin	---
Optic Cover	Plastic	Glass

¹ Increased current consumption (1000 mA) for weCat3D MLWL and MLSL2 with laser class 3B.

² Subsampling in X and Z

³ Subsampling in Z

⁴ Only MLSL2 with laser class 3R and 3B



NOTE!

The warm-up phase lasts roughly 15 minutes.

Order No.	MLSL1x1	MLSL1x2	MLSL1x3	MLSL1x4
Technical Data				
Optical Data				
Working range Z	72...108 mm	65...125 mm	90...280 mm	100...500
Measuring range Z	36 mm	60 mm	190 mm	400 mm
Measuring range X	27...34 mm	40...58 mm	62...145 mm	70...280 mm
Resolution Z	3,3...5,2 μm	4,8...9,6 μm	9,4...49 μm	12,4...160 μm
Resolution X	22...28 μm	33...47 μm	54...123 μm	68...246 μm
Temperature drift	2 $\mu\text{m/K}$	3 $\mu\text{m/K}$	10 $\mu\text{m/K}$	20 $\mu\text{m/K}$
Linearity deviation	18 μm	30 μm	95 μm	200 μm
	0,05 %			
Service life (Tu= +25 °C)*	20.000 h			
max. Ambient Light	5.000 Lux			

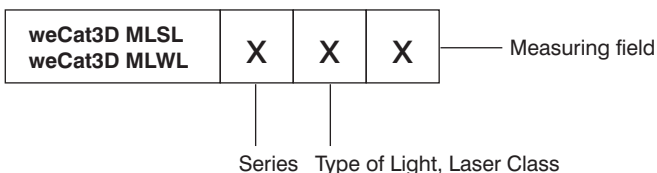
Order No.	MLSL2x5	MLSL2x6
Technical Data		
Optical Data		
Working range Z	280...1280 mm	300...1500 mm
Measuring range Z	1000 mm	1200 mm
Measuring range X	200...850 mm	250...1350 mm
Resolution Z	40...570 μm	60...990 μm
Resolution X	190...760 μm	270...1170 μm
Temperature drift	50 $\mu\text{m/K}$	60 $\mu\text{m/K}$
Linearity deviation	500 μm	600 μm
	0,05 %	
Service life (ambient temp. = +25° C)*	20.000 h	
Max. permissible ambient light	5.000 lux	

* Service life is related to the Laser. Since the Laser is not permanently switched on, the service life increases accordingly.

Order No.	MLWL1x1	MLWL1x2	MLWL1x3	MLWL1x4	MLWL1x5
Technical Data					
Optical Data					
Working range Z	70...130 mm	83...213 mm	215...475mm	390...910 mm	600...1 400 mm
Measuring range Z	60 mm	130 mm	260 mm	520 mm	800 mm
Measuring range X	30...52 mm	50...110 mm	150...230 mm	285...455 mm	450...720 mm
Resolution Z	2...4,9 μm	3,2...14 μm	9,6...22 μm	17,8...43 μm	28...67 μm
Resolution X	17...26 μm	26...55 μm	79...120 μm	151...238 μm	235...361 μm
Temperature drift	3 $\mu\text{m/K}$	6 $\mu\text{m/K}$	12 $\mu\text{m/K}$	24 $\mu\text{m/K}$	37 $\mu\text{m/K}$
Linearity deviation	15 μm	32,5 μm	65 μm	130 μm	200 μm
	0,025 %				
Service life (Tu= +25 °C)*	20.000 h				
max. Ambient Light	5.000 Lux				

Order No.	MLWL2x1	MLWL2x2	MLWL2x3	MLWL2x4	MLWL2x5
Technical Data					
Optical Data					
Working range Z	120...300 mm	120...470 mm	300...1 000 mm	600...2 000 mm	1000...2 500 mm
Measuring range Z	180 mm	350 mm	700 mm	1 400 mm	1 500 mm
Measuring range X	65...145 mm	120...395 mm	280...830 mm	440...1300 mm	850...1300 mm
Resolution Z	5,2...26 μm	8,9...76 μm	27...162 μm	39...289 μm	92...439 μm
Resolution X	36...81 μm	68...198 μm	181...446 μm	251...683 μm	505...1 095 μm
Temperature drift	10 $\mu\text{m/K}$	16 $\mu\text{m/K}$	32 $\mu\text{m/K}$	64 $\mu\text{m/K}$	70 $\mu\text{m/K}$
Linearity deviation	45 μm	87,5 μm	175 μm	350 μm	375 μm
	0,025 %				
Service life (Tu= +25 °C)*	20.000 h				
max. Ambient Light	5.000 Lux				

* Service life is related to the Laser. Since the Laser is not permanently switched on, the service life increases accordingly.



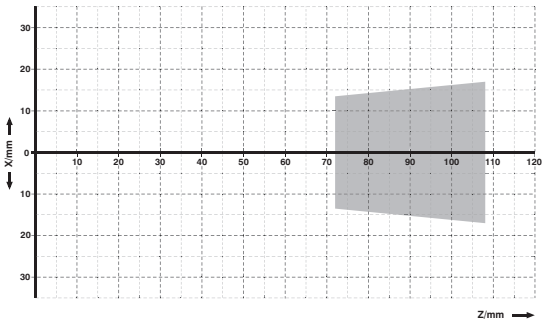
Where type of light and laser class are concerned, the “X” in the order number stands for the following variants:

x	Light Source	Laser Class
0	Laser (Red 660 nm)	1M
2	Laser (Red 660 nm)	2M
3	Laser (Blue 405 nm)	2M
4	Laser (Red 660 nm)	3R*
5	Laser (Blue 405 nm)	3R*
7	Laser (Blue 450 nm)	3B*

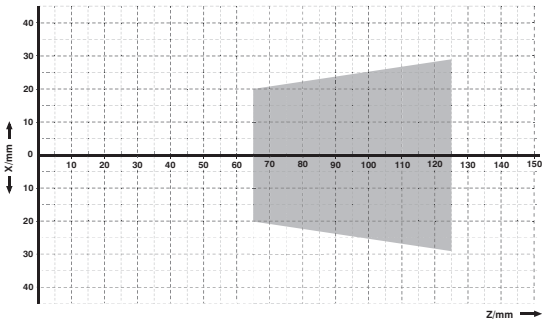
* Only available for weCat3D MLWL and MLSL2

3.1 Measuring fields

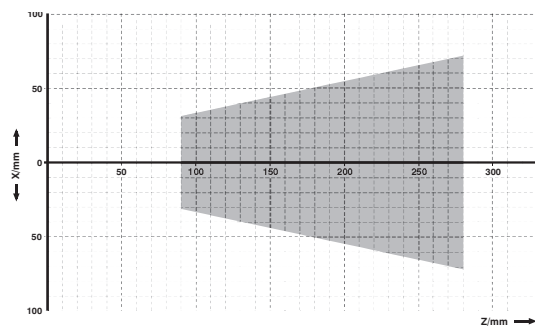
weCat3D MLSL
weCat3D MLSL1x1



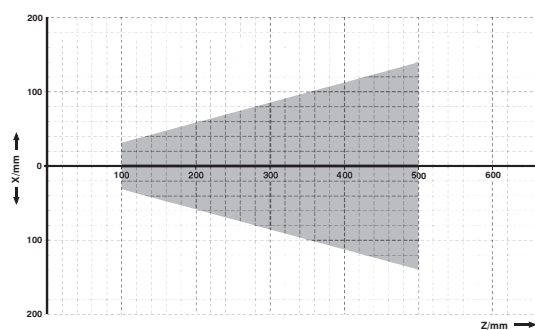
weCat3D MLSL1x2



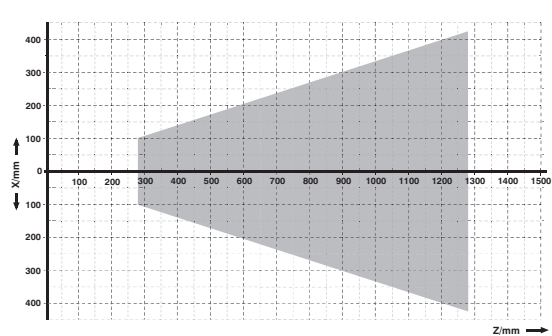
weCat3D MLSL1x3



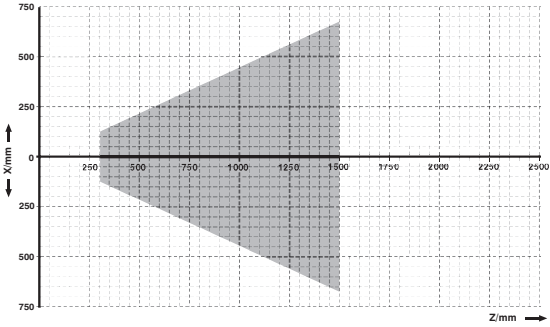
weCat3D MLSL1x4



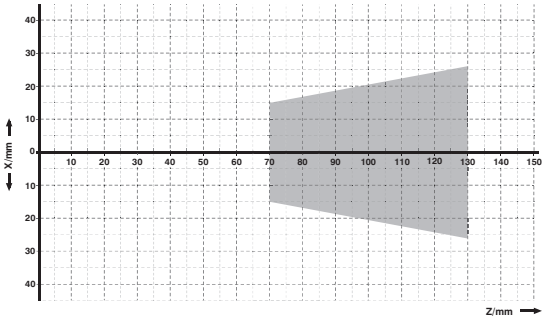
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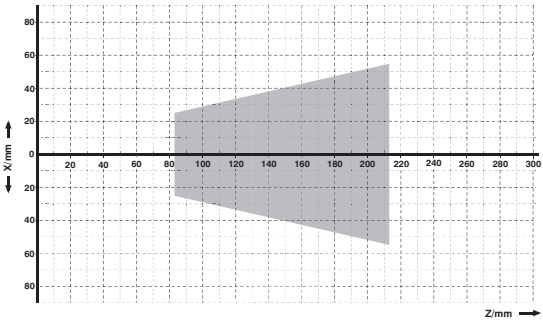
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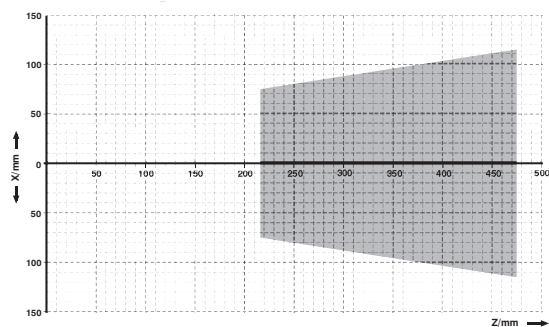
weCat3D MLWL
weCat3D MLWL1x1



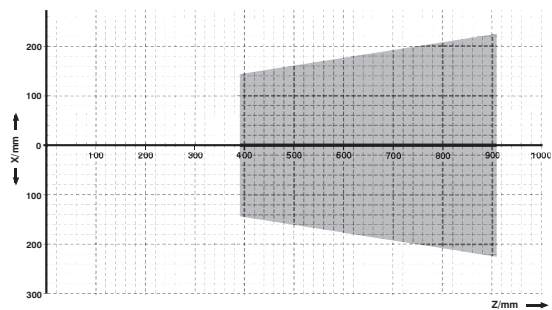
weCat3D MLWL1x2



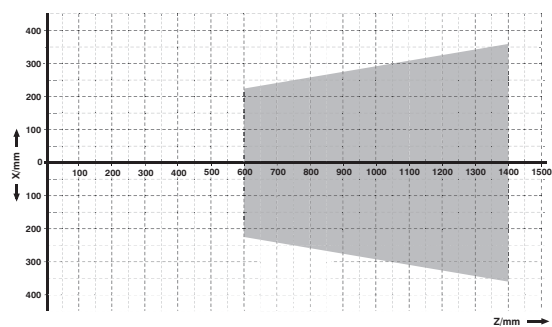
weCat3D MLWL1x3



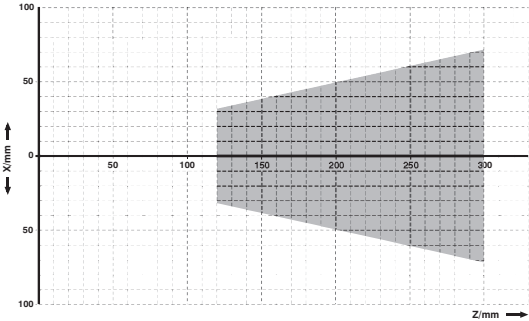
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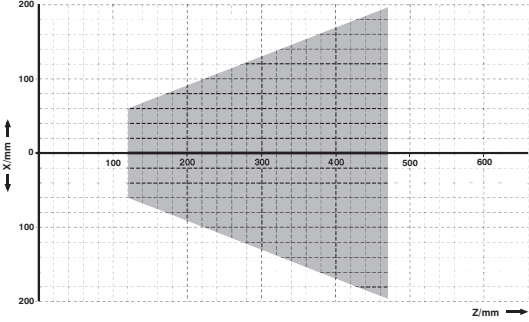
weCat3D MLWL1x5



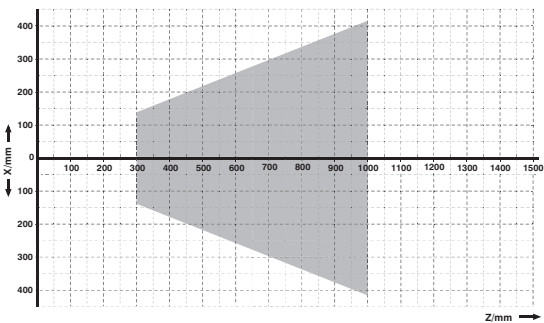
weCat3D MLWL2x1



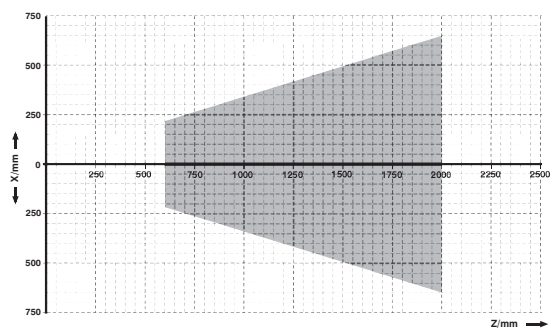
weCat3D MLWL2x2



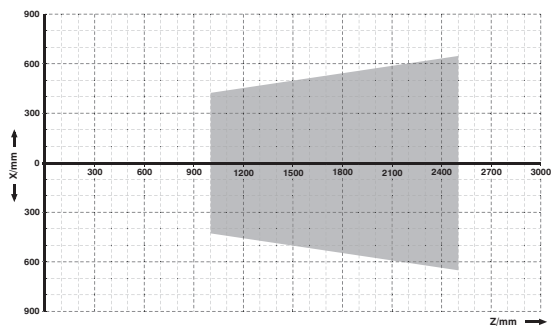
weCat3D MLWL2x3



weCat3D MLWL2x4



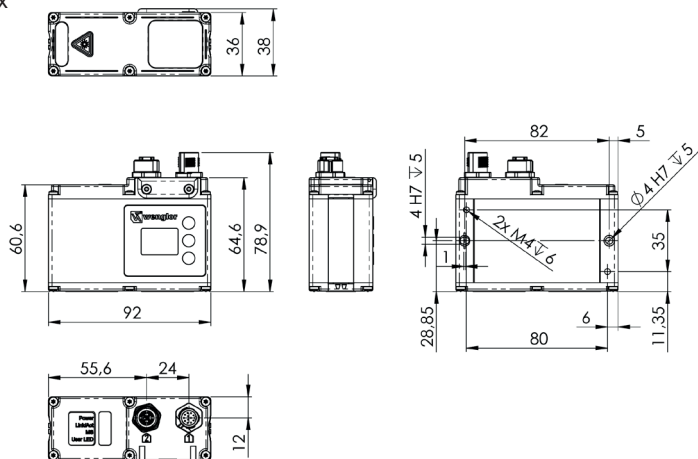
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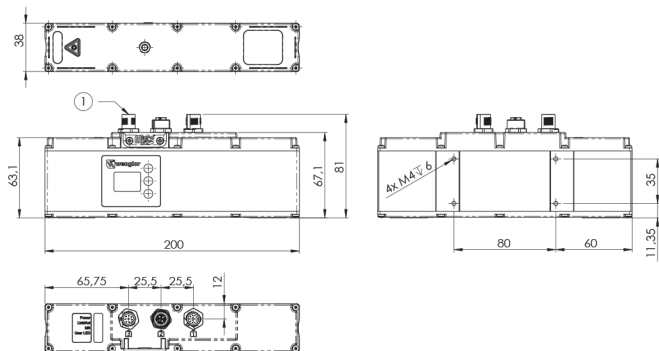
3.2 Dimensional Drawings

weCat3D MLSLxxx

weCat3D MLSL1xx



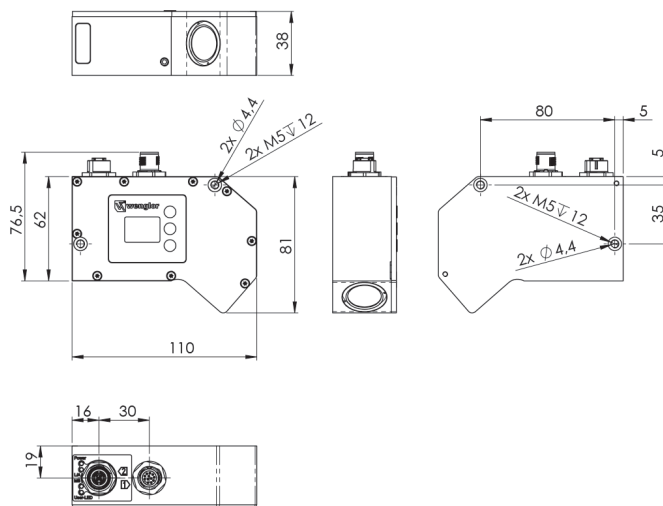
weCat3D MLSL2xx



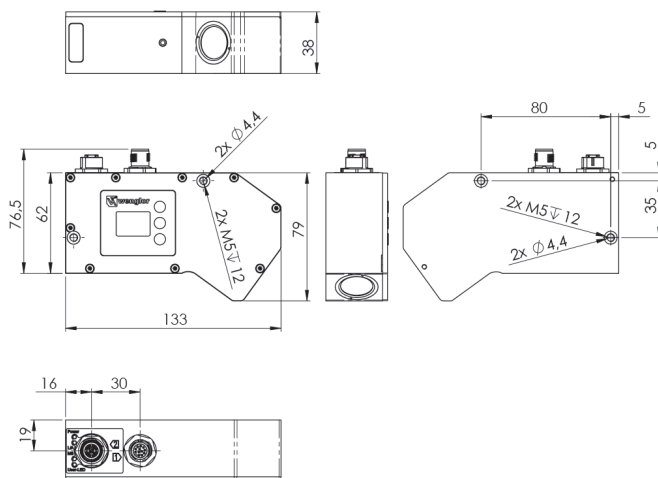
1 = only MLSL2 with laser class 3R and 3B

weCat3D MLWLxxx

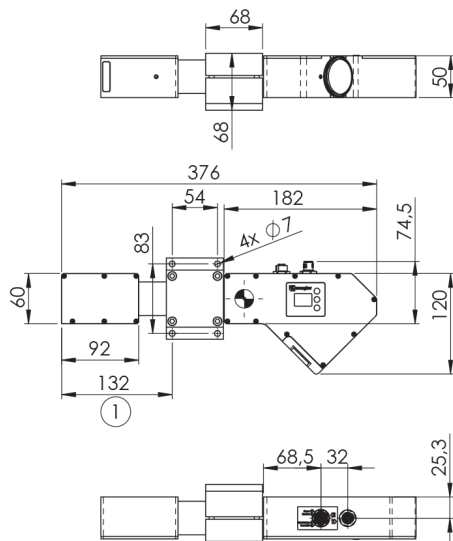
weCat3D MLWL1x1



weCat3D MLWL1x2

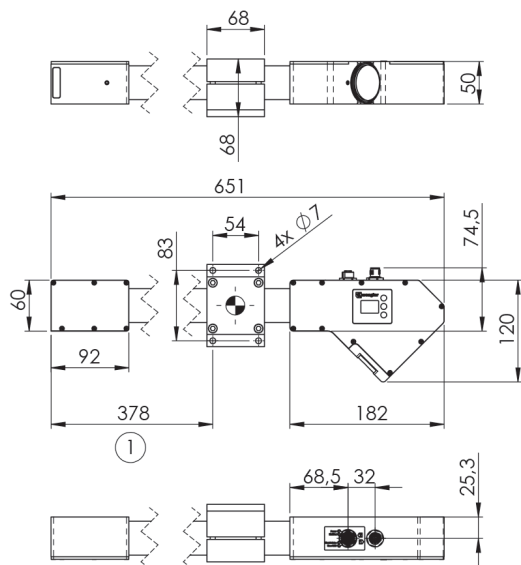


weCat3D MLWL1x3



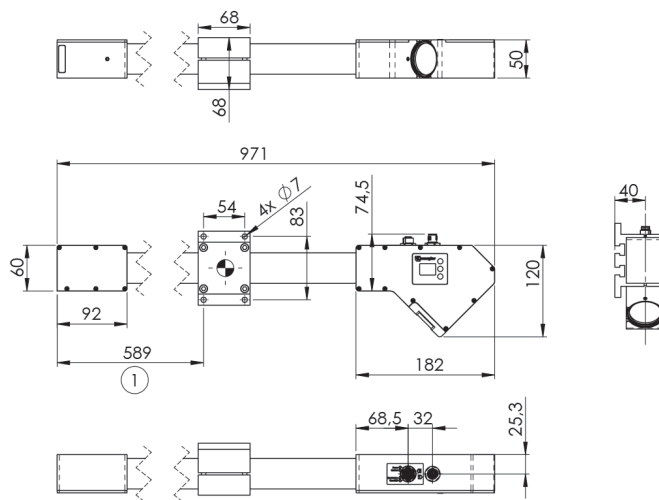
1 = recommended mounting position based on the sensor's center of gravity

weCat3D MLWL1x4



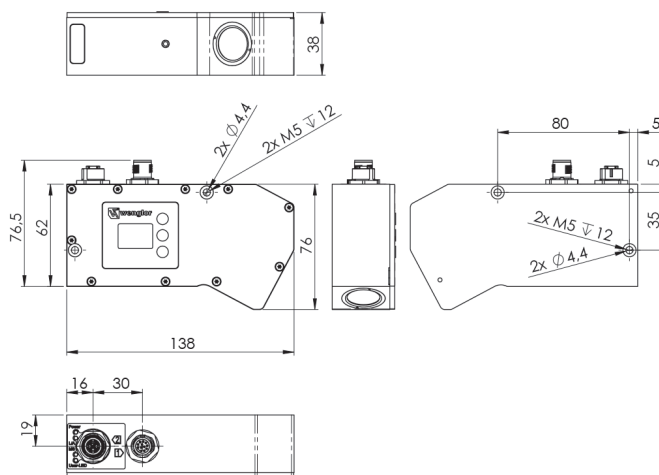
1 = recommended mounting position based on the sensor's center of gravity

weCat3D MLWL1x5

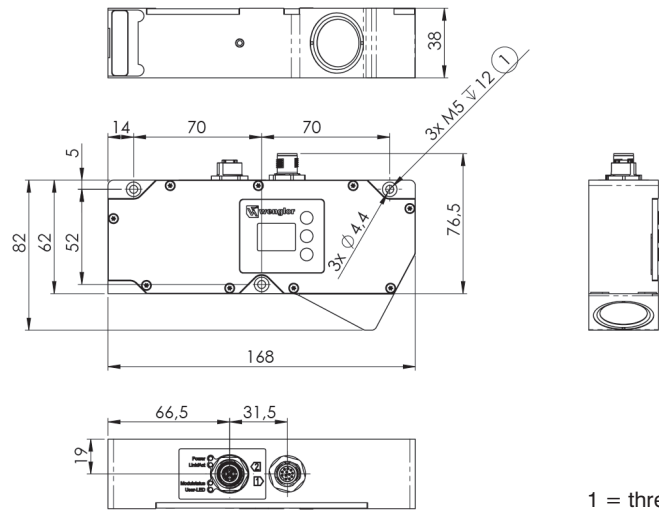


1 = recommended mounting position based on the sensor's center of gravity

weCat3D MLWL2x1

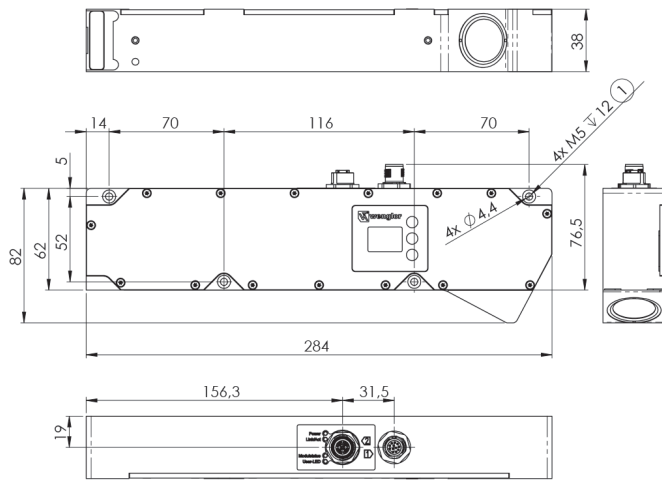


weCat3D MLWL2x2



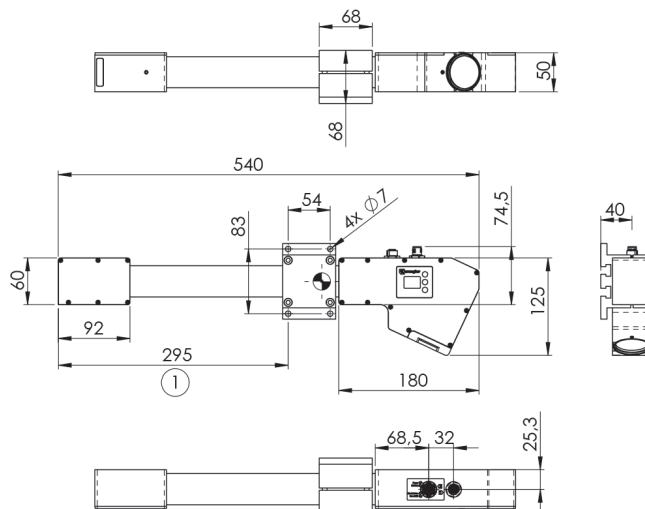
1 = threaded on both ends

weCat3D MLWL2x3



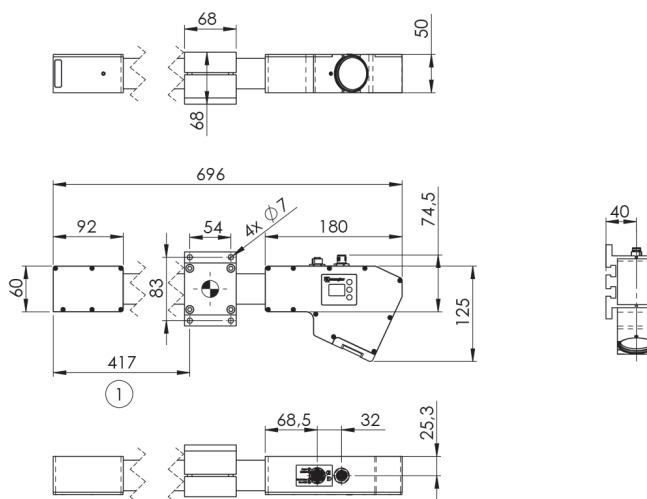
1 = threaded on both ends

weCat3D MLWL2x4



1 = recommended mounting position based on the sensor's center of gravity

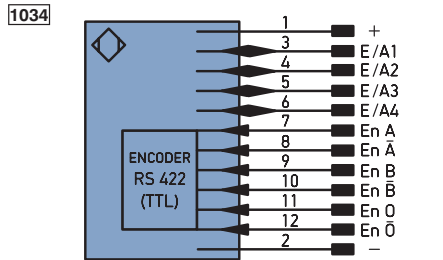
weCat3D MLWL2x5



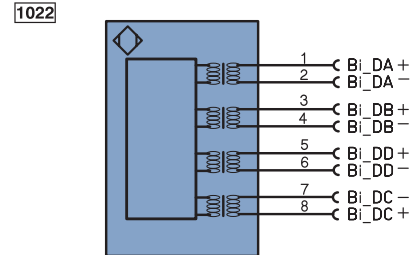
1 = recommended mounting position based on the sensor's center of gravity

3.3 Connection Diagram

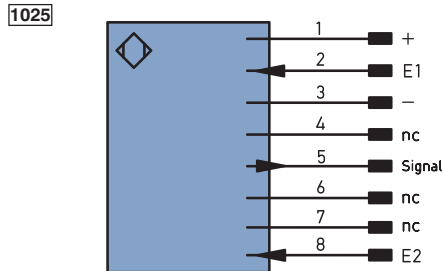
Connection Diagram, Power Supply:



Connection Diagram Ethernet:



Wiring Diagram for External 24 V Laser Shutdown:

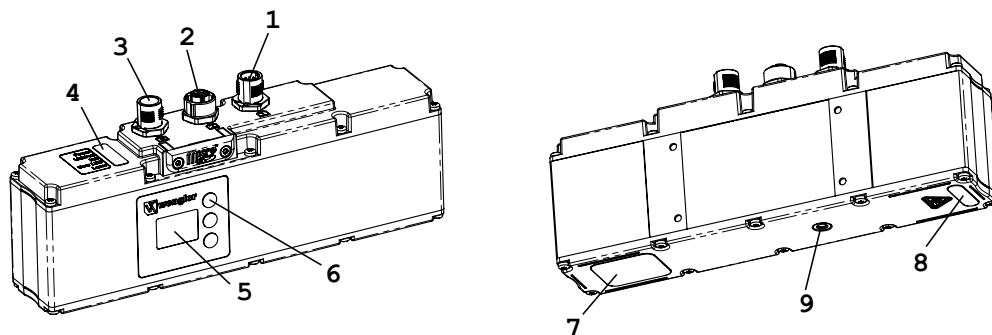


Legend

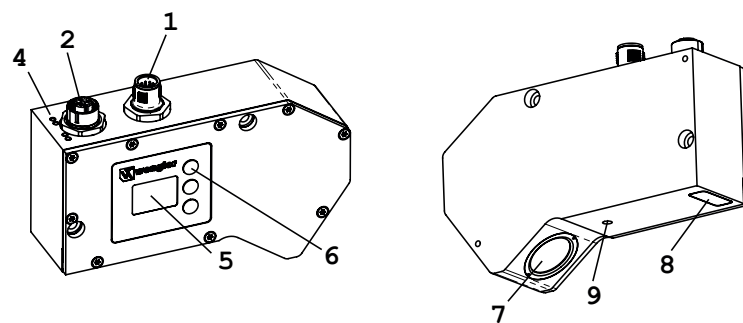
+	Supply Voltage +	PT	Platinum measuring resistor	ENAR5422	Encoder A/Ä (TTL)
-	Supply Voltage 0 V	nc	not connected	ENBR5422	Encoder B/B̄ (TTL)
~	Supply Voltage (AC Voltage)	U	Test Input	ENa	Encoder A
A	Switching Output (NO)	Ū	Test Input inverted	ENb	Encoder B
Ä	Switching Output (NC)	W	Trigger Input	AMIN	Digital output MIN
V	Contamination/Error Output (NO)	W-	Ground for the Trigger Input	AMAX	Digital output MAX
Ū	Contamination/Error Output (NC)	O	Analog Output	AOK	Digital output OK
E	Input (analog or digital)	O-	Ground for the Analog Output	SY In	Synchronization In
T	Teach Input	BZ	Block Discharge	SY OUT	Synchronization OUT
Z	Time Delay (activation)	Awv	Valve Output	ÖLT	Brightness output
S	Shielding	a	Valve Control Output +	M	Maintenance
RxD	Interface Receive Path	b	Valve Control Output 0 V	rsv	reserved
TxD	Interface Send Path	SY	Synchronization	Wire Colors according to IEC 60757	
RDY	Ready	SY-	Ground for the Synchronization	BK	Black
GND	Ground	E+	Receiver-Line	BN	Brown
CL	Clock	S+	Emitter-Line	RD	Red
E/A	Output/Input programmable	±	Grounding	OG	Orange
IO-Link		SnR	Switching Distance Reduction	YE	Yellow
PoE	Power over Ethernet	Rx +/-	Ethernet Receive Path	GN	Green
IN	Safety Input	Tx +/-	Ethernet Send Path	BU	Blue
OSSD	Safety Output	Bue	Interfaces-Bus A(+)/B(-)	VT	Violet
Signal	Signal Output	La	Emitted Light disengageable	GY	Grey
Bi_D +/-	Ethernet Gigabit bidirect. data line (A-D)	Mag	Magnet activation	WH	White
EN0RS422	Encoder 0-pulse 0-0̄ (TTL)	RES	Input confirmation	PK	Pink
		EDM	Contacting Monitoring	GNYE	Green/Yellow

3.4 Layout

weCat3D MSL



weCat3D MLWL



- ① = Power supply plug connector, digital I/O
- ② = Connection Socket Ethernet
- ③ = External 24 V laser shutdown (only for MSL2 with laser class 3R or 3B)
- ④ = LED display
- ⑤ = Control panel display
- ⑥ = Control keys
- ⑦ = Receiver
- ⑧ = Laser outlet
- ⑨ = Thread for fixing the screening grid retainer



ATTENTION:

The thread for fixing the screening grid retainer may not be used for fixing the sensor.

3.5 LED Display

LEDs

A26

68

85

78

4a

7a

68 = Power

85 = Link/Act

78 = Module status

4a = User-LED

7a = Laser (only MLSSL2 with Laser Class 3R and 3B)

LED	Designation	Status	Function
68	Power	Blue	Operating voltage on
		Off	Operating voltage off
85	Link/Act	Green	Link included (1000 Mbit), no transmission
		Green blinking	Communication (1000 Mbit)
		Red	Link included (1000 Mbit), no transmission
		Red blinking	Communication (100 Mbit)
		Orange	Link included (10 Mbit)
		Orange blinking	Communication (10 Mbit)
		Off	No Ethernet device connected
78	MS (Module Status)	Green	Device operative
		Green blinking	Standby
		Red blinking	Device error
		Red	Device error
		Off	Device doesn't start up
4a	User LED	Green	The user can activate this LED individually.
		Red	The user can activate this LED individually.
		Orange	The user can activate this LED individually.
		Off	The user can activate this LED individually.
7a	Laser	Green	Laser approval available
		Red	No laser approval
		Off	No supply voltage for laser shutdown



NOTE!
10 Mbit connection (orange LED lights up / blinks) is inadequate for error-free functioning (see also "Network Buffer" under 6.2).

3.6 Control panel



- 1 Up-button
- 2 Enter-button
- 3 Down-button
- 4 Display

4. Transport and Storage

4.1 Transport

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

4.2 Scope of Delivery

- weCat3D Sensor
- Laser/LED Warnings
- Quickstart instructions
- Mounting Set

4.3 Storage

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

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



ATTENTION:

Risk of property damage in case of improper storage!

The product may be damaged.

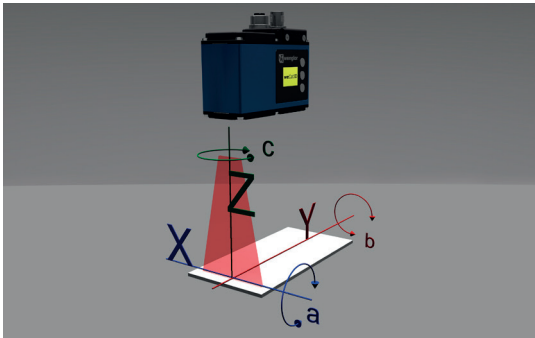
- Comply with storage instructions.
-

5. Installation and Initial Start-Up

5.1 General Installation Instructions

- Observe electrical and mechanical regulations, standards, and safety rules.
- Make sure that the sensor is mounted firmly and securely.
- The power supply should be connected directly and it should be as short as possible.
- The sensor must be protected against mechanical influences.
- The sensor should not be subjected any vibration because this could influence measurement.
- The sensor must be installed such that the laser line is as perpendicular as possible to the surface to be measured in order to obtain accurate measurement results.
- Adequate heat dissipation must be assured for the device. This can be accomplished, for example, by means of a metallic connection between the sensor housing and the mounting base.
- A cooling unit should be used as of an ambient temperature of 45° C or in the event that the sensor is mounted in a thermally insulated manner. Cooling units can be found at www.wenglor.com under "Supplementary Accessories" on the respective product page.

5.1.1 The Sensor's Coordinate System

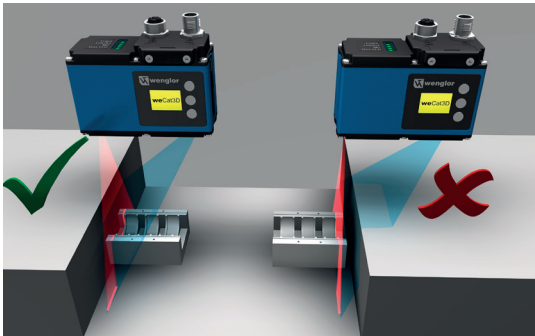


The X-axis corresponds to measuring ranges X.
The a-axis corresponds to rotation around the X-axis.

The Z-axis corresponds to measuring range Z.
The c-axis corresponds to rotation around the Z-axis.

The Y-axis corresponds to advancing in the Y direction.
The b-axis corresponds to rotation around the Y-axis.

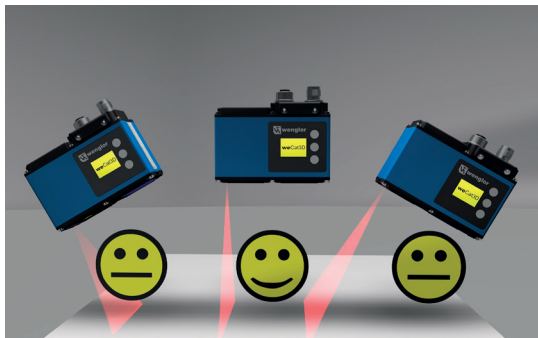
5.1.2 Shadows



A shadow is cast onto the sensor's range of vision by the object to be measured in the example shown at the right.

Measurement is possible without any shadowing in the example shown at the left.

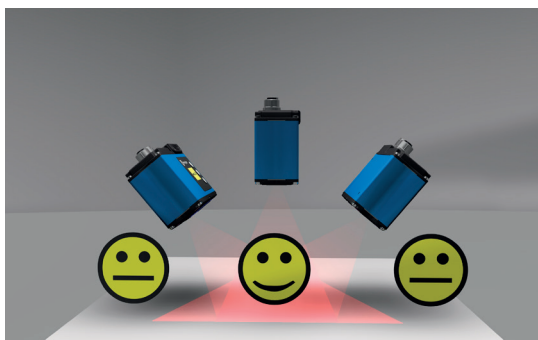
5.1.3 Tilting Around the a-Axis



Tilting should be avoided in order to obtain ideal profile quality.

Nevertheless, thanks to their large dynamic range, weCat3D Sensors continue to provide measured values even in the event of tilting.

5.1.4 Tilting Around the b-Axis



Tilting should be avoided in order to obtain uniform signal distribution for best possible profile quality.

Nevertheless, thanks to their large dynamic range, weCat3D Sensors continue to provide measured values even in the event of tilting.

Tightening torques must be complied with in order to assure error-free operation. The respective values are listed in the following table.

Connection Type	Tightening torque in (Nm)
Connector cable: M12 (plug 1)	0,6
Network cable: M12 (socket 2)	0,4
Mounting: M5 (threaded)	2.5 (min. thread engagement length: 6 mm)
Mounting: M4 (threaded)	1,5 (min. thread engagement length: 4 mm)
M8 mounting (thread)	15



ATTENTION!

Risk of property damage in case of improper installation!

The product may be damaged.

- Comply with installation instructions.

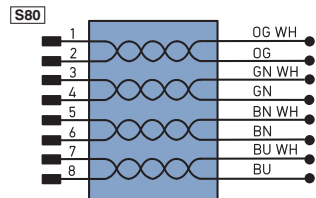
5.2 Complementary Products

wenglor offers Connection Technology for field wiring.

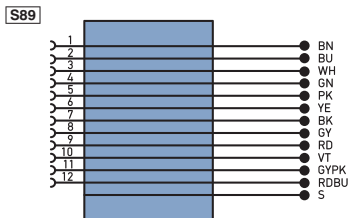
Suitable Mounting Technology No. 343

Suitable Connection Technology No.

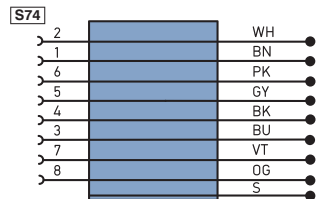
50



87



89



Switch ZAC45FN01

Cooling unit

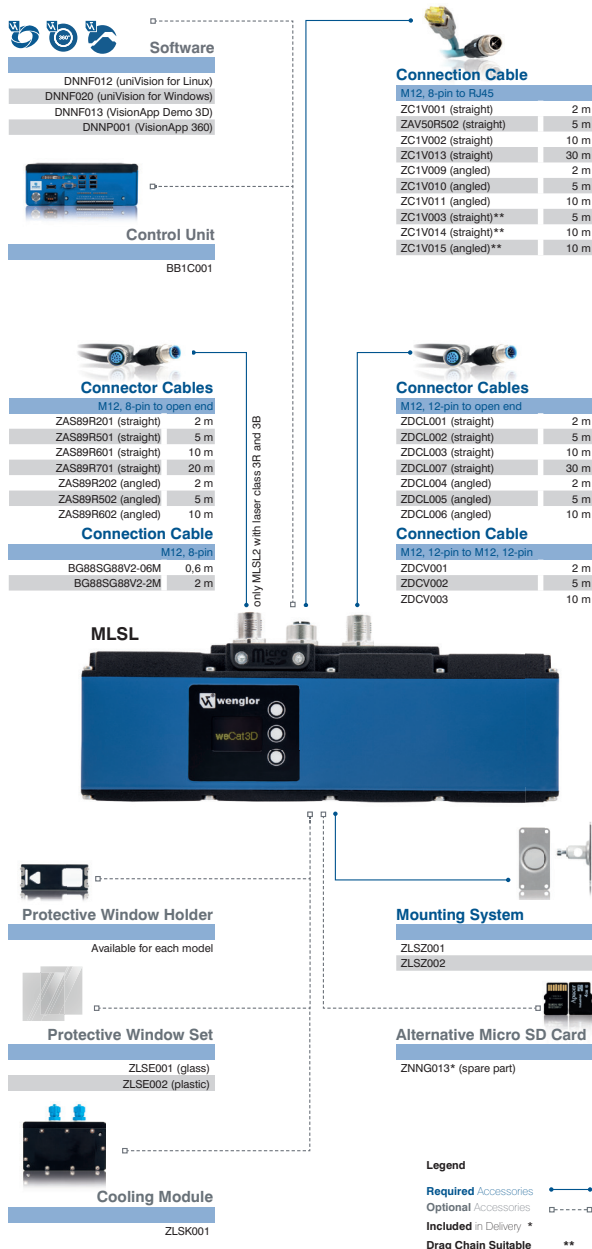
Protective disc retainer

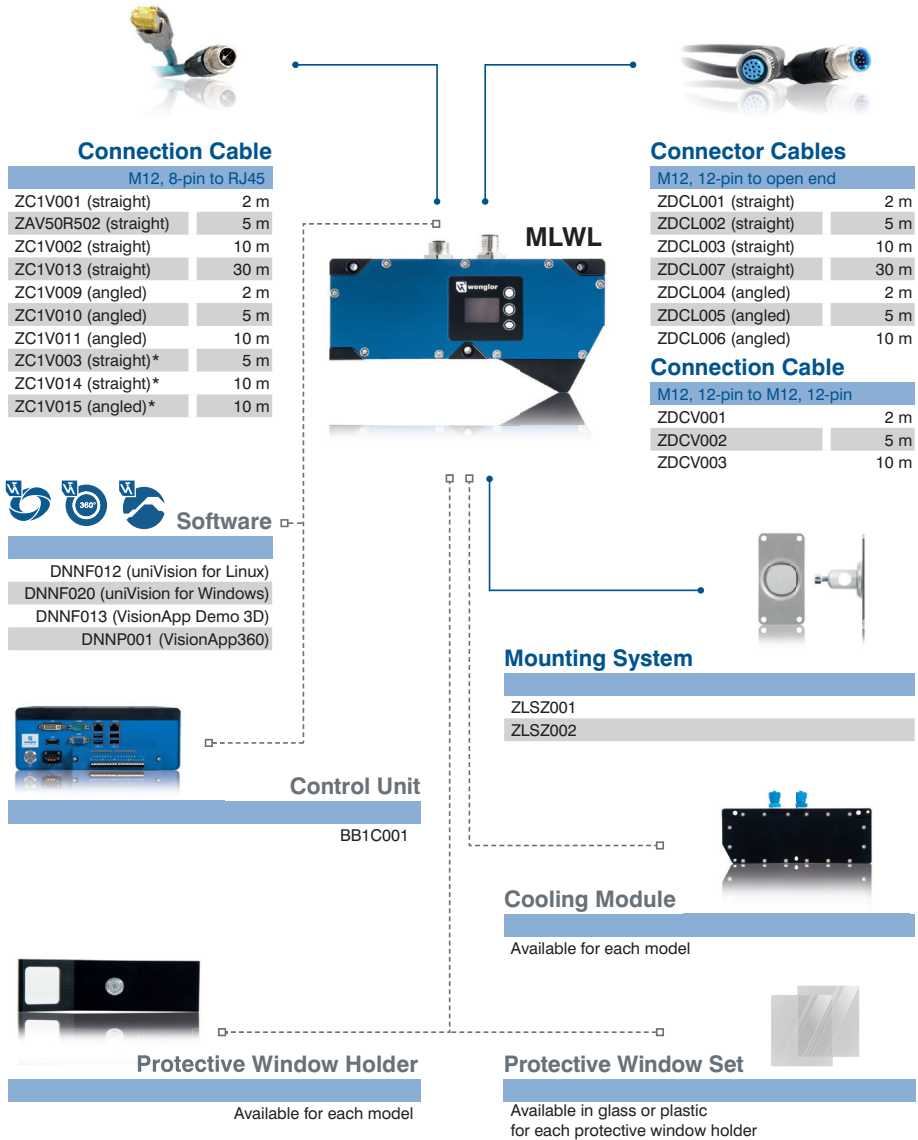
Screening Grid

Control Unit

5.3 System Overview

weCat3D MLSL





Legend

- Required Accessories** ————
- Optional Accessories** - - - - -
- Drag Chain Suitable** *

5.4 Installation

5.4.1 Electrical Connection

There are two plug connectors on the sensor. The sensor is supplied with 24V operating power via the 12-pin plug. The 8-pin socket is used for communicating process and parameters data. There are also variants with 3 plugs. The additional 8-pin plug is used to switch the laser.



Note!

Maximum permissible length of the power supply cable is 30 m.
The power supply cable must be equipped with an additional, suitable shield.

5.4.2 Connecting External 24 V Laser Shutdown

In order to be able to switch the laser on and off, series MLSL2 devices with laser class 3R and 3B are additionally equipped with 24 V laser shutdown (see section 3.3). Laser shutdown must be supplied with 24 V operating voltage to this end. Switching inputs I1 and I2 enable the laser when voltage is applied, and the circuit acknowledges enabling via the signal output (Laser off = 24 V; Laser on = 0 V).



Note!

This device is only ready for operation if external laser shutdown has been correctly connected.

5.4.3 Initial Start-Up at the PC

Connect the product to supply power (plug 1) and connect the Ethernet port (socket 2) to the PC or the switch.



CAUTION!

Make sure that the cables have been correctly and securely connected in order to assure error-free operation.



ATTENTION!

Risk of property damage in case of improper installation!

The product may be damaged.

- Comply with installation instructions.

5.4.4 Adjusting the Sensor's Network Settings

Upon shipment from the factory, the sensor's **IP address is 192.168.100.1** and its **subnet mask is 255.255.255.0**.

In order to be able to connect the sensor to your PC, you have to make sure that the sensor and your PC are both within the same IP address range.

Address Format for IP Addresses (IPv4)

	Network Part	Device Part (host part)
IP address	192.168.100.	001
Subnet mask	255.255.255.	000

The network part of the sensor's IP address must coincide with the network part of PC's IP address, but the device part of the address must be different for the sensor and the PC.

The integrated web server can then be accessed where, amongst other things, the IP address can be changed. Further information can be found in [section 6](#).

Alternatively, the IP address can be changed without connection to the PC directly at the control panel (OLED display). Further information can be found in [section 7](#).

5.5 Default Settings

			WeCat3D MLSL	WeCat3D MLWL
Pin function	E/A1		Encoder E1 + E2	Encoder E1 + E2
	E/A2		Encoder E1 + E2	Encoder E1 + E2
	E/A3		Sync Out	Sync Out
	E/A4		Sync In	Sync In
I/O settings	E/A1		Operating voltage active	Operating voltage active
	E/A2		Operating voltage active	Operating voltage active
	E/A3		Push-Pull	Push-Pull
	E/A4		Operating voltage active	Operating voltage active
Encoder	Direction of rotation		Independent of direction	Independent of direction
	Encoder scaling		0	0
Display	Intensity		Screensaver	Screensaver
	Mode		Analysis	Analysis
Operating mode			Profile Sensor	Profile Sensor
Profile	Measuring rate (Hz)		200	175
	Signal selection		Strength	Strength
	Exposure time (μ s)*		150	150
	Measuring field (pix)	Offset X	0	0
		Width X	1280	2048
		Offset Z	0	0
		Height Z	1024	2048
Interface	IP address		192.168.100.1	192.168.100.1
	Subnet mask		255.255.255.0	255.255.255.0
	TCP port		32001	32001
	Std. gateway		192.168.100.254	192.168.100.254
	MAC address		See OLED display, interface section	See OLED display, interface section
Language			English	English
Password OLED	Deactivate/activate		Deactivated	Deactivated
	Change		„0000“	„0000“
Website password			admin	admin

* A standard exposure time is set upon shipment from the factory. With some surfaces, exposure time has to be matched to ambient conditions, i.e. increased or reduced.

5.6 Programming Interfaces

The exact commands can be taken from the documentation for the weCat3D-SDK (interface descriptions in the product's download area).

6. Integrated Web Server

The integrated web server makes it possible to enter settings for the sensor and save them directly at the PC.

Note!

The website has been optimized for the following web servers:

- Firefox 51 +
- Chrome 49
- IE11

Deviations may result in erroneous displays.



6.1 Accessing the Integrated Website

Start your web browser and enter the preset IP address (192.168.100.1) to the browser's address line.

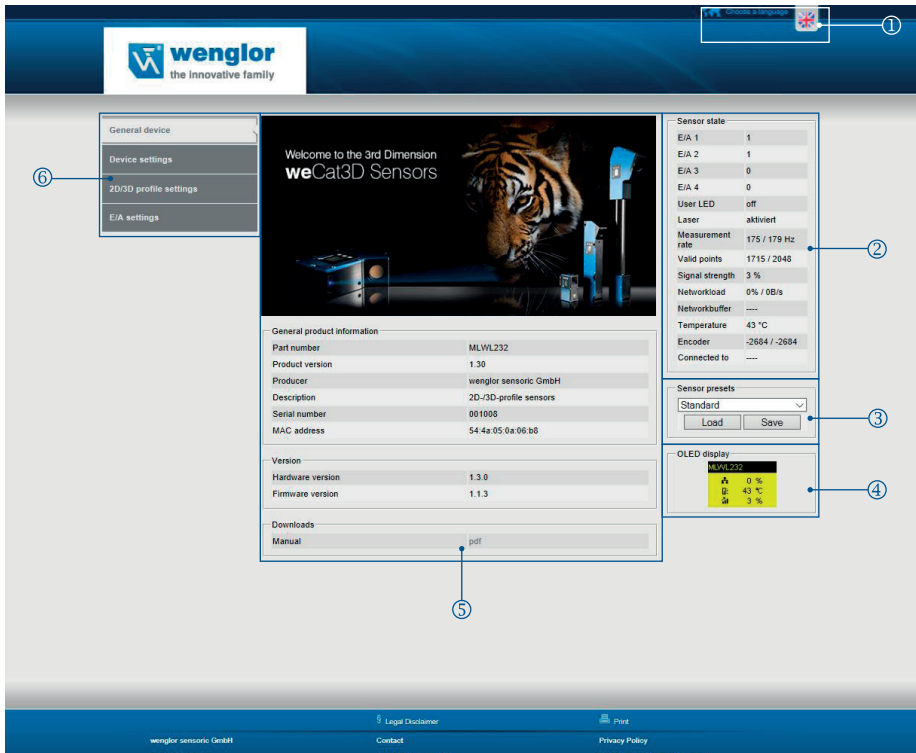
NOTE!

If the actual IP address differs from the preset address and you don't know the actual address, you can view it at the OLED display after selecting the "Interface" menu item.



6.2 Page Layout

The integrated website is subdivided into the following areas:





① Language Selection

The website can be changed from English to German with the language selection function.

② Sensor Status

I/O1...I/O4	Indicates the current switching status of the respective input or output. (1/0)
User LED	Indicates the color in which the user LED currently lights up (off, green, red, orange).
Laser	Indicates the current status of the laser (activated = laser on / deactivated = laser off).
Measuring rate	Left: momentary measuring rate Right: maximum possible measuring rate with selected measuring range and exposure time (calculated value may deviate slightly)
Valid points	Left: number of valid measuring points within the measuring range. Right: maximum number of measuring points within the selected measuring range.
Signal strength	Indicates signal strength of the valid points within the measuring range. In typical applications, a signal strength within a range of 10 to 90 % results in an ideal profile. Signal strength is influenced by sensor installation and the exposure time setting.

Network load	Indicates the network's current transmission load (at the sensor side). Continuous utilization of close to 100 % should be avoided because overrun might otherwise occur at the sensor's network buffer. Utilization can be influenced by reducing the measuring rate or by changing the content of the transmission protocol.
Network buffer	<p>Indicates internal network buffer occupancy as a percentage. Momentary increases in occupancy are no problem. However, if occupancy increases continuously, network utilization must be reduced (see description of "network utilization"), in order to prevent the loss of profile data.</p> <p> NOTE! Bandwidth may be too narrow. Check the network settings at the PC and/or the LED display. If the orange LED lights up, transmission speed is only 10 Mbit (see section 3.5).</p>
Temperature	<p>Displays current temperature inside the sensor housing. Depending on how the sensor is mounted, this temperature is 15 to 25° C above ambient temperature. In order to avoid damage and a reduced service life, use the sensor within the specified temperature range only.</p> <p> NOTE! As of an internal temperature of 60° C, the sensor is in its critical temperature range.</p>
Encoder	<p>Left: HTL encoder counter (rotary encoder) Right: RS422 TTL encoder counter (rotary encoder)</p>
Connected with	Displays the IP address of the PC or the control unit with which the sensor is connected.

③ Sensor Parameter Set

This field provides the user with the opportunity of saving all of the selected settings to the sensor and retrieving them later. The values saved under "Standard" are loaded automatically when the sensor is started up.

④ OLED Display

This field shows the current content of the OLED display. It's refreshed approximately once per second.

⑤ Dynamic Page Content

Depending on which category ⑥ is selected, the corresponding page content is displayed.

⑥ Category Selection

The integrated website offers four different categories:

- **Device, General**
Overview page with general information regarding the sensor.
- **Device Settings**
Network and display settings can be changed, and reset commands as well as a sensor restart can be triggered.
- **2D/3D Profile Settings**
Profile display with option for parameter settings.
- **I/O Settings**
Function and performance of the four configurable I/Os can be selected.

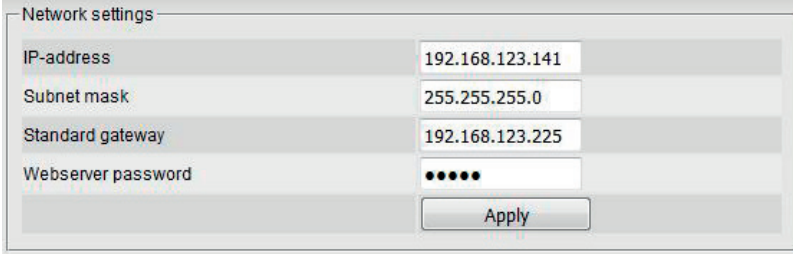
6.2.1 Device, General

This is the sensor's initial page which displays all relevant information concerning the device such as order number, product version, manufacturer, description, serial number and MAC address, as well as hardware and firmware version. These entries play an important role in the event of technical problems and when contacting **Technical Support** with questions.

6.2.2 Device Settings

Content is subdivided into 3 categories:

Network settings



The screenshot shows a web interface for 'Network settings'. It contains four input fields: 'IP-address' with the value '192.168.123.141', 'Subnet mask' with '255.255.255.0', 'Standard gateway' with '192.168.123.225', and 'Webserver password' with five dots. An 'Apply' button is located at the bottom right of the form.

The desired address ranges can be entered to the “**IP Address**”, “**Subnet Mask**” and “**Standard Gateway**” fields. These addresses permit operation, as well as communication between the sensor and your network (PC).



CAUTION!

- If you don't have access to information concerning available address ranges within your network, contact your IT department first.
 - Incorrect entries may result in network conflicts.
 - The sensor's IP address must differ from the IP address of the PC.
-

After the desired changes have been made, enter the web server password (**admin**) to the field and click “**OK**”. The changes are activated without restarting the sensor. In order to return to the integrated website, enter the new IP address to your web browser's address line.

OLED Display Settings

Display settings

Language	English ▼
Rotate	OFF ▼
Intensity	Screensaver ▼
Mode	Analyse ▼

Language	Sets the language for the display (German, English, French Spanish or Italian).
Rotate	The display is rotated 180° (on/off).
Intensity	Adjusts display performance. <ul style="list-style-type: none"> • Normal: Display intensity is set to the default value. • Energy saving: If no keys are pressed for a period of one minute the display is switched off, and is switched back on as soon as a key is activated. • Screensaver: If no keys are pressed for a period of 30 seconds, the display is switched to the run mode and returns to the last used menu as soon as a key is activated. The colors are inverted every 30 seconds in order to protect the display.
Mode	Selection of various display modes for the run mode <ul style="list-style-type: none"> • Network: IP address, subnet mask and MAC address are displayed. • I/O status: Display of input and output states • Analysis: Displays network utilization as a percentage, internal temperature in °C and signal strength as a percentage. • Live Image: Displays the current profile image

General settings

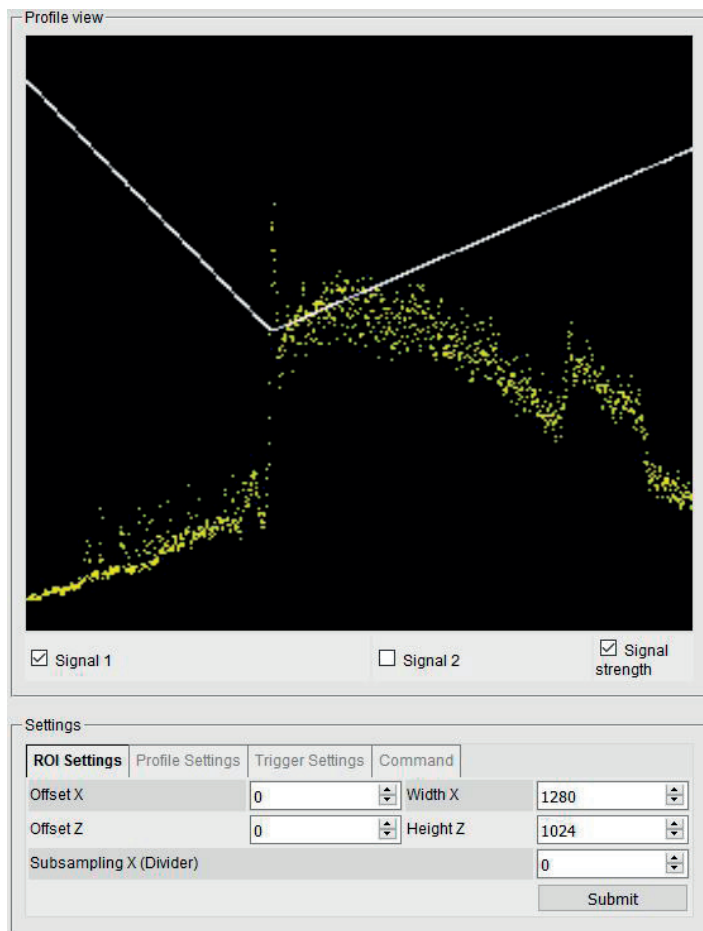
General settings

Operating mode	Sensor profile ▼
Encoder reset	Reset
Reset sensor settings	Reset
Restart	Apply
Network reset	Apply

Operating mode	Profile Sensor: The sensor functions as a 2D Profile Sensor and sends the measured profile to the PC or the control unit.
Encoder reset	Resets both encoder counters (rotary encoders) in the sensor to zero.
Reset sensor settings	Returns all settings to their default values. Exception: Network settings.
Restart	Restarting of the sensor can be forced by pressing "Restart".
Network reset	Returns the network settings to their default values (see section 5.5)

6.2.3 2D/3D Profile Settings

Profile view



Signal 1/2	<p>The signals can be displayed or hidden by selecting or unselecting the checkboxes (this affects the display only and doesn't influence the parameter settings). The individual colors have the following meanings:</p> <p>White: Signal 1</p> <p>Red: Signal 2 (only visible with corresponding software setting)</p> <p>Yellow: Signal strength, signal 1</p> <p>Orange: Signal strength, signal 2 (only visible with corresponding software setting)</p>
Signal strength	Provides information about how much light is received at each point along the laser line.

ROI Settings

ROI Settings		Profile Settings		Trigger Settings		Command	
Offset X	<input type="text" value="0"/>	Width X	<input type="text" value="2048"/>				
Offset Z	<input type="text" value="0"/>	Height Z	<input type="text" value="2048"/>				
Subsampling X (Divider)			<input type="text" value="0"/>				
							<input type="button" value="Submit"/>

The region of interest (ROI) or the sensor’s active range consists of the four following variables: offset X, width X, offset Z and height Z. These variable are specified in pixels and can be changed as desired within their respective limits. This information makes it possible to reduce the active range so that only the actually required range is read out.

The selected ROI should be as large as necessary and as small as possible. The smaller the range, the faster the evaluation and thus the higher the measuring rate. The measuring rate of the individual sensor can be increased in this way.

Differentiation must be made in this respect between the weCat3D MSL, for which a reduction in X and Z influences the measuring rate, and the weCat3D MLWL, for which only a reduction in Z affects the measuring rate. Limiting X only reduces network load in this case.

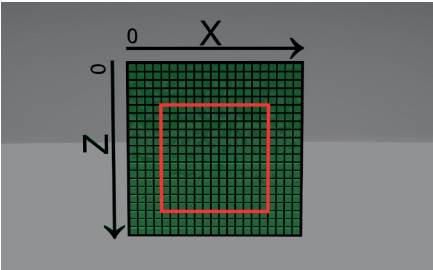




Image from the Integrated Camera

Starting point “0” can be seen at the top left.
X designates the measuring range X of the columns.
Z designates the measuring range in rows.
The red rectangle shows the selected ROI.


Example in the figure: Offset X = 5 Width X = 13
 Offset Z = 5 Height Z = 13


Offset X	The integrated camera in the device has 1280 columns (MSL) or 2048 columns (MLWL) in the X direction, which are read out continuously. As a default setting, offset X has a value of 0. If this value is increased, not all of the columns are read out, but rather only those as of the new starting point. Attention: In this case, width X must be manually adjusted because it’s not self-adjusting.
Width X	Specifies the total number of columns which will be read out in the X direction (see “Offset X”). As a default setting, all 1280 or 2048 columns are read out. <div> NOTE! This setting reduces or increases measuring range X.</div>
Offset Z	The integrated camera in the device has 1024 columns (MSL) or 2048 rows (MLWL) in the Z direction, which are read out continuously. As a default setting, offset Z has a value of 0. If this value is increased, not all of the rows are read out, but rather only those as of the new starting point. Attention: In this case, height Z must be manually adjusted because it’s not self-adjusting.

Height Z	<p>Specifies the total number of rows which will be read out in the Z direction. As a default setting, all 1024 or 2048 rows are read out.</p> <p> NOTE! This setting reduces or increases measuring range Z.</p>
Subsampling X	<p>Sets the number of measured values in X, which will be read out. This setting reduces resolution in X but has no influence on the maximum profile rate – only network load is reduced.</p>

Profile Settings

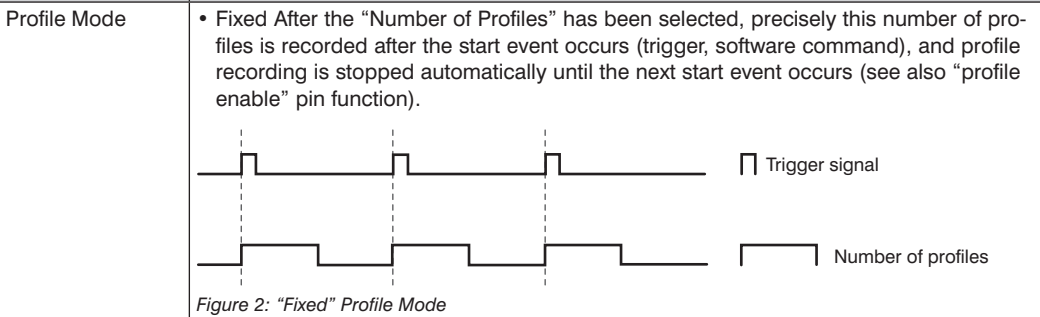
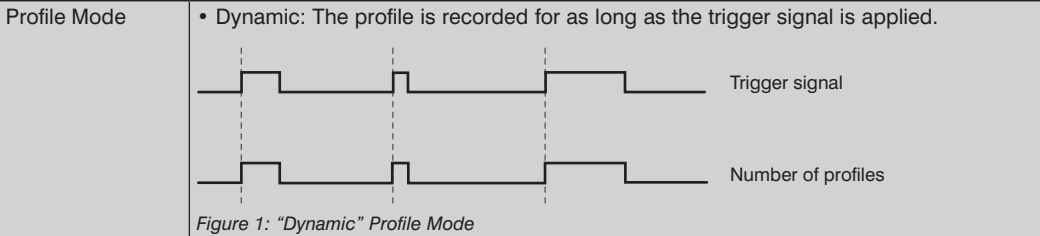
ROI Settings	Profile Settings	Trigger Settings	Command
Exposure time	<input type="text" value="149"/> μ s		
Laser enable	<input type="button" value="On"/>		
Measuring rate	<input type="text" value="175"/> Hz		
Signal selection	<input type="button" value="strong"/>		
<input type="button" value="Submit"/>			

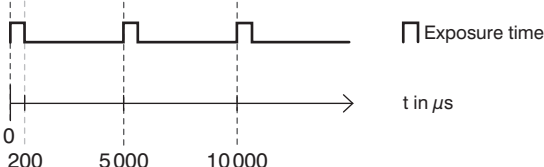
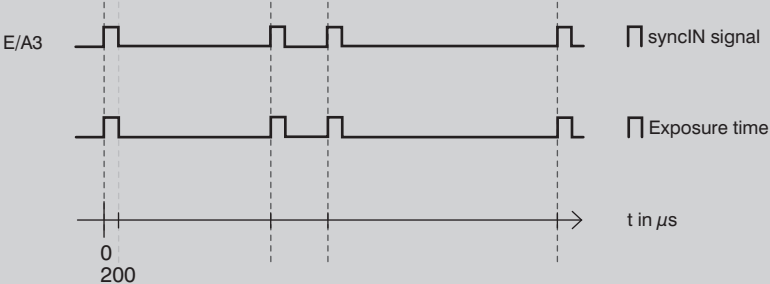


Exposure Time	<p>Exposure time determines how much time the profile sensor takes for exposure at the internal camera. This parameter also controls laser on-time. The value is specified in microseconds.</p> <p>Note regarding profile optimization: At a signal strength of less than 10%, exposure time should be increased for an ideal profile. At a signal strength of greater than 90%, exposure time should be reduced for an ideal profile.</p>
Laser	<p>This function makes it possible to switch the laser on and off manually.</p>
Measuring rate	<p>The measuring rate can be set when the “internal” sync mode is selected. The highest possible measuring rate, depending on the selected ROI, can be found in the “ROI Settings” section.</p> <p>The formula for calculating the measuring rate for the MLSL is: $1 \times 1,000,000 / ((0.003458273 \times \text{width X} + 0.073443424) \times \text{height Z} + 56)$ </p> <p>The formula for calculating the measuring rate for the MLWL is: $149,359.496817005 \times \text{height}^{-0.8678007147}$ </p> <p> NOTE! The measuring rate of the connected sensor is read out in the VisionApp Demo 3D software (DNNF013; can be downloaded for free at www.wenglor.com in the product area) depending on the selected ROI.</p>

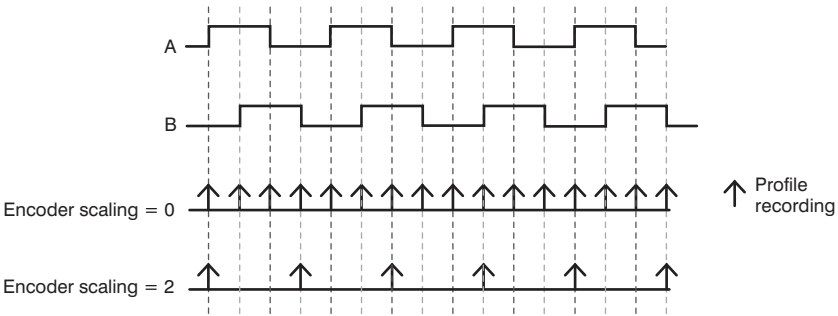
Signal Selection	<p>All of the internal camera's columns are searched for signals. If two or more signals are detected in a single column, the user can specify the order in which the signals are read out as distance value Z.</p> <p> NOTE! This setting can be used to reduce reflection and other laser line interference.</p> <p>The following selection criteria are available:</p> <ul style="list-style-type: none"> • Strength: The brightest signal is read out as signal 1. • Width: The widest signal is read out as signal 1. A wider signal occurs when the laser light penetrates more deeply into the object's surface. Signal width is not shown in the profile display. • First: The first signal in the profile display of the integrated website is read out as signal 1. • Last: The last signal in the profile display of the integrated website is read out as signal 1.
------------------	---

Trigger Settings

ROI Settings	Profile Settings	Trigger Settings	Command
Profile mode		dynamic <input type="button" value="v"/>	
Number of Profiles		<input type="text" value="0"/>	
Sync mode		Intern <input type="button" value="v"/>	
Encoder divider		<input type="text" value="0"/>	
<input type="button" value="Submit"/>			



Number of Profiles	Specifies how many profiles will be recorded before the sensor stops and can only be restarted by a command or an input signal. Can be combined with the “Internal”, “syncIN” and “Encoder” modes.
Sync Mode	<ul style="list-style-type: none"> Internal: The sensor is triggered via the internally selected measuring rate. <p>Sample settings:</p> <ul style="list-style-type: none"> Measuring rate: 200 Hz (i.e. one measurement every 5000 μs) Exposure time: 200 μs  <p>Figure 3: Internal Trigger</p>
Sync Mode	<ul style="list-style-type: none"> syncIN: The sensor is triggered externally via the Sync IN pin function, e.g. by another sensor or by an input signal. Only one profile per input signal is recorded and transmitted. <p>Example with triggering via an I/O pin at the sensor:</p> <ul style="list-style-type: none"> Sync In pin function: I/O3 Input function, operating voltage: Rising edge Exposure time: 200 μs  <p>Figure 4: Triggering via syncIN</p> <p> NOTE! In the case of time-critical applications and strict timing requirements for triggering, the trigger signal via an I/O pin directly at the sensor must be used.</p> <p> NOTE! The applied input signal must be interference-free in order to assure flawless functioning of the sensor.</p>

Sync Mode	<ul style="list-style-type: none"> Encoder: The sensor is triggered by an encoder (HTL or RS422 TTL). <p>Sample settings with an HTL or TTL encoder:</p> <ul style="list-style-type: none"> Trigger source: Encoder (HTL or TTL) Encoder scaling: 0 or 2  <p>Figure 5: Encoder Scaling</p> <p>NOTE! Switching Back and Forth Between HTL and TTL Encoder (see “Encoder I1 + I2” pin function)</p> <p>Any of the following encoder modes can be selected:</p> <ul style="list-style-type: none"> Motion (default): Sensor records profile independent of direction. Position: Sensor records profile in a given direction. If the direction of motion is reversed, the last position is saved. New profiles are not recorded until the saved position has been passed. Direction: Sensor records profile in one direction of motion only.
Sync Mode	<p>Software: The sensor is triggered by a software command.</p> <p>The corresponding interface commands can be found in the documentation for the SDK.</p>
Encoder Scaling	<p>As a standard feature, the sensor is triggered by each pulse. This value can be used to specify how many pulses will be counted before profile recording is triggered: If 149 is entered under “Encoder Scaling”, the sensor records a profile for pulse 150, 300, 450 etc. (see also figure 5, “Encoder Scaling”).</p>

Commands

ROI Settings	Profile Settings	Trigger Settings	Command
Command		<input type="text"/>	
Send		<input type="button" value="Ok"/>	

Permits direct transmission of interface commands to the sensor (for further details please refer to the interface description which is available from the product’s download area).

6.2.4 I/O Settings

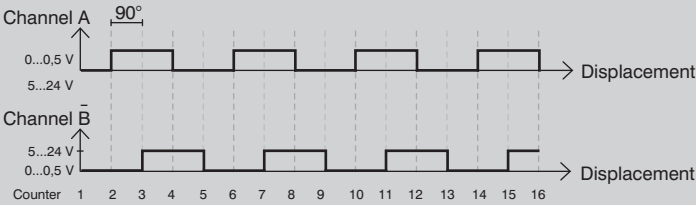
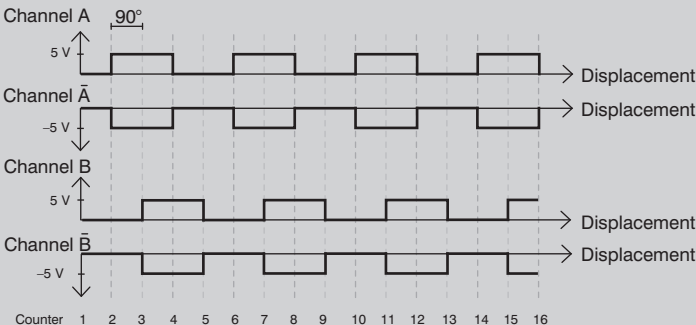
Various pin functions can be selected for the 4 configurable inputs/outputs. Depending on the selected setting, context menus offer corresponding selection options.


E/A 1	
Pin function	Encod. E1+E2 ▾
Input load	Off ▾
Input function	Ub activ ▾
Output	Push-Pull ▾
Output function	NO ▾

E/A 2	
Pin function	Encod. E1+E2 ▾
Input load	Off ▾
Input function	Ub activ ▾
Output	Push-Pull ▾
Output function	NO ▾

E/A 3	
Pin function	Sync. Out ▾
Input load	Off ▾
Input function	Ub activ ▾
Output	Push-Pull ▾
Output function	NO ▾

E/A 4	
Pin function	Sync. In ▾
Input load	Off ▾
Input function	Ub activ ▾
Output	Push-Pull ▾
Output function	NO ▾

Pin function	<ul style="list-style-type: none"> • Sync in: Input function for synchronizing several sensors with each other, or for recording individual profiles with the help of pulses. Attention: Exceeding the sensor's maximum measuring rate must be avoided.
Pin function	<ul style="list-style-type: none"> • Sync out: Output function for synchronizing additional sensors. The sync out pin is connected with the sync in pin of other sensors.
Pin function	<ul style="list-style-type: none"> • User input: Input function for querying the switching status of the selected input at the device via the software interface.
Pin function	<ul style="list-style-type: none"> • User output: Output function for setting the output at the device via the software interface.
Pin function	<ul style="list-style-type: none"> • Encod. I1 + I2: Input function for connecting an HTL (5 to 24 V, A/B channel) rotary encoder. This function must be set for I/O1 and I/O2 at the same time. This function is only available for I/O1 and I/O2. <p>HTL encoder:</p>  <p>TTL encoder:</p>  <p><i>Figure 6: TTL and HTL Encoders</i></p> <p>NOTE! TTL is active when pin functions I/O1 and I/O2 are not set to encoder. All four cables have to be connected (A, \bar{A}, B, \bar{B}).</p>
Pin function	<ul style="list-style-type: none"> • Laser off: Input function for switching off the laser externally with the help of a 24 V signal (attention: does not constitute "safe" shutdown).

Pin function	<ul style="list-style-type: none"> • Profile enable: Input function which enables profile recording for as long as the signal is applied. <div>  NOTE! In combination with the “fixed” mode, the “profile active” pin function is used to start the specified number of profiles. If the signal remains continuously active, the sensor transmits a multiple of the defined number of profiles (see also “Number of Profiles” under “Trigger Settings” in the “Profile Display” menu). </div>
Pin function	<ul style="list-style-type: none"> • Encod. reset: Input function for resetting the internal encoder counter to “0”.
Internal load	Connects an internal resistor to the input (pull-down). Internal load of 2 mA (on/off).
Input function	Determines whether the input responds to supply voltage or 0 V. This makes it possible to invert any pin function.
Output	Sets the output’s polarity (push-pull, PNP, NPN).
Output function	The output can be configured as normally open (NO) or normally closed (NC).


NOTE!

The above listed functions can be set individually for each of the 4 configurable I/Os (with the exception of “Encod. E1 + E2” which is limited to I/O1 in combination with I/O2).

6.3 Using More than One Sensor (synchronization)

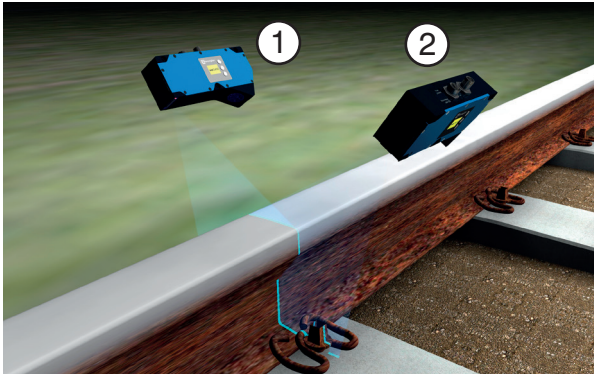
It may be necessary to use more than one weCat3D in an application. This is fundamentally possible, but it necessitates special wiring and sensor configuration depending on sensor array and how the sensors are used.



Note!

The master (sensor 1 in this example) has to be in the “Encoder”, “Internal” or “Software” profile mode, and the slave (sensor 2 in this example) has to be in the “syncIN” sync mode.

Example 1: Time-shifted measurement for extending the measuring range while avoiding reciprocal influence of the sensors despite overlapping of the laser lines.



Sample Application, Rail Head Measurement

Sample configuration:

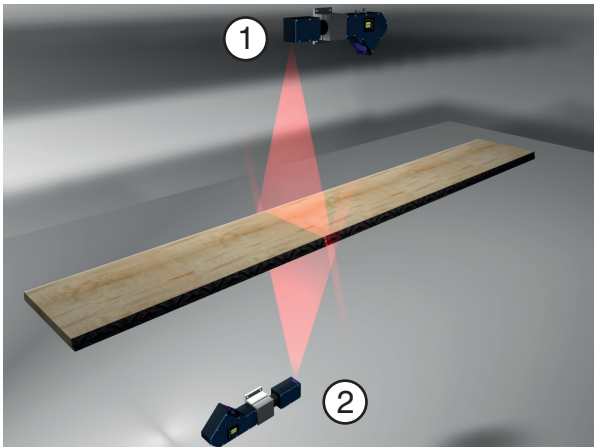
Master, SyncOut (default setting I/O3) connected to slave, SyncIn (default setting I/O4).



Sensor 1:
Sync mode (internal/encoder/software)
Exposure time: 200 μ s
Sync out delay: 200 μ s

Sensor 2:
Sync mode (syncIN)
Exposure time: 200 μ s

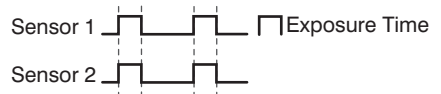
Example 2: Simultaneous measurement:



Sample Application, Thickness Measurement for Wooden Floorboards

Sample configuration:

Master, SyncOut (default setting I/O3) connected to slave, SyncIn (default setting I/O4).



Sensor 1:
Sync mode (internal/encoder/software)
Exposure time: 200 μ s
Sync out delay: 0 (default setting)

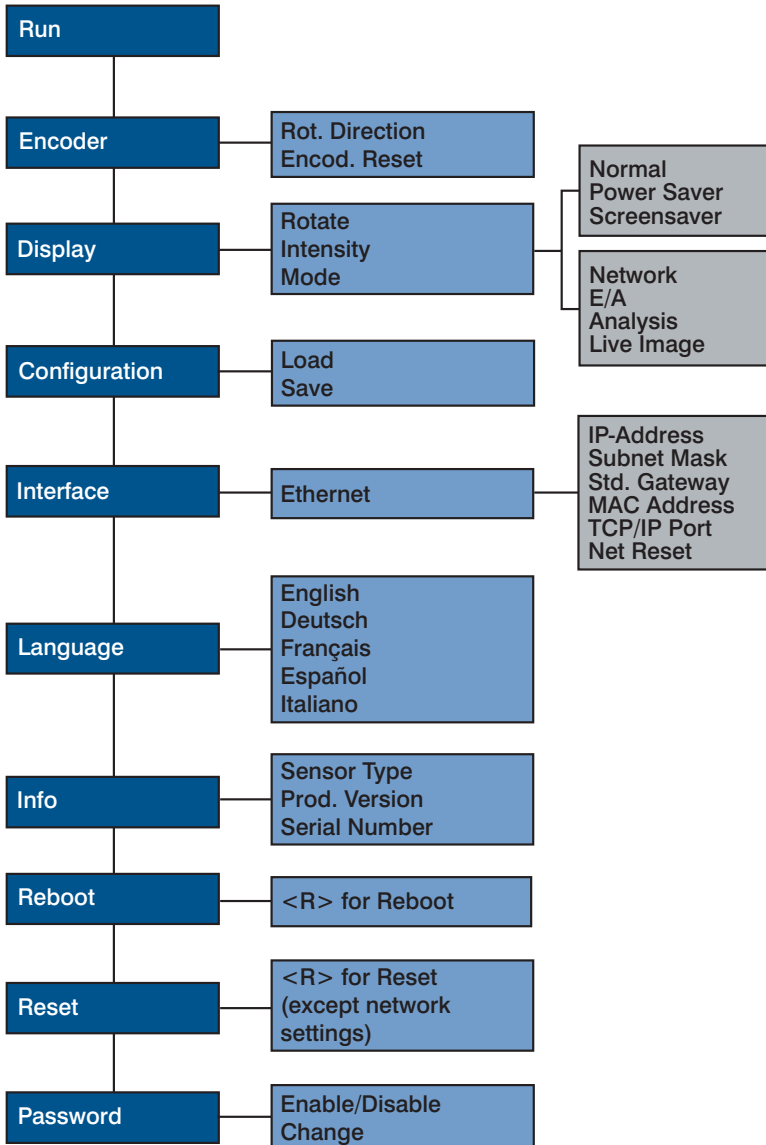
Sensor 2:
Sync mode (syncIN)
Exposure time: 200 μ s



NOTE!

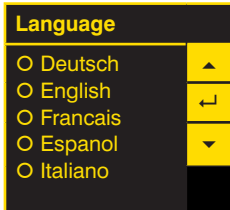
The hardware trigger must have a pulse width of at least 10 μ s.

7. OLED Display



7.1 Settings

A language can be selected for the OLED display from the language selection. This has no effect on the internal website and is saved to the sensor automatically.



Navigation with the keys:

- ▲ : Navigate up
- ▼ : Navigate down.
- ↵ : Selection is acknowledged with the enter key.

Meanings of menu items:

- ◀ Zurück: Move up one level within the menu.
- ⏪ Run: Switch to the display mode.

You can switch to the configuration menu by pressing any key.



NOTE!

If no settings are adjusted in the configuration menu for a period of 30 seconds, the sensor is automatically returned to the display mode. The sensor accesses the last used menu view when a key is once again activated. If a setting is configured, it becomes active when the configuration menu is exited.



CAUTION!

Do not use any sharp objects to press the keys when configuring settings, because they might otherwise be damaged.

7.2 Run

The sensor is switched to the display mode. Further information is available in section 7.4.3. The display mode can be changed to the network mode, the I/O display or the Analysis mode in the display menu.

7.3 Encoder

Encoder	Setting the Encoder's Direction of Rotation
<ul style="list-style-type: none"> ○ Rot. Direction ○ Encod. Reset ◀ Back ◀◀ Run 	<p>Rot. Direction: Rising: the encoder's direction of counting is ascending. Falling: the encoder's direction of counting is descending.</p> <p>Encoder reset: Encoder settings are reset.</p>

7.4 Display

Various changes can be made to the settings at the display in order to simplify operation of the sensor.

7.4.1 Rotate

Rotate	180° Rotation of the Display
--------	------------------------------

7.4.2 Intensity

Display intensity can be adjusted, for example to assure that the display is still easily legible even in bright environments.

Display	Display settings
<ul style="list-style-type: none"> ○ Normal ○ Power Saver ○ Screensaver ◀ Back ◀◀ Run 	<p>Normal: Display intensity is set to the middle value.</p> <p>Power Saver: If no keys are pressed for a period of one minute, the display is switched off, and is switched back on as soon as a key is activated.</p> <p>Screensaver: If no keys are pressed for a period of 30 seconds, the display is switched to the display mode and returns to the last used menu as soon as a key is activated. The colors are inverted every 30 seconds in order to protect the display.</p>

7.4.3 Mode

The sensor is equipped with various display modes which appear in the run display.

Mode	Selection of the display for the "Run" mode
<ul style="list-style-type: none"> ○ Network ○ E/A ○ Analysis ○ Live Image ◀ Back ◀◀ Run 	<p>Network: The IP address, MAC address and the subnet mask are displayed.</p> <p>E/A: Display of input and output states.</p> <p>Analysis: Displays network utilization as a percentage, internal temperature in °C and signal strength as a percentage.</p> <p>Live Image: Displays the current profile image.</p>

7.5 Configuration

Configuration	Sensor Configuration Management	
○ Load	Load:	Stored sensor settings are loaded.
○ Save	Save:	Sensor settings are saved.
◀ Back		
◀◀ Run		

7.5.1 Load

Load	Loading the Sensor Configuration	
○ Standard	Standard	The values saved under standard are loaded automatically when the sensor is started up.
○ Set 1	Set 1:	The values saved to “Set 1” are loaded.
○ Set 2	Set 2:	The values saved to “Set 2” are loaded.
◀ Back		
◀◀ Run		

7.5.2 Save

Save	Saving the Sensor Configuration	
○ Standard	Standard	Sensor settings are saved under “Standard”.
○ Set 1	Set 1:	Sensor settings are saved under “Set 1”.
○ Set 2	Set 2:	Sensor settings are saved under “Set 2”.
◀ Back		
◀◀ Run		

7.6 Interface

Ethernet	Settings for the Ethernet connection	
IP Address	IP Address:	Display of the selected IP address.
Subnet Mask	Subnet Mask:	Display of the selected subnet mask.
Std. Gateway	Std. Gateway:	Display of the selected standard gateway.
MAC Address	MAC Address:	Display of the preselected, non-changeable MAC address.
TCP/IP Port	TCP/IP Port:	Display of the TCP/IP port
Net Reset	Net Reset:	Resets network settings to their default values
◀ Back		
◀◀ Run		
Changes do not become effective until after the sensor has been restarted.		

7.6.1 IP address

IP address		Setting the IP address
192.168.100.001	+	The IP address can be set by pressing the “+” and “-” keys.
	↵	
	-	

IP address		Checking the IP address for correctness
192.168.100.001 Input correct?	Y	Correctness of the entered IP address is confirmed by pressing the “Y” key and the address is transferred to the sensor.
	N	If necessary, the IP address can be reentered after pressing the “N” key.
	◀	After pressing the ◀ key, the display is returned to the Ethernet network menu without saving the entered IP address.

The subnet mask, the standard gateway and the TCP/IP port can be changed using the same procedure as for the IP address.

7.6.2 MAC address

MAC address		Displaying the MAC address
54:4a:05:00:08:04	◀	The sensor’s unchangeable MAC address is displayed.
	↵	After pressing the ◀ key, the display is returned to the Ethernet network menu.
	-	

7.6.3 Network reset

Network reset		Resetting the Network Configuration
Press <R> for Reset	R	The network configuration can be reset by pressing “R”.
	◀	After pressing the ◀ key, the display is returned to the Ethernet network menu.

Refer to section 6 regarding default network settings.

7.7 Language

Language	Selecting a menu language
<ul style="list-style-type: none">○ Deutsch○ English○ Francais○ Espanol○ Italiano◀ Back◀◀ Run	The selected language appears in the menus as soon as it has been selected.

7.8 INFO

Info	Display of sensor information
<p>Sensor type MLSL123</p> <p>Product version 1.0.0</p> <p>Serial number 123456789</p>	<p>Sensor type, product version, serial number and status are displayed in the information menu.</p> <p>These entries play an important role in the event that technical problems should occur, and when contacting Technical Support with questions.</p>

7.9 Restart

Restart	Restarting the sensor
<p>Press <R> for restart</p> <p>R</p> <p>◀</p>	<p>Restarting of the sensor can be forced by pressing “R”.</p> <p>After pressing the ◀ key, the display is returned to the main menu.</p>

7.10 Reset

Sensor settings (except for network settings) can be returned to their default values in the “Reset” menu (see section 5.5).

Reset	Restoring default settings
<p>Press <R> for reset</p> <p>R</p> <p>◀</p>	<p>All of the selected sensor settings are returned to their default values by pressing the “R” key.</p> <p>After pressing the ◀ key, the display is returned to the main menu.</p>

7.11 Password

Password protection prevents inadvertent changes to selected settings.

Password	Activating the password function	
Enable/Disable Change ◀ Back ◀◀ Run	Enable/Disable:	Enable or disable password protection. When password protection is enabled, the sensor is automatically disabled after pressing any key in the "Run" mode.
	Change:	Change the password.

NOTE!

- If the password function has been activated, the password must be entered each time supply power is interrupted. After pressing any key, the menu is automatically switched to the password entry mode.
- After the password has been correctly entered, the entire menu is enabled and the sensor can be operated. The password function is deactivated upon shipment from the factory.
Passwords can be selected within a range of **0000 to 9999**.
- It must be assured that the selected password is noted before any changes occur. If the password is forgotten, it has to be overwritten with a master password.
The master password can be requested by e-mail from **support@wenglor.com**.



8. Maintenance Instructions

NOTE!

- This wenglor sensor is maintenance-free.
- Cleaning of both lens covers at regular intervals is recommended in order to assure uniform good quality of the measured values. A commercially available cloth for cleaning eyeglasses can be used for this purpose.
- Do not clean the sensor with solvents or cleansers which could damage the product.



9. Proper Disposal

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

10. Appendix

10.1 Special Device OPT3013



NOTE!

All information and data of the Operation Instructions apply, unless otherwise stated below.

10.1.1 Use for Intended Purpose

The OPT3013 may only be used for the measurement of materials. It's not suitable for measuring living beings because the skin may be endangered if the system comes to a standstill. The sensor must move at a speed of at least 0.3 mm per second in order to assure safe operation. This prevents inadvertent irradiation of the skin at any given point. Use of the product for other than its intended purpose may be hazardous to the skin. Use of the product for other than its intended purpose is deemed improper. Any liability on the part of the manufacturer is excluded in this case.

10.1.2 Minimum coverage of the visual field width

The visual field always has 2048 points over its entire width. A point is defined by an X/Z coordinate and an intensity value. The points are classified as valid or invalid:

Invalid points: $X\text{-value} = 0$ $Z\text{-value} = 0$ $intensity = 0$

Valid points: $X\text{-value} \neq 0$ $Z\text{-value} \neq 0$ $intensity \neq 0$

When using the OPT3013, 5% of the valid points within the visual field width must be detected in order to enable measurement at full speed, i.e. the sensor switches from flash mode to measuring mode after at least 105 points have been detected.

10.1.3 Technical Data

Light source	Laser (UV) / laser (red)
Wavelength	375 nm / 660 nm
Laser class UV/red (EN 60825-1:2014)	1/2
Current consumption ($U_b = 24\text{ V}$)	1500 mA
Measurement enable *	EA3: 5...24 V DC
Trigger *	EA1 + EA2: encoder signal TTL or HTL OR EA4: Frequency proportional to movement speed
Weight	600 g

* see flowchart "Standard Operation" below

10.1.4 OPT3013 Safety Clearances

In accordance with laser standard EN 60825-1:2014, NOHD (distance as of which laser class 1 is achieved) amounts to 3.4 meters.

In accordance with TROS, which takes skin safety into consideration in addition to eye safety, safety clearance is 15 meters. Country-specific safety clearances can be calculated from the irradiance values listed in the table shown below.

Abbreviations:

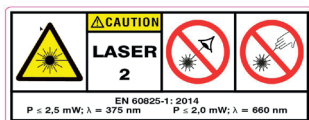
NOHD: Nominal ocular hazard distance

TROS: Technical rules of the German occupational safety regulation concerning artificial optical radiation

10.1.5 Irradiance of UV Light

Distance [m]	0.1	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
W/m ²	2673.8	67.5	29.9	16.9	10.8	7.6	5.6	4.3	3.4	2.8

Distance [m]	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0
W/m ²	1.9	1.4	1.1	0.9	0.7	0.6	0.5	0.4	0.4	0.3



LASER ENERGY - EXPOSURE IN CLOSE PROXIMITY TO THE APERTURE MAY CAUSE INJURY TO THE SKIN!



CAUTION!

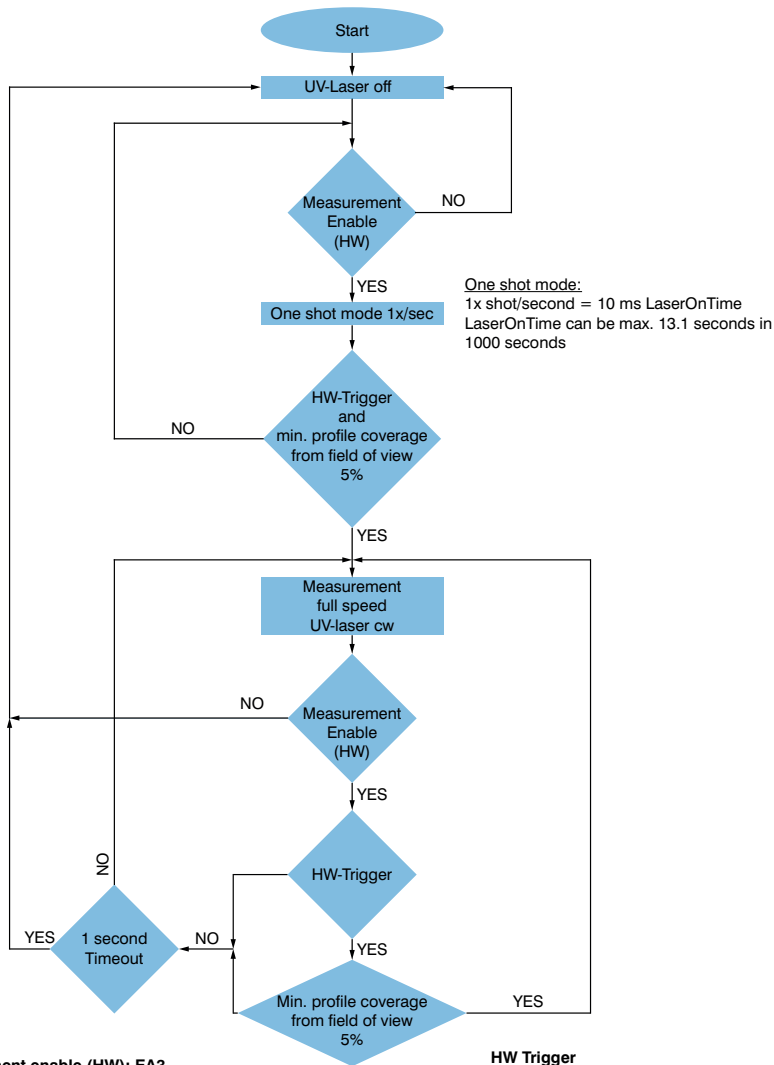
In accordance with TROS Laser 2015 (Germany), the skin may not be statically exposed to UV radiation for longer than 13 seconds at a distance of 100 mm. We recommend wearing gloves during use in the setup mode. Red laser light (660 nm ± 10 nm) may not be obstructed!



NOTE!

Adequate heat dissipation must be assured. If the sensor is operated with the default exposure time set at the factory, a metallic connection between the sensor housing and the mounting surface is sufficient to this end. As of an internal temperature of 56 °C, the sensor must be cooled with the help of the suitable cooling element (see MLWL1x2 standard device). If internal temperature rises to greater than 61 °C, the sensor's laser diodes (red and UV) are shut down automatically in order to protect them. If temperature drops to below 59 °C, automatic shutdown is once again deactivated.

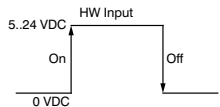
10.1.6 Standard Operation



Measurement enable (HW): EA3

•Signal edge controlling:
Low → High edge = Loop On
(must stay high)
High → Low edge = Loop Off
(must stay low)

Condition: New pulse to turn on
regardless of reason of switching off



HW Trigger

•Movement control signal:
1. Encoder signal on both inputs (TTL or HTL / EA1 + EA2)
OR
2. Frequency on I/O pin proportional to movement speed (EA4)

Condition: Signal must have a minimum frequency of 1 Hz

10.2 Change Index of Operating Instructions

Version	Date	Description/Change	Valid for	Firmware version
1.0.0	20/06/2016	Initial version of the operating instructions	weCat3D MLSL xxx weCat3D MLWLxxx	1.0.0 1.0.1
1.1.0	25/09/2017	<ul style="list-style-type: none"> • Updating of laser warnings • Use of the MLSL2 for intended purpose • Technical data for the MLSL • Measuring fields of the MLSL2 • MLSL2 housing dimensions • MLSL1/MLSL2 layout • LED display with LED laser • Link/Act LED description • M8 tightening torque • S74 connection technology • MLSL1/MLSL2 system overview • External 24 V laser shutdown • Default settings: direction of rotation, signal selection • Note regarding programming interfaces • Web server optimization • Web server updating: <ul style="list-style-type: none"> • Laser status • Measuring rate • ROI, profile and trigger settings • Using more than one sensor • Firmware update • OLED display: encoder, display (rotate), configuration 	weCat3D MLxLxxx	1.1.0
1.2.0	28/06/2018	<ul style="list-style-type: none"> • Technical addenda • Temperature specifications updated • "Firmware Update" section removed 	weCat3D MLxLxxx	1.1.0
1.2.1	12/12/2018	<ul style="list-style-type: none"> • Begin of measuring rate • Change in descriptions: measuring range X, measuring field 	weCat3D MLxLxxx	1.1.0
1.3.1	06/03/2019	<ul style="list-style-type: none"> • Correction of connection diagram • Update of layout graphics • Description OPT3013 	weCat3D MLxLxxx	1.1.1
1.4.0	18/04/2019	<ul style="list-style-type: none"> • New: Modus Live Image 	weCat3D MLxLxxx	1.1.4
1.5.0	26/06/2019	<ul style="list-style-type: none"> • Temperature switch-off 	weCat3D MLxLxxx	1.1.6
1.6.0	24/09/2019	<ul style="list-style-type: none"> • Laser Warnings 	weCat3D MLxLxxx	1.1.6
1.7.0	03/12/2019	<ul style="list-style-type: none"> • Description "Extended source" • Measuring rate updated • Comment service life 	weCat3D MLxLxxx	1.1.6

Version	Date	Description/Change	Valid for	Firmware version
1.7.1	21/01/2019	• Amendment service life of laser	weCat3D MLxLxxx	1.2.0
1.7.2	25/03/2020	• Dimensional Drawings MLSL1xxx • Adaption Electrical Connection	weCat3D MLxLxxx	1.2.0

10.3 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.