LASER

Analog Laser Displacement Transducer



LAS Series

Key-Features:

- *Available measurement ranges: 10 to 800 mm*
- *Resolution up to 2 µm, linearity up to ±6 µm*
- *Spot and line laser versions*
- *Individual parametrization by teach-in procedure*
- *Protection class: IP67*
- *Working temperature: 0 to 50 °C*
- *Very precise distance measurement on most materials*
- *Protected against reverse polarity and short circuit*
- *Analog output 4..20 mA and/or 0...10 V*

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29.07.15

WayCon Positionsmesstechnik

INTRODUCTION

LAS laser sensors cover measurement ranges from 1 to 800 mm. The integrated micro-controller delivers an accurate output signal, which is proportional to the detected distance. External analysers to evaluate the signals are not required. Reliable operation, independent of color or other influences of the surface, is ensured by sophisticated electronic elements integrated in the system. The small visible laser spot allows a simple and precise orientation of the sensor. Distances to rough surfaces can be measured by using a fine laser line instead of the spot.

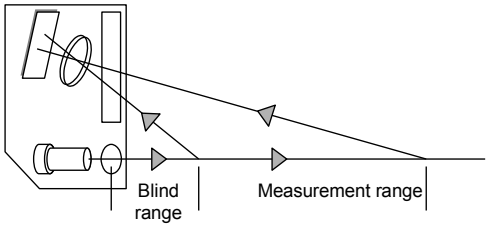
MEASURING PRINCIPLE

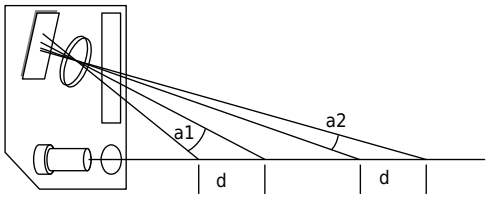
The triangulation principle is basic for this measurement method. The laser beam in the form of a small spot arrives on the surface of the target, while the detector of the system captures its position. The distance itself is calculated by means of the change of the angle. Achievable resolution and accuracy are therefore influenced mainly by the distance d: In proximity of the sensor, a large angular change a1 can be obtained, whereas larger values result in a smaller angle a2, thus in reduced accuracy (see drawing).

A photo diode array integrated in the sensor represents the receiver, high speed versions use a PSD element. The receiver is directly coupled to a micro-controller, being part of the system. This micro-controller analyses the light distribution on the element, calculates the exact angle and out of it the distance to the object. The calculated distance is either transferred to a serial port or alternatively is converted to a proportional output current. The micro-controller guarantees a very high linearity and accuracy. The combination of photo diode array and micro-controller allows a suppression of interfering reflections and ensures a reliable results even on most critical surfaces.

The sensor automatically adapts to the surface colour by a change of its internal sensitivity. This way influences due to the target colour are nearly excluded.

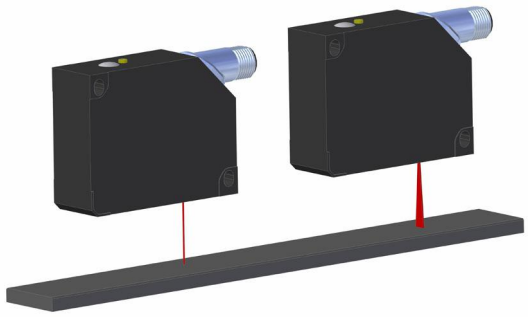
An integrated digital output is activated whenever the sensor does not receive enough light (pollution signal), or if no object within the measuring range can be detected at all.





INSTALLATION

Spot laser
The object is sampled by a focussed laser beam. This version is the most preferred within the LAS series.



Line laser

The laser beam is expanded to a fine line, by means of a deflection unit. Typical applications for sampling a target with a line laser are the position or thickness measurements of objects with rough, uneven, porous or interrupted surfaces.

Teach-in function

The desired range can conveniently be adapted within the maximum measurement range by means of the teach-in line or button. The analog output has its full stroke within the teached range. The default configuration uses the maximum measurement range. A separate description of the teach-in procedure is available upon request.

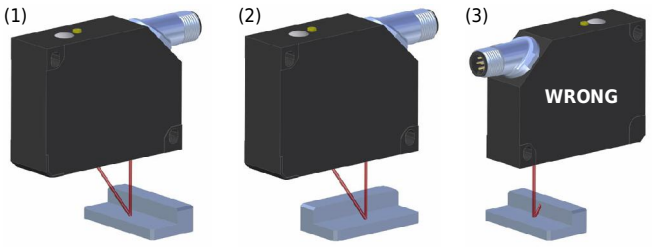
Installation

The first condition for a successful distance measurement is the absence of any obstruction in the light path, as shown in fig. 3. The receiver optics must be able to detect the light spot directly (fig. 1 and 2).

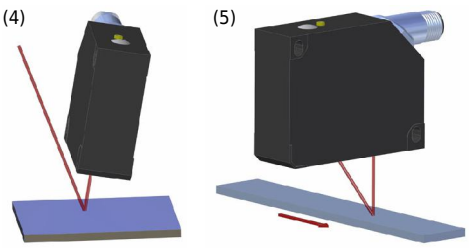
For highly polished or mirror-like objects it is important to keep the direct reflection away from the detector. In these cases, it is recommended to slightly tilt the sensor (fig. 4).

Optimum results are obtained by transverse installation of the sensor with respect to the target movement (fig. 5).

For triangulation sensors, there is a simple rule, that the distance between sensor and target should be as small as possible. The smaller the working range the better the linearity and accuracy.



Electromagnetic compatibility: The sensor must correctly be grounded, a shielded cable is recommended.



Cleaning of the laser window

1) dry cleaning with a soft brush

2) cleaning with a dry, soft, antistatic cloth

3) wet cleaning with clear water, approx. 30 degree Celsius, if necessary with a little mild soap.

Please do NOT use window cleaner!!

OVERVIEW OF THE LAS SERIES

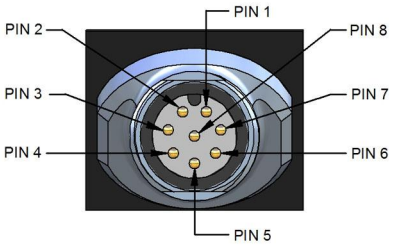
		LAS-TM	LAS-TML	LAS-TB	LAS-T/TL	LAS-T5
Smallest working range within the series *	[mm]	16	50	50	200	30
Largest working range within the series **	[mm]	550	550	200	1000	600
Smallest measurement range within the series	[mm]	10	300	10	800	40
Largest measurement range within the series	[mm]	500	500	100	800	500
Measuring range teachable		■	■	■	■	■
Smallest linearity error within the series	[mm]	±0,006	±0,05	<0,045	±0,011	+/- 0,012
Best resolution within the series	[mm]	0,002	0,010	<0,015	0,020	0,004
Highest sampling rate within the series	[ms]	<0,9	<0,9	<2	<4	<0,9
Spot laser		■			LAS-T	■
Line laser			■	■	LAS-TL	
Laser class		2	2	1	2	2
Output signal 0...10 V		■	■	■		■
Output signal 4...20 mA		■	■	■		■
Output signal 0...10 V and 4...20 mA					■	
Alarm output					PNP	
Connector M8, 4-pole		■	■	■		
Connector M12, 5-pole						■
Connector M12, 8-pole					■	
Special properties		Very compact		Applicable for mat black surfaces		Outstanding price-performance ratio

* corresponds to the blind range of the sensor
** corresponds to the blind range + the measurement range

CONNECTION LAS-T / LAS-TL

Electrical connection LAS-T/ LAS-TL

PIN	Cable colour K8P..	Function
1	white	n. c.
2	brown	V +
3	green	4...20 mA
4	yellow	Teach-in
5	grey	Alarm
6	pink	0...10 V
7	blue	GND
8	red	Synchro-in



Alarm output

The alarm output is activated, as soon as the object is outside of the measurement range, or if the received signals are useless for a distance measurement (too low, or too high). In both cases the analog output signal is 4 mA / resp. 0 V.

The sensor has no internal hold function to bridge missing measurement signals. Therefore it may happen in critical applications (extremely bright surfaces) that the output shortly drops to 4 mA / resp. 0V , when the measurement signal gets lost. By checking the status of the alarm output before making a measurement, this false output signal can be identified.

TECHNICAL DATA – LAS-TM / LAS-T SERIES

LAS-TM: Very compact design
Measurement range teachable
Type of analog output:
4...20 mA or 0...10 V

LAS-T/TL: Dual analog output:
4...20 mA and 0...10 V
Measurement range teachable
Synchronization input
Alarm output







Spot laser **Line laser**		**LAS-TM-10**	**LAS-TM-104**	**LAS-TM-300** **LAS-TML-300**	**LAS-TM-500** **LAS-TML-500**	**LAS-T-800** **LAS-TL-800**
Measurement range	[mm]	16…26	16…120	50…350	50…550	200…1000
Resolution *	[mm]	0.002…0.005	0.002…0.12	0.01…0.40	0.01…1.15	0.02…0.4
Linearity error *	[mm]	±0.006…0.015	±0.015…0.35	±0.05…1.2	±0.08…3.5	±0.11…1.65
Min. teach-in range	[mm]	>1	>2	>5	>10	>10
Response time	[ms]	< 0.9	< 0.9	< 0.9	<2	< 4
Sensor element		Photo diode array				
Alarm output		-	-	-	-	PNP****
Power-ON indicator		LED green				
Alarm indicator		LED red				
Pollution indicator		LED red flashing				
Supply	[VDC]	12…28				
Max. current consumption	[mA]	100		80		100
Load resistance	[Ω]	4…20 mA: <300, 0…10 V: >100 k				
Light source		Laser diode red, pulsed				
Laser class		2				
Wavelength	[nm]	650				
Safety features		yes / yes				
Housing material		Zinc diecasting		Aluminium	Aluminium	Aluminium
Protection class		IP67				
Working temperature	[°C]	0…50				
Connection		M8 connector, 4 poles				M12 connector, 8 poles
Beam diameter spot laser	[mm]	0.5…0.2	0.9…0.5	1	1	2
Beam type, line laser ***		-	-			
Beam height	[mm]	-	-	4.0…9.0	4.0…11.0	6…20
Width	[mm]	-	-	2	2.0…1.0	02.05.15
Output signal **		4…20 mA or 0…10 V **				4…20 mA and 0…10 V

* Values for linearity and resolution are given for a mat white reference surface.

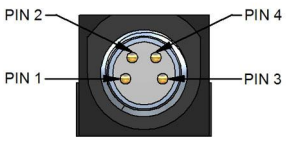
** Type of analog output (4…20 mA or 0…10 V) has to be specified when ordering.

*** The detector calculates an optical (not a mathematical) averaging of the sampled surface, i.e. a kind of a surface integral.

**** Binary open collector switching output with PNP transistor switching to +Vs. Consequently the load current flows from the switching output through the load resistance to 0 V. A suppressor diode is integrated and also an internal load resistor of approx. 10 kOhm ... 50 kOhm for measurement purposes.

Electrical connection LAS-TM, LAS-TML, (LAS-T/TL see page 3)

PIN	Function
1	V +
2	Teach-in
3	GND
4	Signal +



Connection cable

Cable with M8 mating connector	
K4P2M-S-M8	2 m, straight connector, 4 pole, shielded
K4P5M-S-M8	5 m, straight connector, 4 pole, shielded

PIN	Cable colour
1	brown
2	white
3	blue
4	black

TECHNICAL DATA – LAS-TB SERIES

LAS-TB: Line laser
Made for mat black surfaces
Measurement range teachable
Type of analog output:
4...20 mA or 0...10 V

Line laser		LAS-TB-10	LAS-TB-40	LAS-TB-100
Measurement range	[mm]	50…60	60…100	100…200
Resolution *	[mm]	<0.015	0.015…0.038	0.039…0.15
Linearity error *	[mm]	<0.045	±0.047…0.118	±0.123…0.457
Min. teach-in range	[mm]	>1	>4	>5
Response time	[ms]	<2		
Sensor element		Photo diode array		
Alarm output		-		
Power-ON indicator		LED green		
Alarm indicator		LED red		
Pollution indicator		LED red flashing		
Supply	[VDC]	12…28		
Max. current consumption	[mA]	80,0		
Load resistance	[Ω]	4…20 mA: <300, 0…10 V: >100 k		
Light source		Laser diode red, pulsed		
Laser class		1		
Wavelength	[nm]	650		
Safety features		yes / yes		
Housing material		Aluminium		
Protection class		IP67		
Working temperature	[°C]	0…50		
Connection		M8 connector, 4 poles		
Beam type, line laser ***	[mm]	0.1...0.18	0.11...0.45	0.2...0.74
Beam height	[mm]	1.1	1.7	2.8...3.7
Width	[%]	>0.5	>0.8	>2
Output signal **		4…20 mA or 0...10 V		

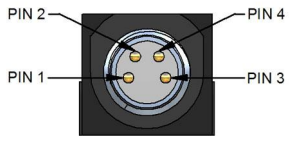
* Values for linearity and resolution are given for a mat white reference surface.

** Type of analog output (4…20 mA or 0…10 V) has to be specified when ordering.

*** The detector calculates an optical (not a mathematical) averaging of the sampled surface, i.e. a kind of a surface integral.

Electrical connection LAS-TB

PIN	Function
1	V +
2	Teach-in
3	GND
4	Signal +



Connection cable

Cable with M8 mating connector	
K4P2M-S-M8	2 m, straight connector, 4 pole, shielded
K4P5M-S-M8	5 m, straight connector, 4 pole, shielded

PIN	Cable colour
1	brown
2	white
3	blue
4	black

TECHNICAL DATA – LAS-T5 SERIES

LAS-T5: Low-cost series for conventional applications.
Measuring range teachable.
Type of analog output: 4...20 mA or 0...10 V



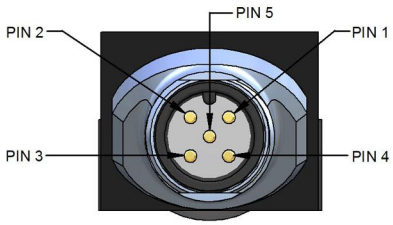
		LAS-T5-40	LAS-T5-100	LAS-T5-250	LAS-T5-500
Measuring range	[mm]	30…70	30…130	50…300	100…600
Resolution *	[mm]	0,004…0,02	0,005…0,06	0,01…0,33	0,015…0,67
Linearity error *	[mm]	±0,012…0,06	±0,015…0,2	±0,03…1	±0,05…2
Minimum Teach-in-range	[mm]	>2	>3	>5	>10
Response time	[ms]	< 0,9			
Sensor element		Photo diode array			
Power ON indicator		LED green			
Alarm lamp		LED red			
Pollution indicator		LED red, flashing			
Supply	[VDC]	12…28			
Max. current consumption	[mA]	100			
Load resistance	[Ω]	4…20 mA: <300, 0…10 V: >100 k			
Light source		Laser diode red, pulsed			
Laser class		2			
Wavelength	[nm]	650			
Safety features		Protection against reverse polarity and short circuit			
Housing material		Zinc diecasting			
Protection class		IP67			
Working temperature	[°C]	0…50			
Connection		M12 plug, 5-pole			
Beam diameter spot laser	[mm]	1…0,2	2…1	2,0	2,0
Analogue output **		4…20 mA, 0…10 V			

* Values for linearity and resolution are given for a mat white reference surface.

** Type of analog output (4…20 mA or 0…10 V) has to be specified when ordering.

Electrical connection LAS-T5

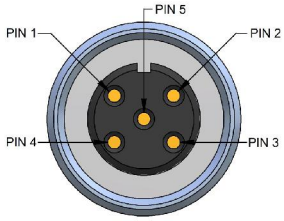
PIN	Function
1	V +
2	Signal
3	GND
4	n. c.
5	Teach-in



Connection cable

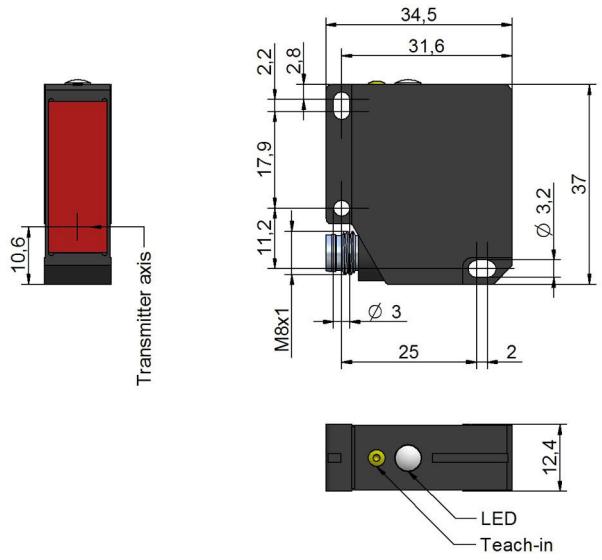
Cable with M12 connector, 5 pole, shielded, IP67	
K5P2M-S-M12	2 m, M12 connector straight
K5P5M-S-M12	5 m, M12 connector straight
K5P10M-S-M12	10 m, M12 connector straight
K5P2M-SW-M12	2 m, M12 connector angular
K5P5M-SW-M12	5 m, M12 connector angular
K5P10M-SW-M12	10 m, M12 connector angular

PIN	cable colour
1	brown
2	white
3	blue
4	black
5	grey

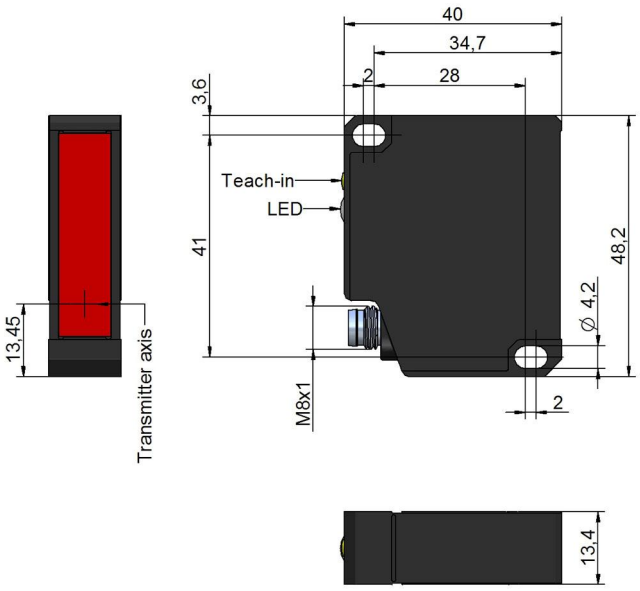


TECHNICAL DRAWING

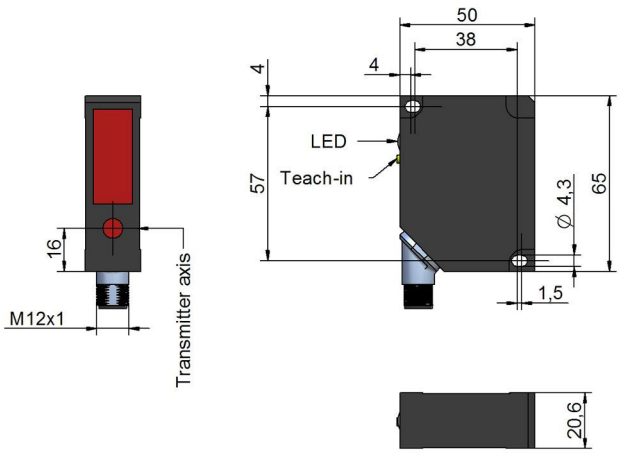
LAS-TM-10 / LAS-TM-104



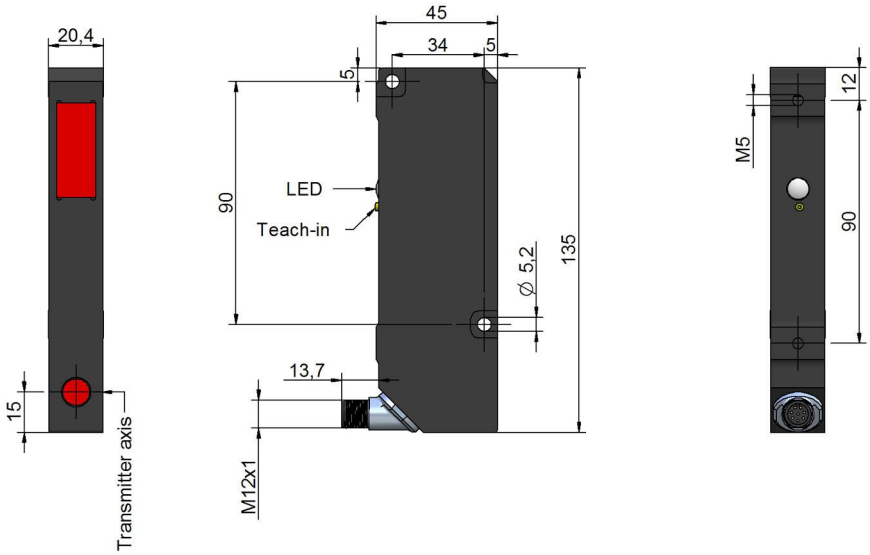
LAS-TM-300 / LAS-TM-500 / LAS-TB-10 / LAS-TB-40 / LAS-TB-100



LAS-T5-40...500



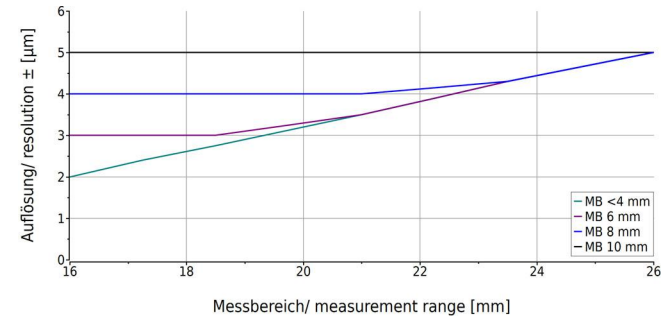
LAS-T-800 / LAS-TL-800

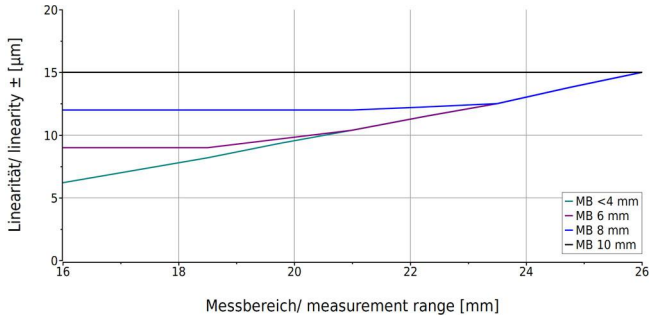


LINEARITY / RESOLUTION - LAS-TM / LAS-T SERIES

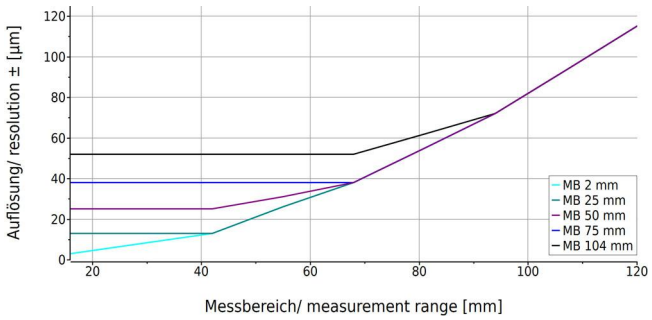
When teaching the measurement range, it is recommended always to select the smallest possible range, because this way the resolution is increased and the linearity error decreased. Also keep in mind that the distance between sensor and target should be as small as possible.

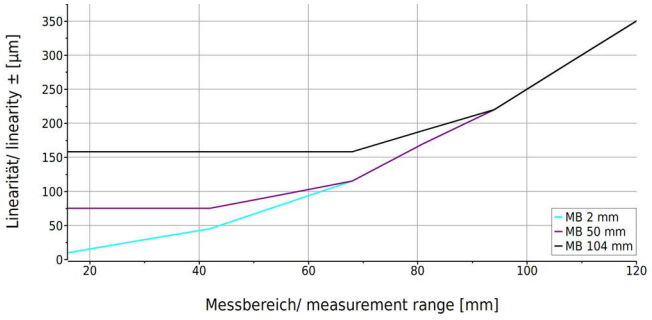
LAS-TM-10



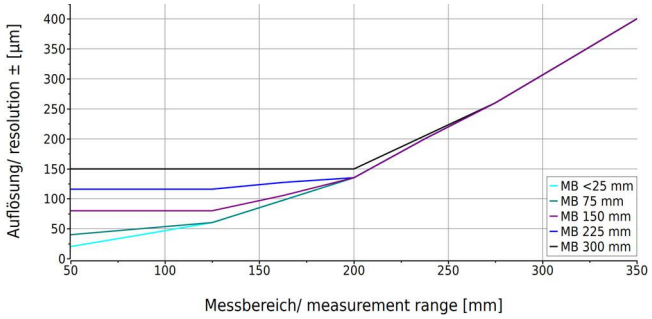


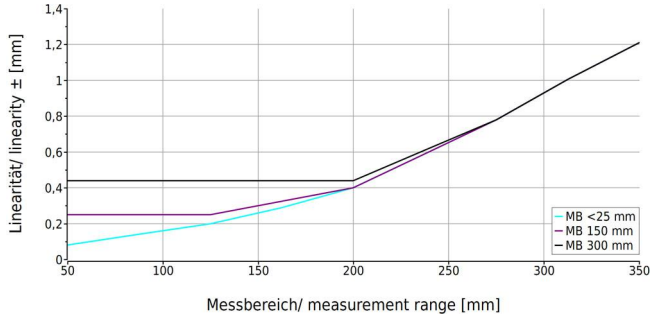
LAS-TM-104



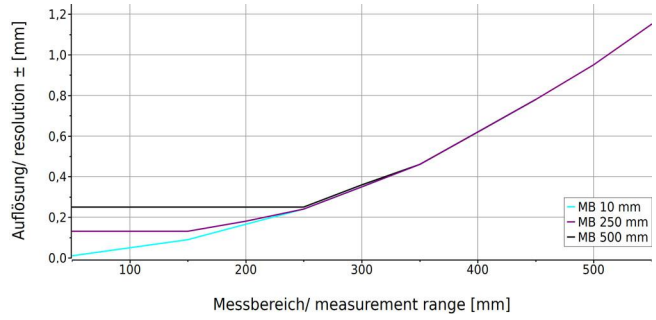


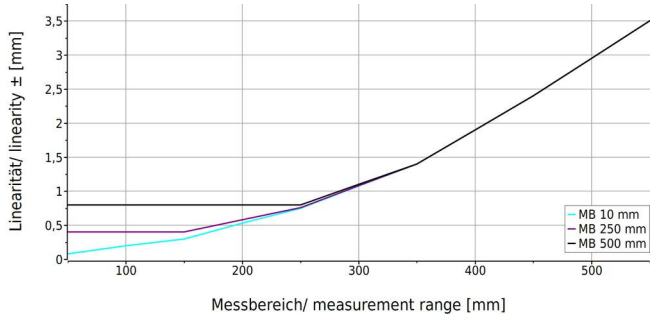
LAS-TM-300



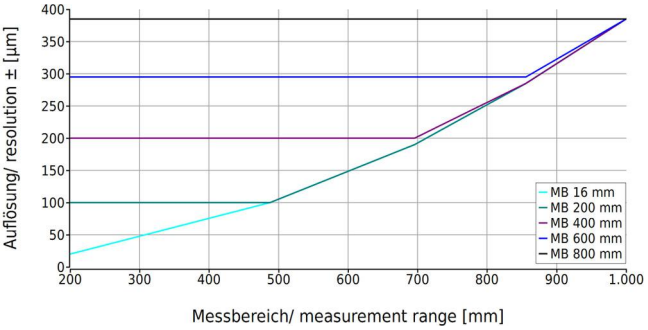


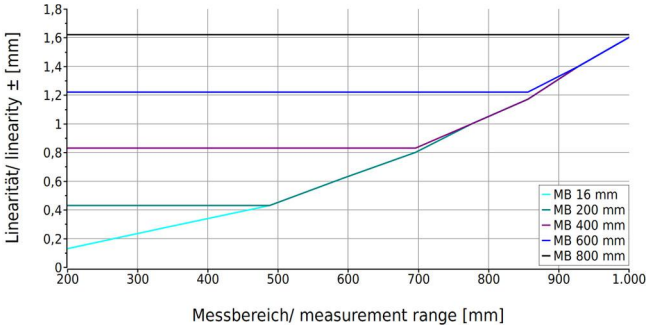
LAS-TM-500





LAS-T-800



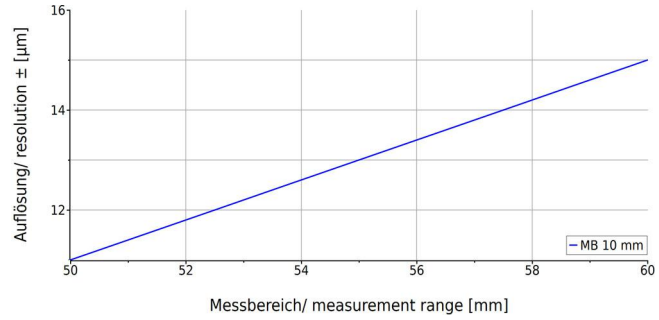


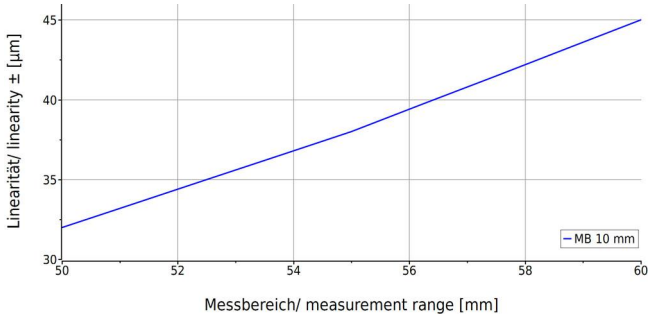
MB stands for teached measurement range.

LINEARITY / RESOLUTION - LAS-TB SERIES

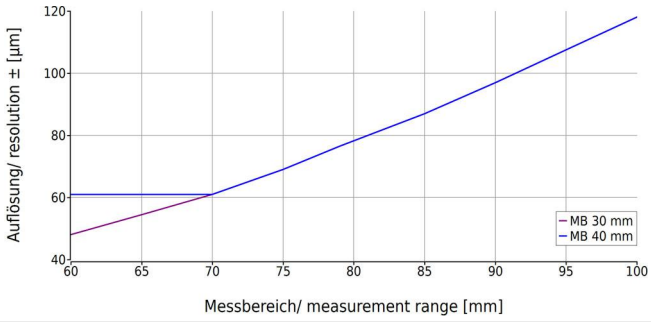
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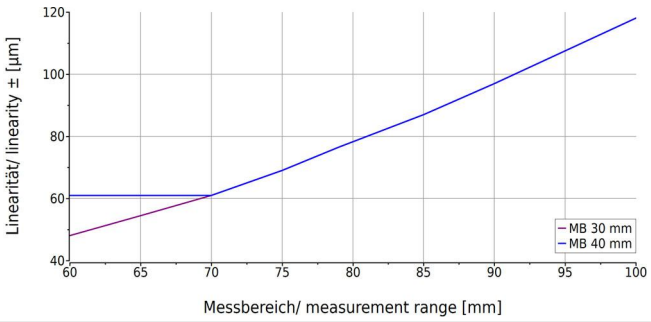
LAS-TB-10



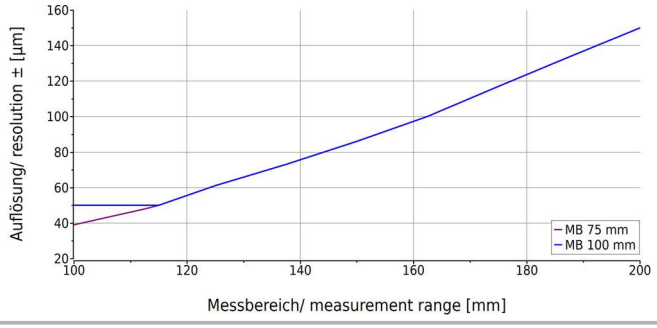


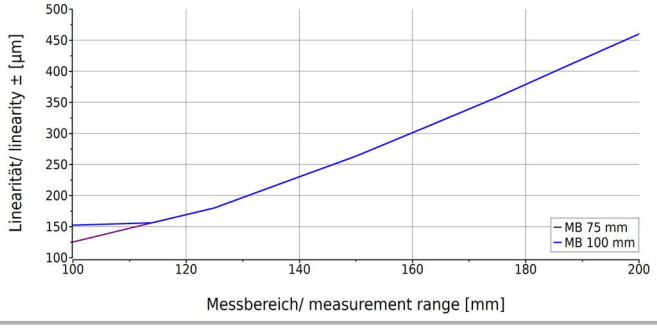
LAS-TB-40





LAS-TB-100



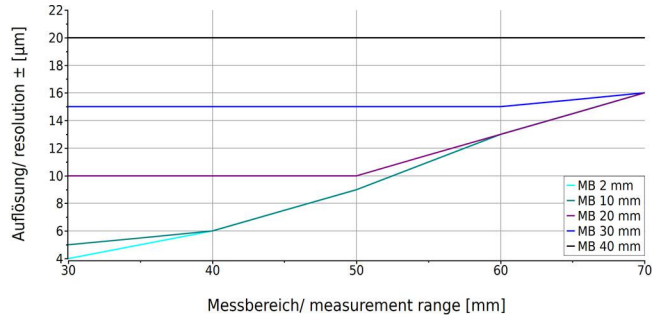


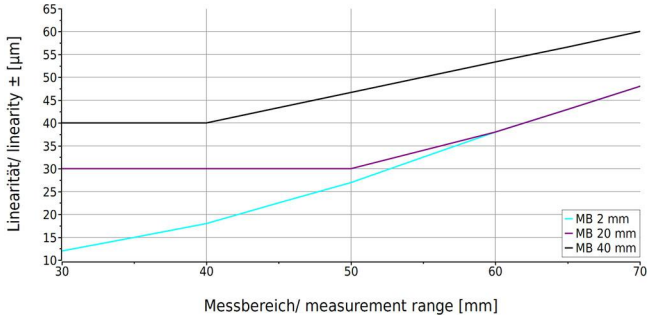
MB stands for teached measurement range.

LINEARITY / RESOLUTION - LAS-T5 SERIES

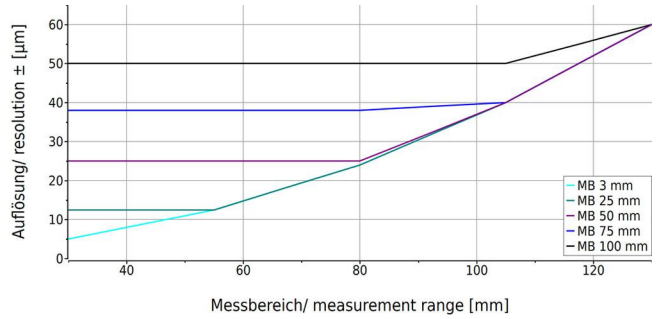
When teaching the measurement range, it is recommended always to select the smallest possible range, because this way the resolution is increased and the linearity error decreased. Also keep in mind that the distance between sensor and target should be as small as possible.

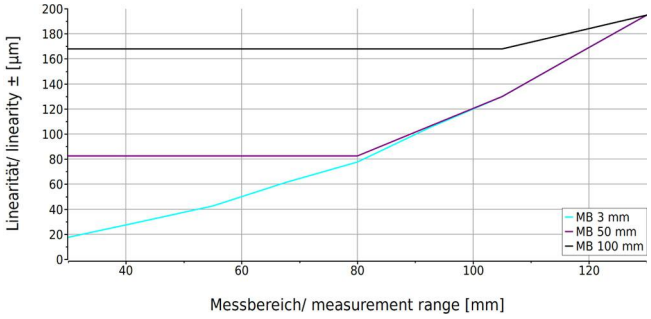
LAS-T5-40



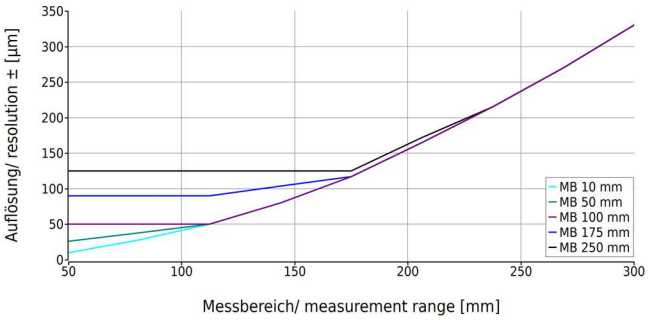


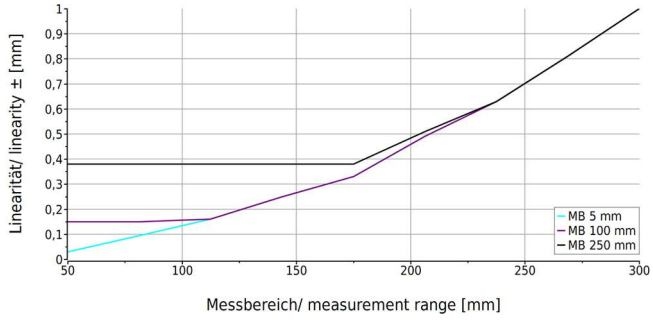
LAS-T5-100



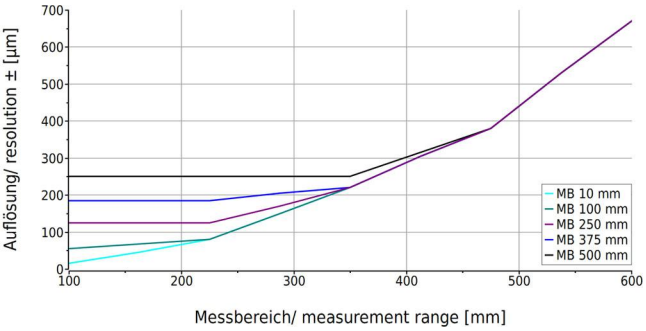


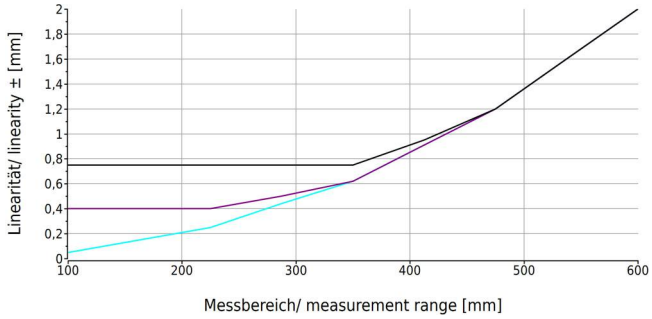
LAS-T5-250





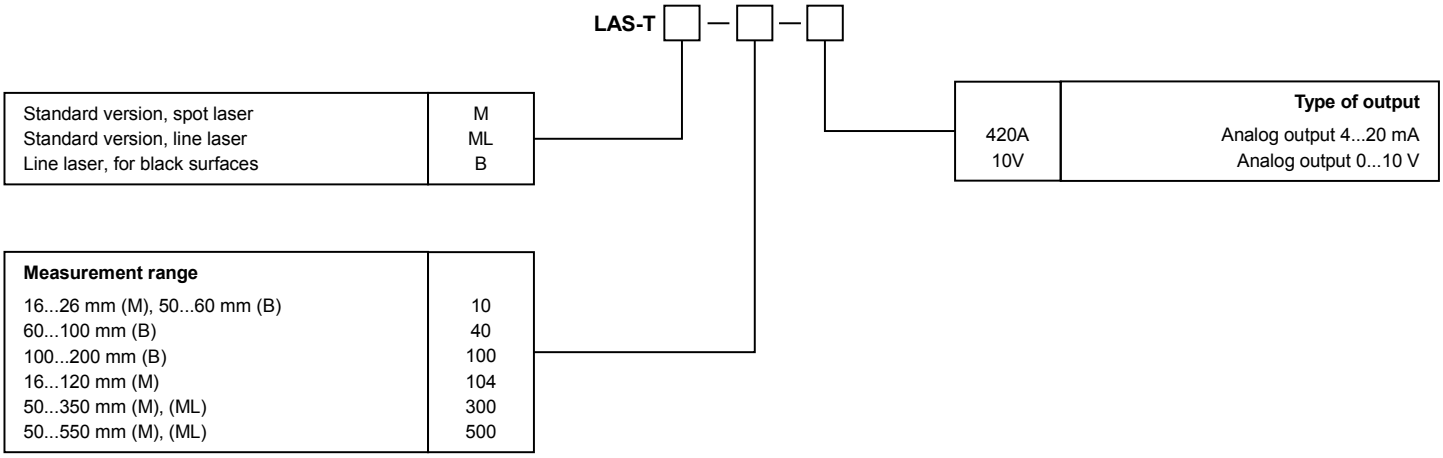
LAS-T5-500



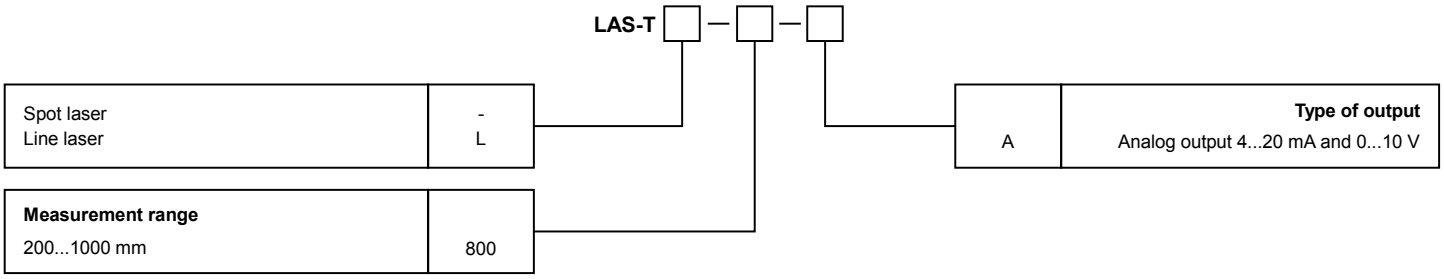


MB stands for teached measurement range.

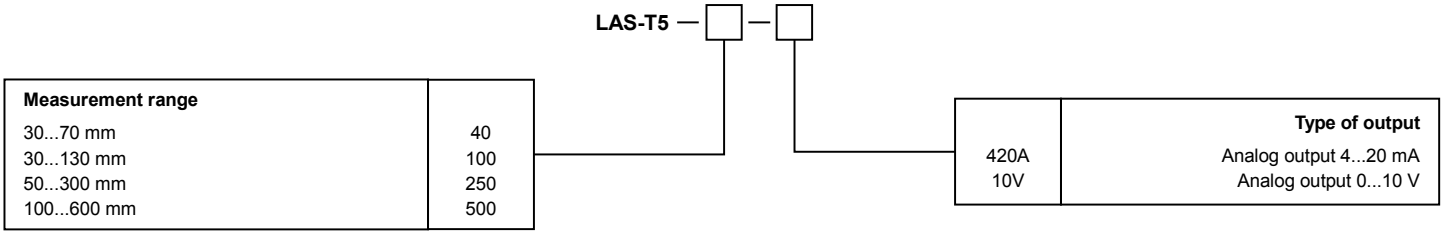
ORDER CODE LAS-TM / LAS-TML / LAS-TB



ORDER CODE LAS-T / LAS-TL



ORDER CODE LAS-T5



ACCESSORIES

Connection cable, 5 pole, shielded, with mating M12 connector for LAS-T5 series	
K5P2M-S-M12	2 m, connector straight
K5P5M-S-M12	5 m, connector straight
K5P10M-S-M12	10 m, connector straight
K5P2M-SW-M12	2 m, connector angular
K5P5M-SW-M12	5 m, connector angular
K5P10M-SW-M12	10 m, connector angular

Connection cable, 8 pole, shielded, with mating M12 connector for LAS-T/TL series	
K8P2M-S-M12	2 m, connector straight
K8P5M-S-M12	5 m, connector straight
K8P10M-S-M12	10 m, connector straight
K8P2M-SW-M12	2 m, connector angular
K8P5M-SW-M12	5 m, connector angular
K8P10M-SW-M12	10 m, connector angular

Connection cable, 4 pole, shielded, with mating M8 connector for LAS-TM / LAS-TML / LAS-TB series	
K4P2M-S-M8	2 m, connector straight
K4P5M-S-M8	5 m, connector straight

Protection glass for series LAS-T5, LAS-T/TL (only up to 500 mm FS)	
Schutzglas-LAS	self-adhesive

Digital display 1 channel, 0...10V/4...20 mA	
PAXP000B	1 channel, supply: 85 to 250 VAC
PAXP001B	1 channel, supply: 11...36 VDC/24 VAC

Digital display 2 channels, 0...10V/4...20 mA	
PAXDP00B	2 channels, supply: 85 to 250 VAC
PAXDP01B	2 channels, supply: 11...36 VDC/24 VAC

For further information please see the separate PAX data sheet





General safety instructions

Attention radiation laser.
Do not stare into beam.
Do not point the laser beam towards someone's eye.
It is recommended to stop the beam by a matte object or matte metal shield.
Laser regulations require the power to the sensor be switched off when turning off the whole system this sensor is part off.

Subject to change without prior notice.

WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.de

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen / Germany
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Cologne / Germany
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
Fax +49 (0)2232 56 79 45

LASER

Analog Laser Displacement Transducer



Series LAR

Key-Features:

- *Measurement ranges 10, 30, 70, 160, 400 mm*
- *Repeatability up to 10 µm*
- *Linearity up to ± 0.1%*
- *Individual parametrization by teach-in procedure*
- *External input setting function*
- *Window comparator mode and Zero set function*
- *Peak and bottom hold function*
- *Working temperature -10 to 45 °C*
- *Protection class IP67*
- *Analog output 0...5 V*
- *PNP or NPN output type*

Content:

Technical Data	***....2***
Technical Drawing	***....2***
Operation & Connection	***....3***
Order Code	***....4***

17.08.15

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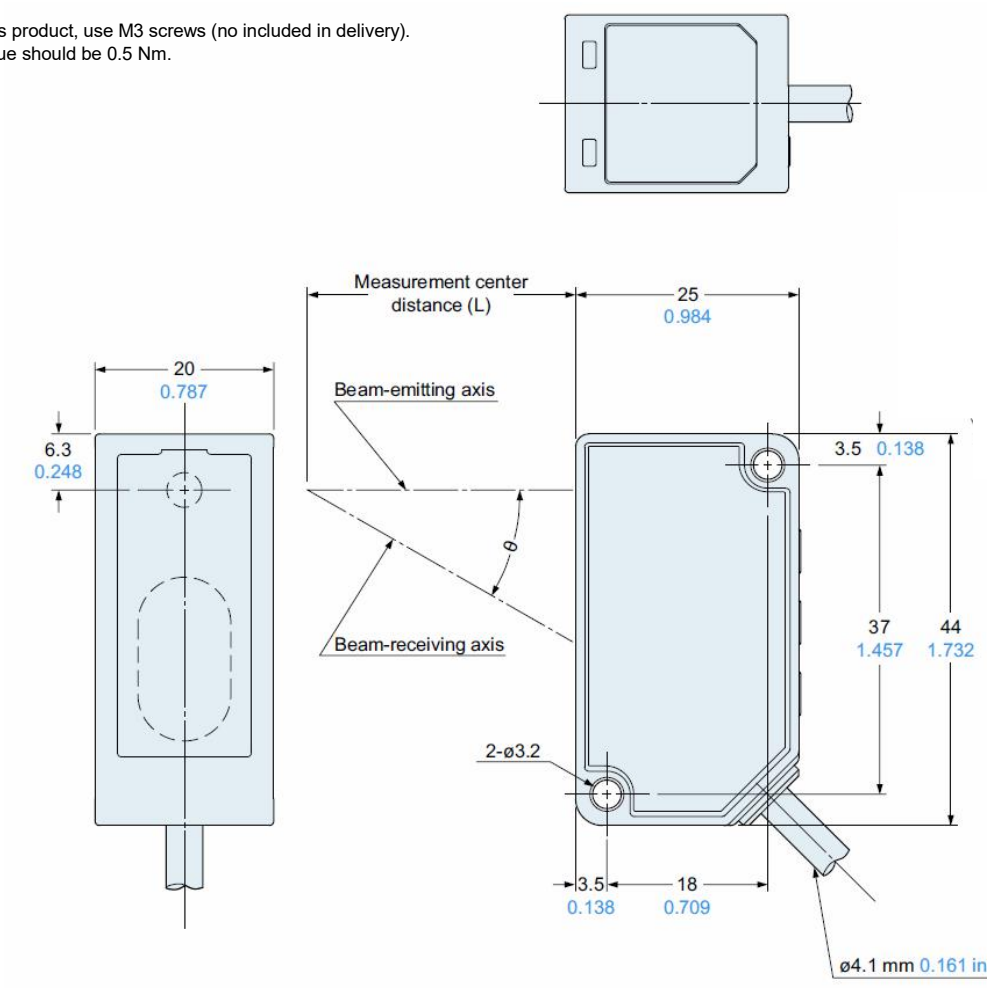
TECHNICAL DATA

	LAR-10-5V	LAR-30-5V	LAR-70-5V	LAR-160-5V	LAR-400-5V
Measurement range	25...35 mm	35...65 mm	65...135 mm	120...280 mm	200...600 mm
Linearity	±0.1 %	±0.1 %	±0.1 %	±0.2 %	±0.2 %...±0.3 %
Repeatability	10 µm	30 µm	70 µm	200 µm	300 µm...800 µm
Beam diameter	approx. 50 µm	approx. 70 µm	approx. 120 µm	approx. 300 µm	approx. 500 µm
Temperature drift	0.03 % of FS/°C				
Laser specification	Red semiconductor laser Class 2 [JIS/IEC/GB/FDA (Note 2)] Max. output: 1 mW, emission peak wavelength: 655 nm				
Supply voltage	12...24 VDC, ±10 %				
Power consumption	40 mA, or less (at 24 V) / 60 mA, or less (at 12 V)				
Control output	PNP or NPN Open-Collector Transistor				
Analog output	0...5 V (Alarm: +5.2 V), output impedance: 100 Ohm				
Response time	Switchable between 1.5 ms (high speed) / 5 ms (Standard) / 10 ms (high accuracy)				
Protection class	IP67				
Working temperature	-10...+45 °C (storage temperature -20...+60 °C)				
Humidity	35 to 85 % RH, Storage: 35 to 85 % RH				
Ambient illuminance	Incandescent lamp: Acceptance surface illuminance 3,000 ℓx or less				
Vibration	10 to 55 Hz (period: 1 min.) frequency, 1.5 mm amplitude in X, Y and Z directions for two hours each				
Shock	500 m/s² acceleration (50 G approx.) in X, Y and Z directions for three times each				
Output	5 wire cable, 2 m length				
Housing	Aluminum die-cast, Front cover: Acrylic				

TECHNICAL DRAWING

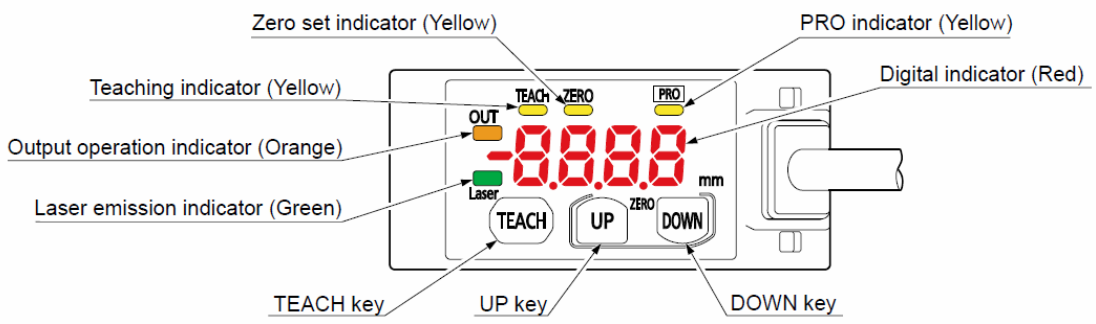
LAR, all models

When mounting this product, use M3 screws (no included in delivery).
The tightening torque should be 0.5 Nm.



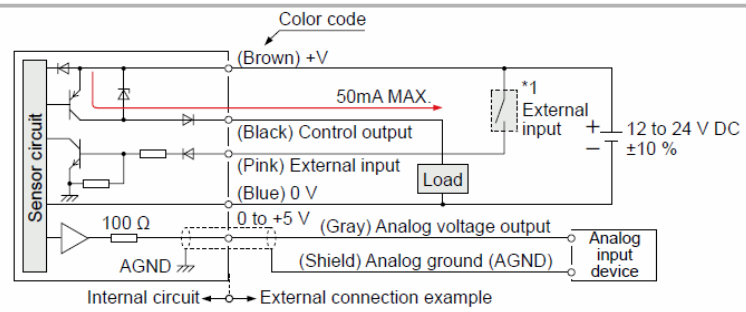
OPERATING ELEMENTS

A detailed description of the functions is given in the manual that comes with every LAR sensor.



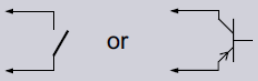
ELECTRICAL CONNECTION PNP

Cable colour	Function
brown	+V
black	Control output
pink	External input
blue	0 V
grey	Analog output 0…5 V
silver	Shield



*1

Non-voltage contact or PNP open-collector transistor



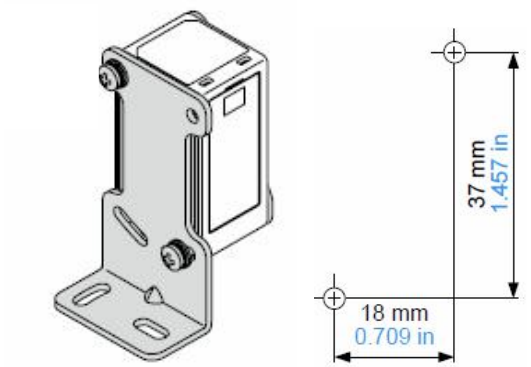
- External input
  Invalid: 0 to +0.6 V DC or open
  Valid: +4 to +V DC

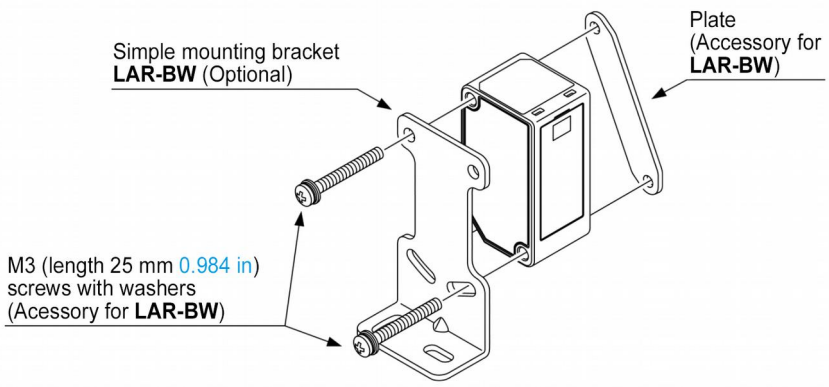
NPN output on request.

ACCESSORY

Mounting bracket LAR-BW

When mounting this product, use M3 screws (no included in delivery).
The tightening torque should be 0.5 Nm.





ORDER CODE LAR WITH PNP OUTPUT



Measurement range [mm]	
25...35	10
35...65	30
65...135	70
120...280	160
200...600	400

NPN output on request.

ACCESSORIES

LAR-BW	Mounting bracket



General safety instructions
Attention radiation laser.
Do not stare into beam.
Do not point the laser beam towards someone's eye.
It is recommended to stop the beam by a matte object or matte metal shield.
Laser regulations require the power to the sensor be switched off when turning off the whole system this sensor is part off.

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WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.biz

WayCon Positionsmesstechnik

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Köln
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
Fax +49 (0)2232 56 79 45

LASER

Analog Laser Displacement Transducer



LAM Series

Key-Features:

- *Available measurement ranges: 0.5 to 200 mm*
- *Resolution up to 0.2 µm , linearity up to ±1 µm*
- *Excellent for highly dynamic measurements*
- *Measuring frequency up to 100 kHz*
- *Sampling rate up to 400 kHz*
- *Working temperature 0 to 50 °C*
- *LAM external evaluation electronics*
- *Analog output 4...20 mA, -10...10 V*
- *with Ethernet Interface*

Content:

Measuring Principle	***....2***
Installation Instructions	***....3***
Technical Data LAM-S	***....4***
Technical Data LAM-F	***....5***
Technical Drawing	***....6***
Electrical Connection	***....7***
Order code	***....9***

03.03.15

WayCon
Positionsmesstechnik

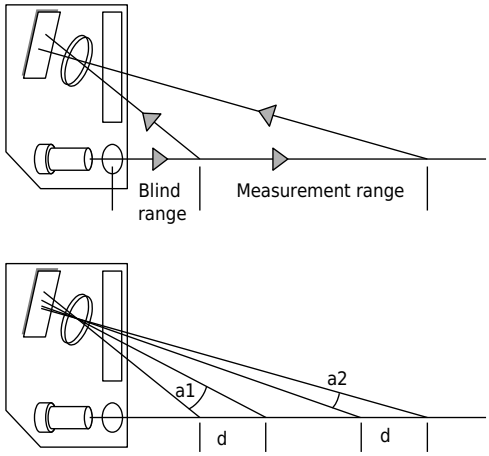
OVERVIEW

The optical position measuring system LAM is used in touchless measurement applications. LAM distance sensors are available in various models so as to offer the suitable sensor type for any application.

Due to the high measuring frequency of up to 100 kHz this series is particularly suited for highly dynamic measurements. This high resolution of up to 0.05 µm guarantees reliable use in sophisticated measurements in quality control.

MEASURING PRINCIPLE

The LAM laser sensors are used for touchless position, or presence measuring of objects. They utilise the triangulation method for measuring**.** The laser beam hits the object as a small spot and the sensor's receiver defines the position of this spot. The relation of the angles is used to calculate the distance. The possible resolution and the accuracy change with the distance d: If d is near the sensor, it causes a large change to the angle a1. If d is farther away, the change to the angle is much smaller a2 (see drawing).
The middle of the measuring rang is the reference distance. A light spot is focused on the object measured. The technology uses light impulses for very low dependence on constant ambient light. The projected light spot is mapped onto a position sensor through use of a lens. Diffuse reflection of the light of the light spot is important for the measurement. Depending on the reflectance of the area measured a fine self-actuated regulating circuit automatically adjusts the light intensity of the light source.
If the intensity of the reflected light is too low (min. 10% surface reflection), this will trigger error message F1: "too little light". With highly reflective surfaces reflecting the transmitting light directly into the reception optics will trigger error message F2: "too much light/reflection". Both errors are indicated by logic signals and LED displays. Analogue voltage describing the light intensity is delivered as additional information on the lighting conditions.
The output voltage "Distance" on pin 1 is emitted linear to the distance of the object. In addition to signal output ±10 V the output signals 4...20 mA and an Ethernet interface are available (optional 0...10 V, 0...5 V, ±5 V). Two comparators can be used to adjust the limits for the object distance measured. Thus the ranges too close, OK or too far are defined. The respective range can be identified by the LED display..



Self test

Permanent monitoring of the reflected light tests if an object is within the measuring ranges and the intensity of the reflected light is adequate.

Response time and frequency response

The rise time of the analog output is particularly fast in laser sensors. On the LAM-N it is ca. 100 µs , 50 µs for the LAM-S and 5 µs for the LAM-F for rising to > 90% of the end value.
The cutoff frequency of the low pass filter can be adjusted with dip -switches (under the cover in the lid of the electronics unit).
The internal sampling rate of the sensor is not impacted by the dip-switch-settings. The filter frequencies specified on pages 9 and 10 correspond to the -3 dB bandwidth of the low pass filter. Higher frequencies and noise are reduced more and more, thus increasing the measuring accuracy.
Example: Set to 2.5 kHz a recorded oscillation of a frequency of 2 kHz is transmitted without considerable reduction. A frequency of 10 kHz, however, would be severely reduced.

Sensor head installation

To achieve absolutely accurate distance measurements, the light measuring beam must be aligned square to the measuring surface. Any tipping will geometrically cause a greater measured displacement.

When installing the laser measuring head be sure the laser light beam can neither directly nor indirectly (e.g. through reflection) hit the human eye. The laser warning decal must be applied to the sensor where it is clearly visible.

To adjust, use the MIN, OK and MAX LEDs.

At delivery the MIN and MAX values are set to the limits of the measuring range. Whilst the OK LED is lit the object is within the measuring range and reflecting adequate light.

INFORMATION

Surface measurement error

Surface-related measurement errors impacted by material and colour

Any materials, e.g. metal, plastic, ceramics, rubber and paper, can be measuring objects. Use only needs to be reviewed on an individual basis with highly reflective surfaces or liquids.

Surface reflectance

The sensor requires a minimum of 10% surface reflection to function properly. Only diffuse reflection can be used for measurement.

Lateral flare

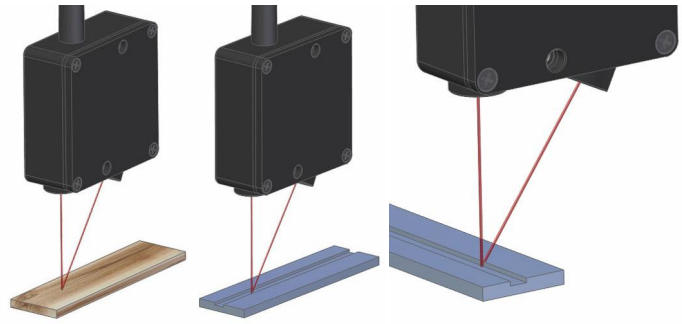
When projecting the light spot slight flare also occurs, which is reflected laterally by the measuring point, and then reaches the receiver. Highly reflective parts within the flare area close to the measuring point reflecting the flare directly to the receiver can result in measurement errors. Homogeneously scattering objects with the same level of reflectance do not cause this error. If the reflecting range is outside of the measuring point the errors can in worst case be 2%.

Beam entering the measured material

With slightly transparent plastics or cloudy liquids the measuring beam penetrates the medium to a certain level before the diffusely reflected light is reflected. Here the true measuring plane must be expanded by the penetration depth. In individual cases this can only be determined experimentally.

Striped objects

If the measuring objects have light/dark stripes, e.g. wood, the sensor must be mounted with the optical axis parallel to the direction of the stripe (see drawing right). The LAM lasers with its small measuring points are ideally suited for this.



Light/ dark change within the measuring point

If a distance is measured at a point where the material transitions from a diffusely reflecting to a reflective material, hence has a strong change in the reflection factor, measurement errors can result. Based on the surface, here the maximum of the light intensity is not at the centre of the measuring point. However, if the line of the transition is in the direction of the optical axis, the error is minimal.

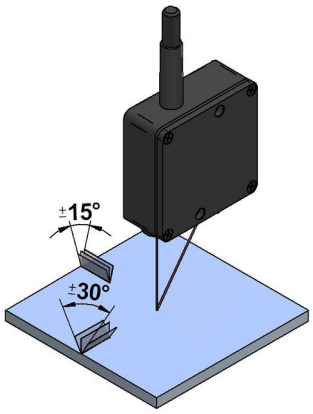
Change of the surface reflection factor during measurement

The LAM sensor features an automatic light intensity adjustment to adjust to well or low reflecting objects. If the surface reflection changes during the measurement it automatically readjusts accordingly.

Angle dependency of measurements

If the sensor is not square to the object surface the measurement has low angle dependency. On matt surfaces with high diffuse reflection the angle dependency is low, with reflective surfaces it is higher.

The object's angles of rotation around the x-axis can be reached up to ±30 ° without considerable measurement error, around the y-axis up to ±15 °. The measurement error shows to be a change between the output voltage / distance relation. If the angle is constant it can be eliminated through readjustment.



TECHNICAL DATA – SERIES LAM-S

- for dynamic measurements
- low noise
- measuring frequency up to 10 kHz
- sample rate 54 kHz
- Ethernet interface







		LAM-S-0,5	LAM-S-2	LAM-S-4	LAM-S-10	LAM-S-20	LAM-S-50	LAM-S-100	LAM-S-200
Measuring range	[mm]	23,75…24,25	23…25	22…26	40…50	55…75	115…165	170…270	240…440
Cutoff frequency CF		adjustable: 20 Hz …10 kHz, (-3 db) please see page 10 for DIP switch settings and corresponding cutoff frequencies							
Resolution at CF 10 kHz	[µm]	0.3	1.3	2.6	6.5	13.0	32.5	65.0	200.0
Resolution at CF 20 Hz	[µm]	0.02	0.10	0.20	0.50	1.00	2.50	6.00	20.00
Linearity error	[µm]	±1	±4	±8	±20	±40	±100	±200	±400
Sampling rate	[kHz]	54 (at the output of the electronics)							
Analog output		±10 V, 4…20 mA, (optional: ±5 V, 0…20 mA, 0…10 V, 0…5 V)							
Output impedance	[Ω]	approximately 0 (10 mA max.)							
Temperature drift	[%/°K]	0.02							
Light intensity	[VDC]	0…10: Signal quality: <3 = risk of underexposure, ~5 = excellent, >8 = risk of overexposure							
Digital output		Ethernet TCP / IP							
Max. extraneous light	[Lux]	20000,00							
Light source		Red pulsed laser diode, wavelength 650…670 nm							
Laser class		2,00							
Isolation voltage	[VDC]	Sensor head IP64, electronics IP40							
Permissible vibration		5 g bis 1 kHz (20 g optional)							
Housing material		Aluminium							
Protection class		Sensor head IP64. electronics IP40							
Operating temperature	[°C]	0…50							
Beam shape									
Spot laser, ø	[mm]	0.1	0.2	0.3	0.6	0.9	1.5	1.5	2.0
Output signal		±10 V, 4…20 mA, Ethernet, (optional: ±5 V, 0…20 mA, 0…10 V, 0…5V)							
Supply		24 VDC / 250 mA (10…30 VDC)							
External electronics		included							

Note: Specifications on linearity and resolution refer to measuring a matt, white reference surface.

RESOLUTION AS FUNCTION OF FILTERSETTINGS

Sensor-Type: LAM-S-10, measurement range 10 mm. The measurement was recorded with an analog oscilloscope

Measurement on a white target		
LAM-S-10	**Noise ***	**Resolution**
10.000 Hz	13 mV	6.5 µm
7000 Hz	12 mV	6.0 µm
4000 Hz	8 mV	4.0 µm
1000 Hz	6 mV	3.0 µm
250 Hz	3 mV	1.5 µm
100 Hz	2 mV	1.0 µm
25 Hz	1.5 mV	0.7 µm
20 Hz	1.0 mV	0.5 µm

Measurement on a black target		
LAM-S-10	**Noise ***	**Resolution**
10.000 Hz	200 mV	100 µm
7000 Hz	180 mV	90 µm
4000 Hz	150 mV	75 µm
1000 Hz	100 mV	50 µm
250 Hz	60 mV	30 µm
100 Hz	40 mV	20 µm
25 Hz	20 mV	10 µm
20 Hz	15 mV	7.5 µm

* measured at analog output 10 V = 10 mm

TECHNICAL DATA – SERIES LAM-F

- for highly dynamic measurements
- measuring frequency up to 100 kHz
- Sample rate 400 kHz
- Ethernet interface







		LAM-F-0,5	LAM-F-2	LAM-F-4	LAM-F-10	LAM-F-20	LAM-F-50	LAM-F-100	LAM-F-200
Measuring range	[mm]	23.75…24.25	23…25	22…26	40…50	55…75	115…165	170…270	240…440
Cutoff frequency CF		adjustable: 230 Hz …100 kHz, (-3 db) please see page 9 for DIP switch settings and corresponding cutoff frequencies							
Resolution at CF 100 kHz	[µm]	0.8	3.5	7.0	17.5	35.0	50.0	100.0	330.0
Resolution at CF 230 Hz	[µm]	0.05	0.2	0.4	1.0	2.0	7.5	15.0	50.0
Linearity error	[µm]	±1.5	±6	±12	±30	±60	±150	±300	±600
Sampling rate	[kHz]	400 (at the output of the electronics)							
Analog output		±10 V, 4…20 mA, (optional: ±5 V, 0…20 mA, 0…10 V, 0…5V)							
Output impedance	[Ω]	approximately 0 (10 mA max.)							
Temperature drift	[%/°K]	0,02							
Light intensity output	[VDC]	0…10: Signal quality: <3 = risk of underexposure, ~5 = excellent, >8 = risk of overexposure							
Digital output		Ethernet TCP / IP							
Max. extraneous light	[Lux]	20000,00							
Light source		red pulsed laser diode, wavelength 650…670 nm							
Laser class		2,00							
Isolation voltage	[VDC]	200 (0 V against housing)							
Permissible Vibration		5 g bis 1 kHz (20 g optional)							
Housing material		Aluminium							
Protection class		Sensor head IP64, electronics IP40							
Operating temperature	[°C]	0…50							
Beam shape									
Spot laser, ø	[mm]	0.1	0.2	0.3	0.6	0.9	1.5	1.5	2.0
Output signal		±10 V, 4…20 mA, Ethernet, (optional: ±5 V, 0…20 mA, 0…10 V, 0…5V)							
Supply		24 VDC / 250 mA (10…30 VDC)							
External electronics		included							

Note: Specifications on linearity and resolution refer to measuring a matt, white reference surface.

RESOLUTION AS FUNCTION OF FILTERSETTINGS

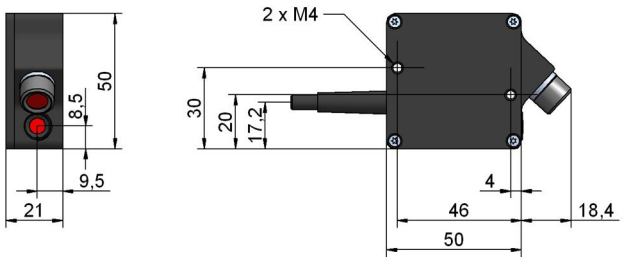
The measurement was done on a white target and recorded with an analog oscilloscope

LAM-F-4	Noise	Resolution
100000 Hz	32 mV	6.4 µm
70000 Hz	30 mV	6.0 µm
40000 Hz	22 mV	4.4 µm
10000 Hz	12 mV	2.4 µm
2500 Hz	8 mV	1.6 µm
1000 Hz	5 mV	1.0 µm
250 Hz	3 mV	0.5 µm
230 Hz	2 mV	0.4 µm

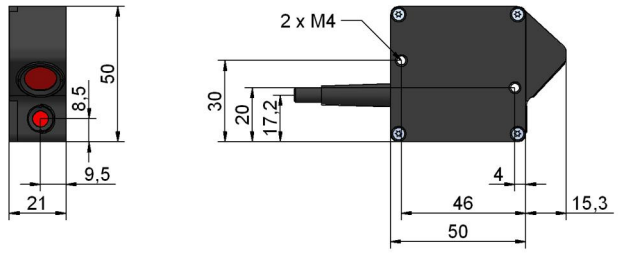
LAM-F-0,5	Noise	Resolution
100000 Hz	30 mV	0.75 µm
70000 Hz	27 mV	0.68 µm
40000 Hz	22 mV	0.55 µm
10000 Hz	12 mV	0.30 µm
2500 Hz	8 mV	0.20 µm
1000 Hz	5 mV	0.13 µm
250 Hz	4 mV	0.10 µm
230 Hz	4 mV	0.10 µm

TECHNICAL DRAWING LAM-S, LAM-F

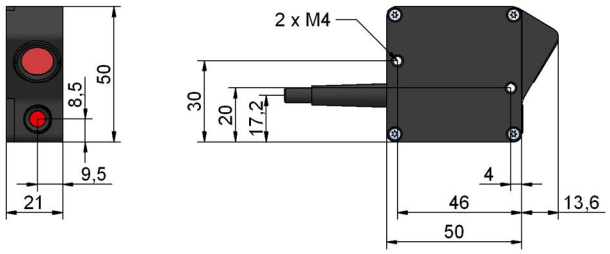
LAM-S-0,5
LAM-F-0,5



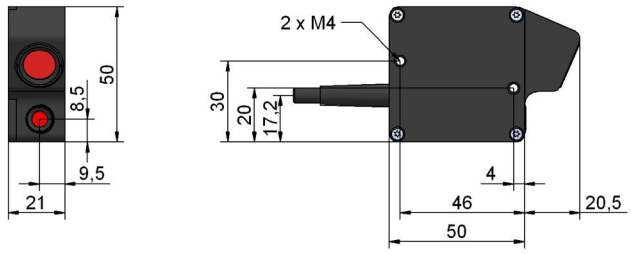
LAM-S-2 / LAM-S-4
LAM-F-2 / LAM-F-4



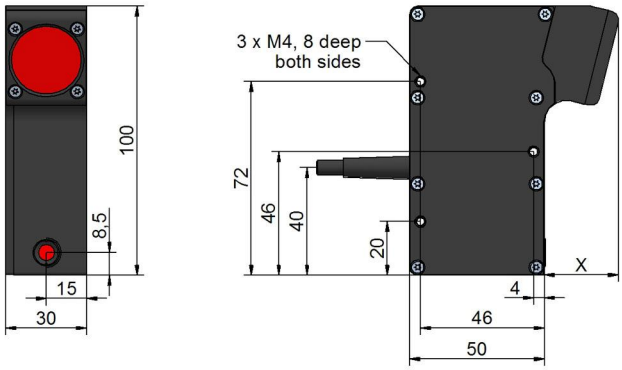
LAM-S-10
LAM-F-10



LAM-S-20
LAM-F-20

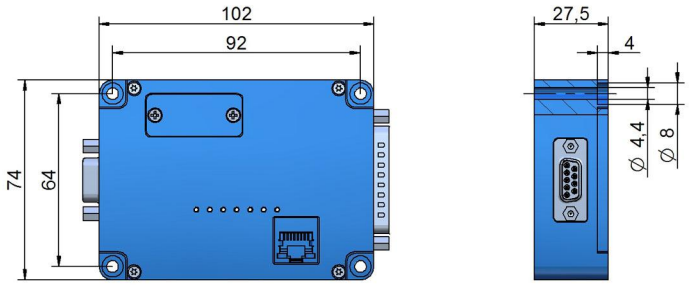


LAM-S-50 / LAM-S-100 / LAM-S-200
LAM-F-50 / LAM-F-100 / LAM-F-200



Type	x
50	26,6
100	25,8
200	27,5

Electronics housing LAM-S / LAM-F

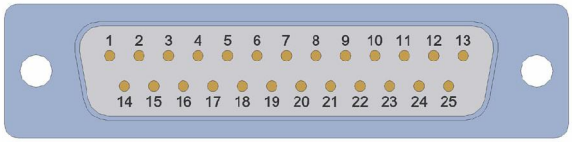


PIN ASSIGNMENT / DIP SWITCH SETTINGS LAM-S, LAM-F

Assignment SUB-D connector, 25-pin

PIN	Function	Colour
1	Distance output ±10 V (0…10 V, ±5 V, 0…5 V)*	white
2	Error+24 V/ 10 mA	red
3	Sync signal output	
5	Digital output OK 0/ 24 V	pink
6	Distance output 4…20 mA (0…20 mA)*	blue
8	Mass 0 V	yellow
14	Analogue Mass 0 V	brown
15	Sync signal input	
16	Digital output MAX, 0/ 24 V	purple
17	Distance input 0…5V	
18	Mass	
19	Digital output MIN, 0/ 24 V	black
20	Light intensity output 0…10 V	grey
21	+24 V supply	green
Housing	EMV	screen

*optional



Electronics LED Status

LED	Function	Color	operating
Power	Power ok	green	lights up
Link	Ethernet Link operating	yellow	lights up
10	Ethernet Link activity	yellow	flashing rapidly
MAX	maximum threshold	red	lights up
OK	object within range	green	lights up
MIN	minimum threshold	red	lights up
Error	FPGA self test ok	red	off
	object out of range	red	lights up

LAM-S Dip switch / filter settings

Frequency	S1	S2	S3	S4	S5	S6
10 kHz	-	-	-	-	-	-
7 kHz	X	-	-	-	-	-
4 kHz	-	X	-	-	-	-
1 kHz	-	X	X	-	-	-
250 Hz	-	-	-	X	-	-
100 Hz	-	-	-	-	X	-
25 Hz	-	-	X	X	-	X
20 Hz	X	X	X	X	X	X

X = switch closed

- = switch open

Factory setting: S1 + S2 closed

LAM-F Dip switch / filter settings

Frequency	S1	S2	S3	S4	S5	S6
100 kHz	-	-	-	-	-	-
70 kHz	X	-	-	-	-	-
40 kHz	X	X	-	-	-	-
10 kHz	-	X	X	-	-	-
2,5 kHz	-	-	-	X	-	-
1 kHz	-	-	-	-	X	-
250 Hz	-	-	-	-	X	X
230 Hz	X	X	X	X	X	X

X = switch closed

- = switch open

Factory setting: S1 + S2 closed



The Dip-switch (under the cover inside the lid for the electronics unit) is used to adjust the frequency of the low pass filter. Switch 1 is on the left, switch 6 on the right.
Never change the potentiometers.
The internal sampling rate of the sensor is not impacted by the Dip-Switch-settings. The filter frequencies specified correspond with the -3 db bandwidth of the low pass filter. Higher frequencies and noise are reduced more and more.
Example: Set to 2.5 kHz a recorded oscillation of a frequency of 2 kHz is transmitted without considerable reduction. A frequency of 10 kHz, however, would be severely reduced.

ETHERNET CABLE PIN ASSIGNMENTS, RJ45, CROSSED

PIN	Signal	Plug A
1	Transmitted data +	green + white
2	Transmitted data -	green + white
3	Date received +	red + white
4	not used -	blue
5	not used +	blue + white
6	Date received -	red + white
7	not used +	brown + white
8	not used -	brown

PIN	Signal	Plug B, crossed
1	Date received +	red + white
2	Date received -	red
3	Transmitted data +	green + white
4	not used -	blue
5	not used +	blue + white
6	Transmitted data -	green
7	not used +	brown + white
8	not used -	brown

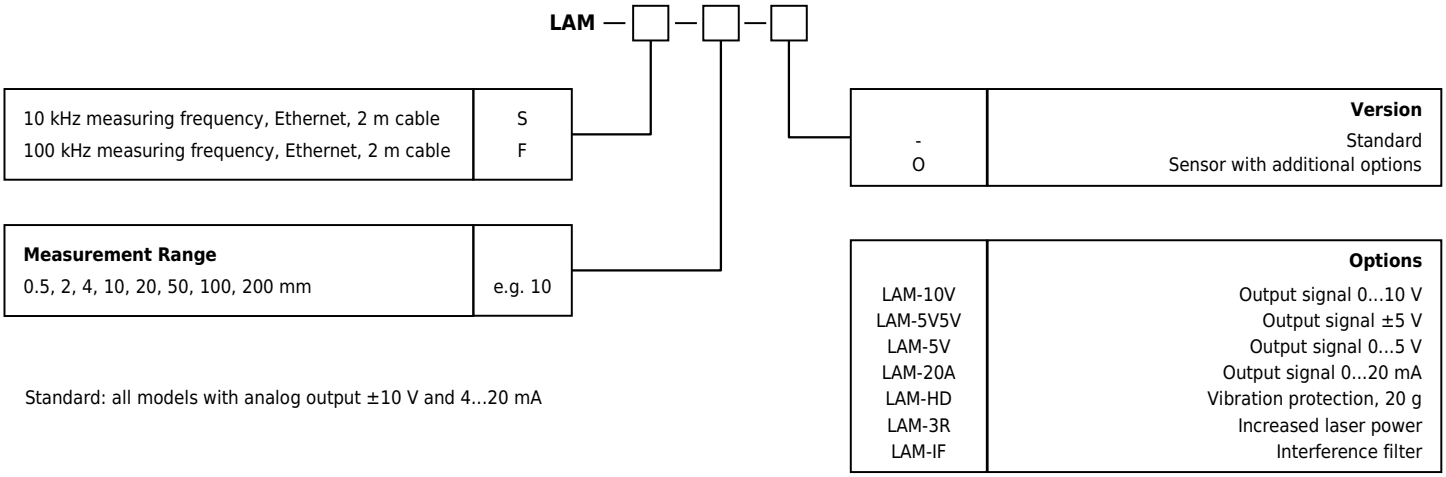
Hint: direct connection between sensor and network card requires a cross Ethernet cable.
If an Ethernet-switch is interconnected, Ethernet cables assigned 1:1 can be used. If the Ethernet-switch automatically recognises the line polarity due to its "Autosense + AutoMDI"-function it doesn't matter if the cables used are assigned 1:1 or crossed.

INCLUDED IN DELIVERY – SERIES LAM

- Sensor with 2 m sensor cable
- External electronics
- 25 pin SUB-D plug, solderable
- Test log



ORDER CODE



Standard: all models with analog output ±10 V and 4...20 mA

OPTIONS AND ACCESSORIES

Accessories	
LAM-AG	Protective glass replacement (2 pieces)
LAM-KUEHL	Heat sink, attaches to sensor from outside (only on request)

Options	
LAM-10V	Signal output 0…10 V
LAM-5V5V	Signal output ±5 V
LAM-5V	Signal output 0…5 V
LAM-20A	Signal output 0…20 mA
LAM-HD	Sensor head vibration protection: 20 g / 1 kHz
LAM-3R	Increased laser power
LAM-IF	Interference filter



General safety instructions
Attention radiation laser.
Do not stare into beam.
Do not point the laser beam towards someone's eye.
It is recommended to stop the beam by a matte object or matte metal shield.
Laser regulations require the power to the sensor be switched off when turning off the whole system this sensor is part off.

Subject to change without prior notice.

WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.de

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Cologne
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
Fax +49 (0)2232 56 79 45

LASER

Analog Laser Displacement Transducer



Series LAV

Key-Features:

- *Measurement ranges 0.2 to 8.0 and 0.2 to 50.0 m*
- *Absolute accuracy ±25 mm*
- *Repeatability <5 mm*
- *Response time 10 ms*
- *Individual parametrization by teach-in procedure*
- *Protection class IP65*
- *Working temperature -30 to 50 °C*
- *Analog output 4..20 mA and switching output*
- *IO-Link Interface*

Content

Measurement Principle & Installation	*....2*
Technical Data	*....3*
Electrical Connection	*....3*
Technical Drawing	*....4*
Teach-In	*....5*
Order Code	*....6*

18.02.16

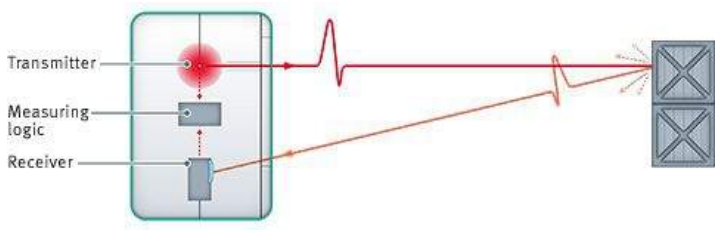
WayCon Positionsmesstechnik

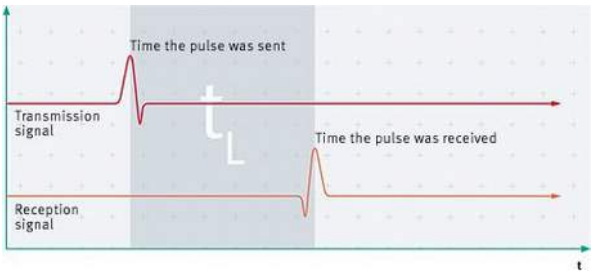
INTRODUCTION

LAV laser sensors cover measurement ranges from 0.2 to 50.0 m. The integrated micro-controller delivers an accurate output signal, which is proportional to the detected distance. External analysers to evaluate the signals are not required. Reliable operation, independent of colour or other influences of the surface, is ensured by sophisticated electronic elements integrated in the system. The small visible laser spot allows a simple and precise orientation of the sensor.

MEASURING PRINCIPLE

A powerful light source emits short, high-energy pulses, which are reflected by the target object and then recaptured by a light-sensitive receiver. During this process, the emission and reception times are detected with a high degree of precision. From the values determined, the distance to the target object is calculated using the runtime of the light pulses. If the target object is close, the light propagation time is short. If the object is further away, the light propagation time is longer.





GENERAL NOTES

Teach-in function

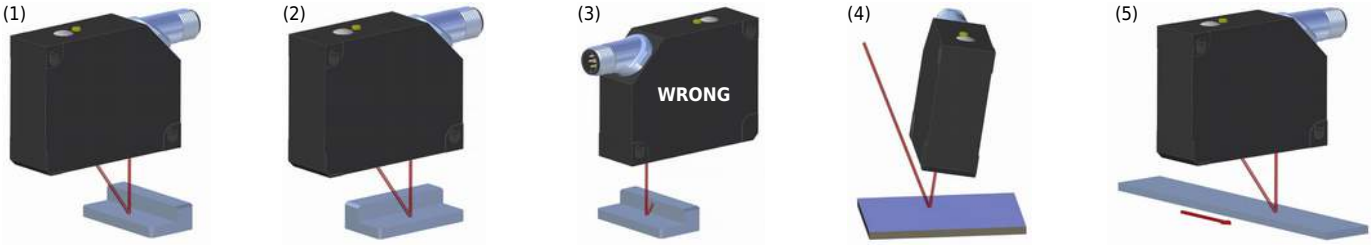
The desired range can conveniently be adapted within the maximum measurement range by means of the teach-In button. The analog output has its full stroke within the teached range. The default configuration uses the maximum measurement range. A description of the teach-in procedure can be found on page 5 of this data sheet.

Installation

The first condition for a successful distance measurement is the absence of any obstruction in the light path, as shown in fig. 3. The receiver optics must be able to detect the light spot directly (fig. 1 and 2).

For highly polished or mirror-like objects it is important to keep the direct reflection away from the detector. In these cases, it is recommended to slightly tilt the sensor (fig. 4).

Optimum results are obtained by transverse installation of the sensor with respect to the target movement (fig. 5).



Electromagnetic compatibility: The sensor must correctly be grounded, a shielded cable is recommended.

Cleaning of the laser window

1) dry cleaning with a soft brush

2) cleaning with a dry, soft, antistatic cloth

3) wet cleaning with clear water, approx. 30 degree Celsius, if necessary with a little mild soap.

Please do NOT use window cleaner!!

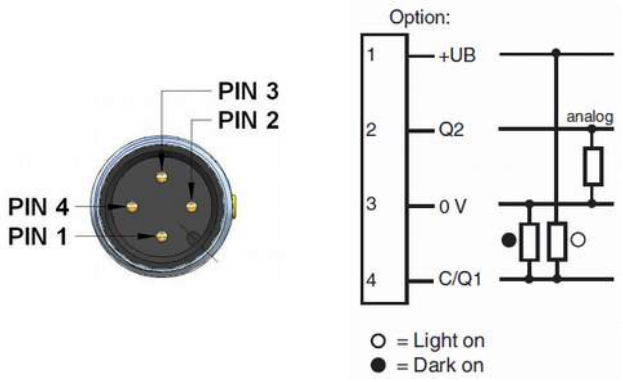
TECHNICAL DATA

		LAV-8-420-IO	LAV-50-420-IO
Measurement range (see page 4)	[m]	0.2...8.0 (target: white 90%) *	0.2...50.0 (with target board)
Absolute accuracy	[mm]	±25	±25
Repeatability	[mm]	<5	<5
Beam divergence	[mrad]	1	1
Pulse length	[ns]	5	5
Repetition rate laser	[kHz]	250	250
Angle deviation	[°]	max. ±2	max. ±2
Laser class		2	2
Diameter of light spot	[mm]	<10 at a distance of 8 m at 20°C	<50 at a distance of 50 m at 20°C
Ambient light limit	[Lux]	50000	50000
Temperature influence	[mm/K]	typ. ≤0.25	typ. ≤0.25
MTTF	[a]	200	200
Mission time (T_M)	[a]	10	10
Operating voltage	[VDC]	10...30 VDC / when operating in IO-Link mode: 18...30 V	10...30 VDC / when operating in IO-Link mode: 18...30 V
Ripple		10% within the supply tolerance	10% within the supply tolerance
No-load supply current		≤70 mA / 24 VDC	≤70 mA / 24 VDC
Time delay before availability	[s]	2	2
Operating temperature	[°C]	-30...50	-30...50
Protection class		IP65	IP65
Interface		IO-Link (V1.0)	IO-Link (V1.0)
Signal output		Push-pull	Push-pull
Switching voltage	[VDC]	30	30
Switching current	[mA]	100	100
Measurement output		4...20 mA	4...20 mA
Switching frequency	[Hz]	50	50
Response time output	[ms]	10	10
Connection		4-pin, M12 x 1 connector (cable output on request)	4-pin, M12 x 1 connector (cable output on request)
Housing material		Plastics ABS	Plastics ABS
Weight	[g]	90	90
EMC		EMC Directive 2004/108/EC	EMC Directive 2004/108/EC
UL approval		cULus Listed, Class 2 Power Source, Type 1 enclosure	cULus Listed, Class 2 Power Source, Type 1 enclosure

* gray taget (18%) : range approx. 3.5 m / black target (10%): range approx. 2.5 m

ELECTRICAL CONNECTION

Electrical connection LAV

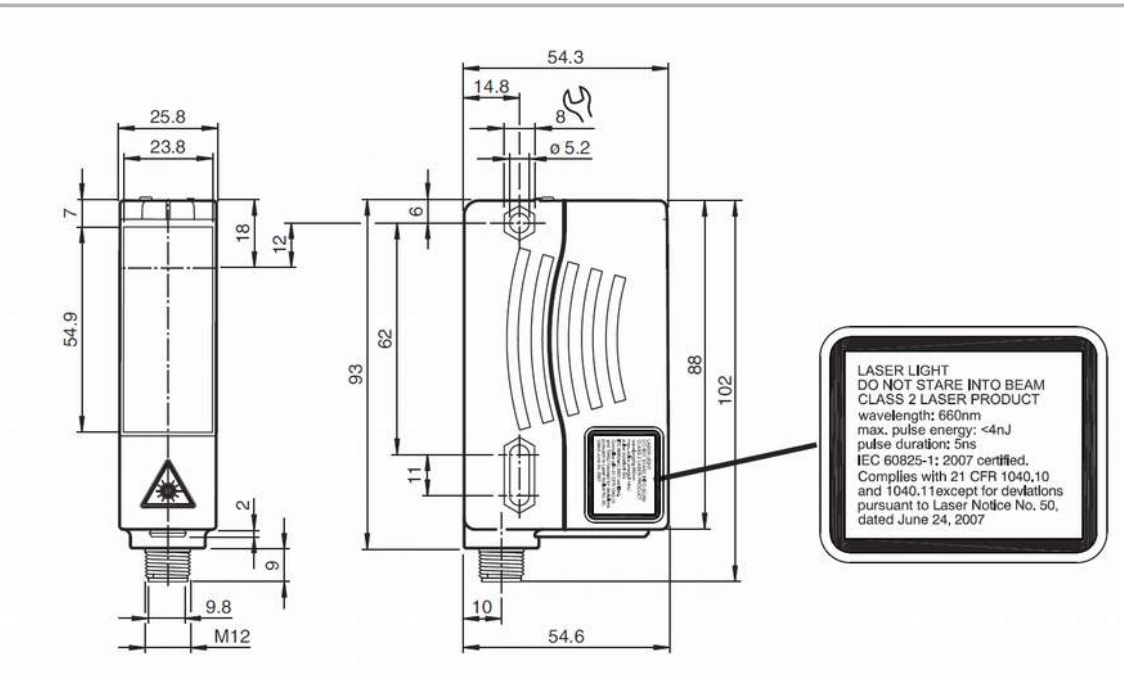


Q1: Switching output (push-pull)
Setting the switching threshold A and B see page 5
Light on: switches to 0 V
Dark on: switches to +UB

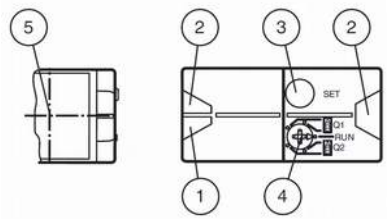
Q2: Analog output 4...20 mA
Setting the minimum and maximum values A and B see page 5

C: Data line IO-Link

TECHNICAL DRAWING



INDICATORS

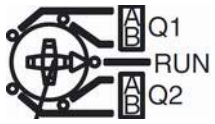


1	Operating displays	green	4	Mode rotary switch
2	Signal display	yellow	5	Laser output
3	Teach-In button			

Mode rotary switch:

Q1: switching output (push-pull)
Setting the switching threshold A and B
see page 5

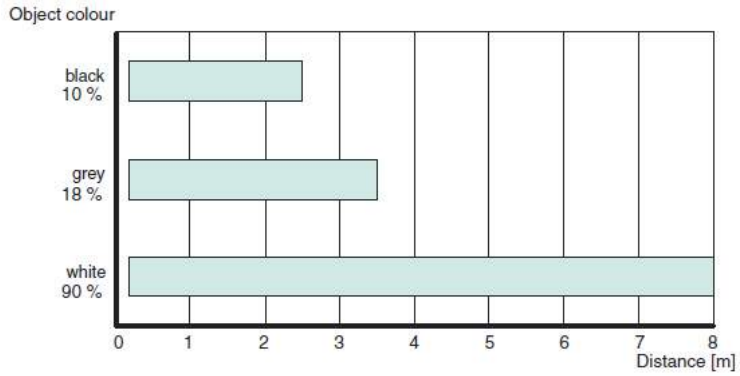
Q2: Analog output 4...20 mA
Setting the minimum and maximum values A and B
see page 5



MEASUREMENT RANGE

LAV-8-420-IO

Reference object: Kodak white (90%)



LAV-50-420-IO

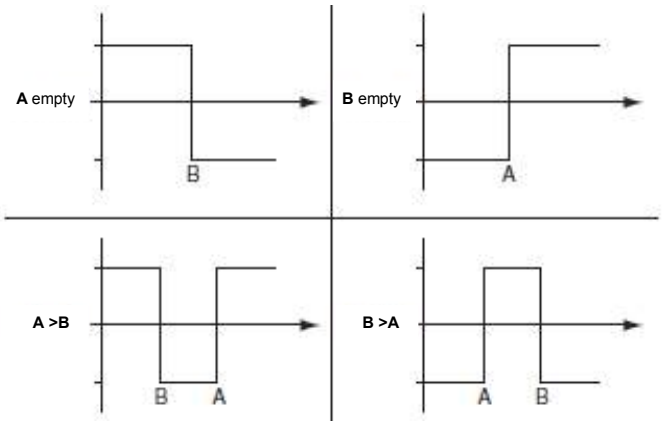
Reference object: target board ZT51_WEISS (accessory)

In case of a measurement without target board the measurement range will decrease depending on the objects colour and its distance to the laser sensor.
We highly recommend to use the target board ZT51_WEISS.

TEACH-IN GUIDE

Switching output Q1:

You can use the rotary switch to select the relevant switching threshold A and/or B for teaching in for switching output Q1. The yellow LEDs indicate the current state of the selected output. To store a switching threshold (distance measured value), press and hold the "SET" button until the yellow and green LEDs flash in phase (approx. 2 s). Teach-In starts when the "SET" button is released.
Successful Teach-In is indicated by alternating flashing (2.5 Hz) of the yellow and green LEDs. An unsuccessful Teach-In is indicated by rapidly alternating flashing (8 Hz) of the yellow and green LEDs. After an unsuccessful Teach-In, the sensor continues to operate with the previous valid setting after the relevant visual fault signal is issued.
Different switching modes can be defined by teaching in the relevant distance measured values for the switching thresholds A and B: (see diagram on the right).
Every taught-in switching threshold can be retaught (overwritten) by pressing the SET button again. Pressing and holding the "SET" button for > 5 s completely deletes the taught-in value. The yellow and green LEDs go out simultaneously to indicate that this procedure has been completed.

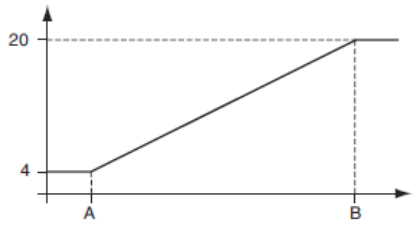


Analog output Q2:

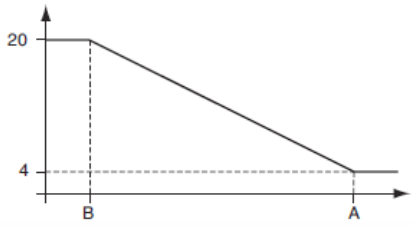
Minimum and maximum values for the analog output **Q2** are taught in in the same way as those for the switching output:

The following values apply:
A = 4 mA
B = 20 mA
This provides three different options for operation:

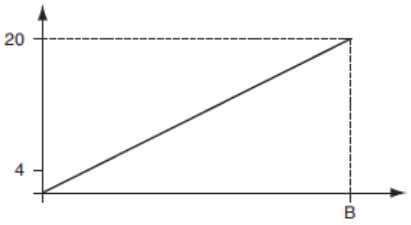
A < B -> rising slope



A > B -> falling slope



A empty -> zero start point



Reset to default settings:

Factory setting for switching output Q1:
Switching output inactive
Factory setting for analog output Q2:
A = 200 mm
B = 5000 mm

Value B cannot be deleted
The "zero start point" operating mode can be obtained by deleting value A

- Set the rotary switch to the "RUN" position
- Press and hold the "SET" button until the yellow and green LEDs stop flashing in phase (approx. 10 s)
- When the green LED lights up continuously, the procedure is complete.

Note!

The difference in the taught-in distance measured values for switching thresholds A and B must be greater than 20 mm.
If the difference in the taught-in measured values is the same as or smaller than the set switching hysteresis, the sensor will visually signal an unsuccessful Teach-In. The last distance measured value that was taught in will not be adopted by the sensor. Select a new distance measured value for switching threshold A or B with a greater difference between the switching thresholds.
Teach in this distance measured value on the sensor again. Switching threshold A can be deleted or set to a value of zero. (E.g., when setting the "zero start point" curve). However, switching threshold B can neither be deleted nor set to a value of zero.

ORDER CODE

LAV-8-420-IO	**Range 0.2...8.0 m**
LAV-50-420-IO	**Range 0.2...50.0 m**

ACCESSORIES

Cable with mating connector M12, 4 poles, shielded, IP67	
K4P2M-S-M12	2 m, straight connector
K4P5M-S-M12	5 m, straight connector
K4P10M-S-M12	10 m, straight connector
K4P2M-SW-M12	2 m, angular connector
K4P5M-SW-M12	5 m, angular connector
K4P10M-SW-M12	10 m, angular connector

Mating Connector M12, 4 poles, shielded, IP67	
D4-G-M12-S	straight, M12 for self assembly
D4-W-M12-S	angular, M12 for self assembly

Digital display 1 channel, 0...10V/4...20 mA	
PAXP000B	1 channel, supply: 85 to 250 VAC
PAXP001B	1 channel, supply: 11...36 VDC/24 VAC

Digital display 2 channels, 0...10V/4...20 mA	
PAXDP00B	2 channels, supply: 85 to 250 VAC
PAXDP01B	2 channels, supply: 11...36 VDC/24 VAC

For further information please see the separate PAX data sheet

Target board	
ZT100	for LAV



General safety instructions

Attention radiation laser.
Do not stare into beam.
Do not point the laser beam towards someone's eye.
It is recommended to stop the beam by a matte object or matte metal shield.
Laser regulations require the power to the sensor be switched off when turning off the whole system this sensor is part off.

Subject to change without prior notice.

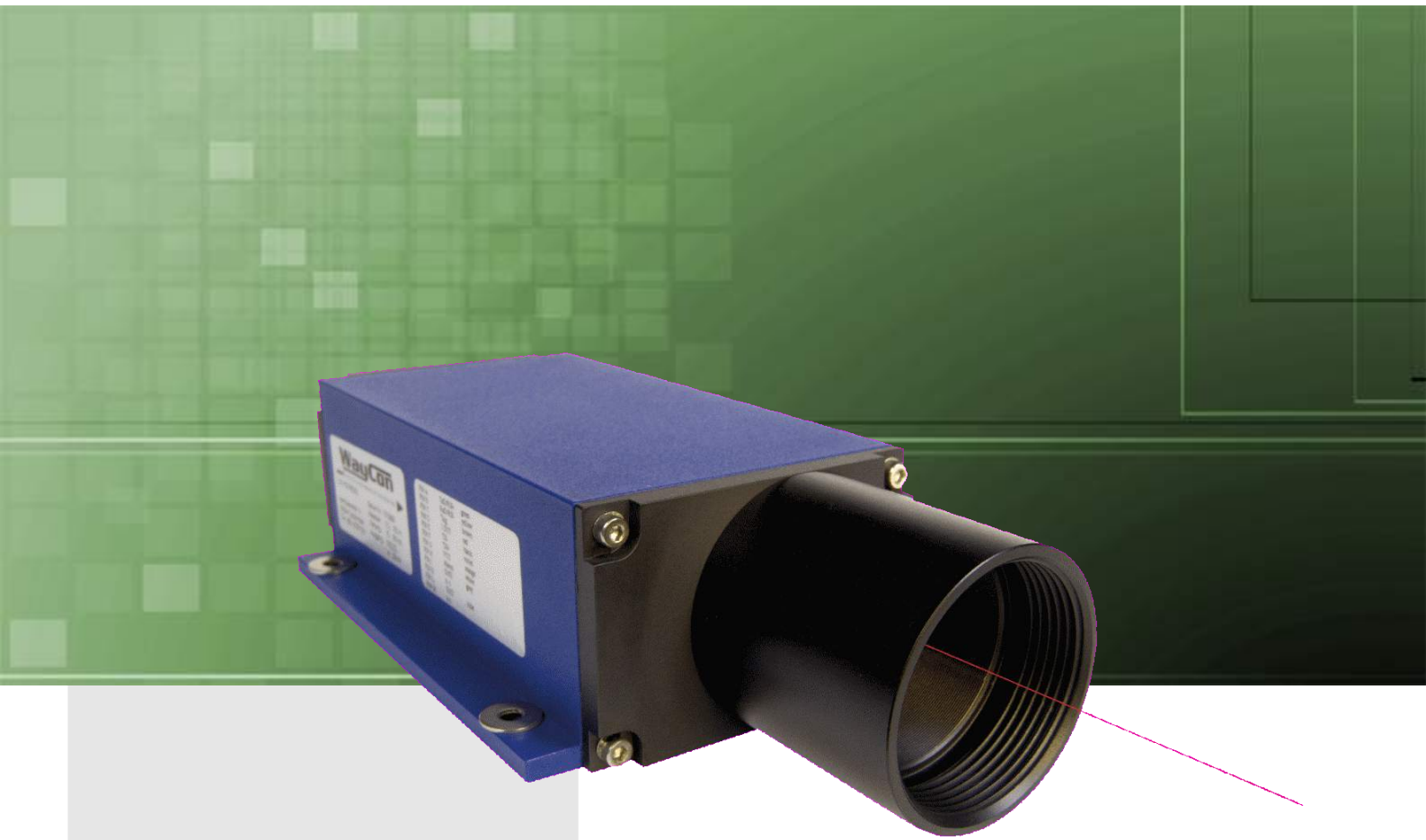
WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.de

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Köln
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
Fax +49 (0)2232 56 79 45

LASER

Laser-Position-Transducer



LLD Series

Key-Features:

- Measurement range: 0.1 to 150 m
- Resolution: 0.1 mm
- Repeatability: ±0.5 mm
- Linearity: ±2 mm on white surfaces, ±3 mm on natural surfaces
- Protection class: IP65
- Working temperature: -10 to 50 °C, with heating: -40 to 50 °C
- Measuring frequency selectable: 10Hz or 50Hz
- Analog output: 4..20mA (must be configured with the included software)
- Digital outputs: RS232, RS422, Profibus, SSI

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11.11.15

WayCon Positionsmesstechnik

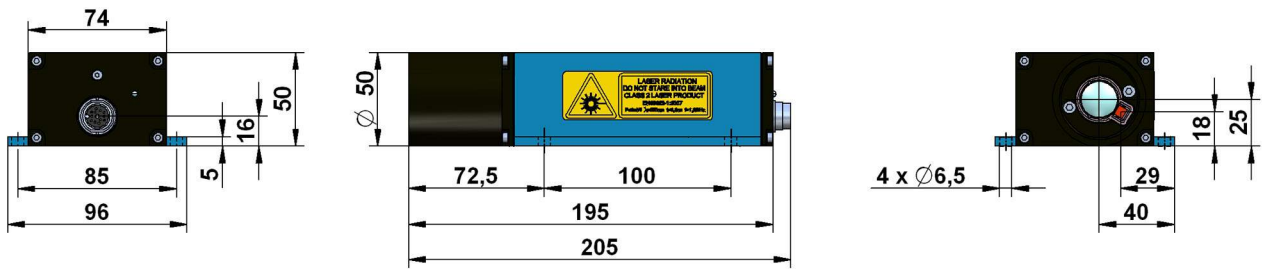
TECHNICAL DATA

Measurement range	0.1…30 m on all natural diffuse reflecting surfaces, on target board up to 150 m
Resolution	0.1 mm
Linearity	±2 mm on white surfaces (+15…+30 °C), ±3 mm on natural surfaces (+15…+30 °C), ±5 mm (-10…+50 °C)
Repeatability	≤0.5 mm
Selectable measuring frequency	10 Hz or 50 Hz
Measuring rate	0.16…6 s (10 Hz), 0.02 s (50 Hz)
Supply voltage	10…30 VDC
Max. power consumption	1.5 W, Profibus: 3.2 W
Max. power consumption, option H	24 W (24 VDC), Profibus, SSI: 25.7 W (24 VDC)
Analog output	4…20 mA (parameterise using RS232/ RS422), load ≤500 Ohm
Digital Output	RS232, RS422, Profibus, SSI
Transfer rate	2,4 / 4,8 / 9,6 / 19,2 / 38,4 kBaud for RS232 and RS422, max. 12 MBaud for Profibus, 50…1000 kHz for SSI
Switching outputs	1 (max. capacity load 0.5 A), Profibus, SSI: 2 (max. capacity load 0.5 A)
Trigger input *	trigger impulse 24 V
Connection	12-pole M16-connector; for Profibus, SSI in addition: 5-pole M12-connector (male) and M12-connector (female)
Light source	laser diode (red), wavelength 650 nm
Laser class	2, ≤1 mW
Protection class	IP65
Storage temperature	-40…+70 °C
Working temperature	-10…+50 °C
Working temperature, option H	-40…+50 °C, by heating
Weight	760 g, Profibus, SSI: 770 g
Electromagnetic compatibility (EMC)	EN 61326-1

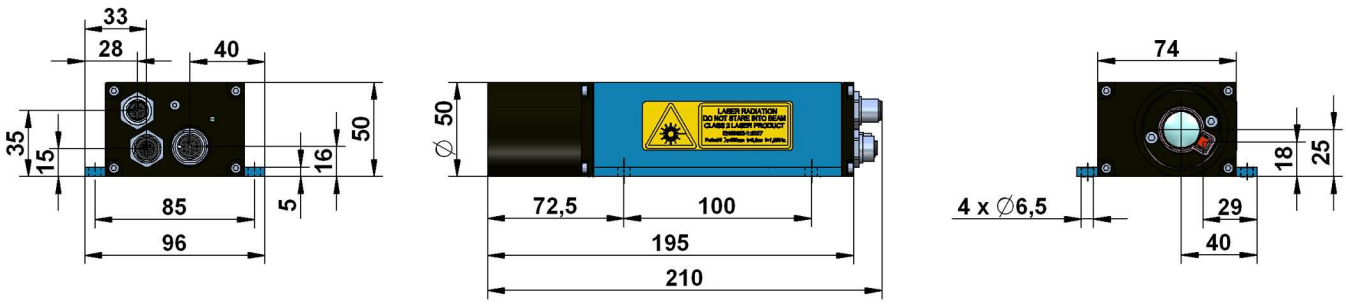
* not available for models with option H (heating)

TECHNICAL DRAWINGS

LLD-150-RS232, LLD-150-RS422



LLD-150-Profibus



GETTING STARTED

For initial operation, the sensor has to be set into operation mode, i.e. the autostart function must be configured. This function decides on the mode generally to be activated after switching on. Single point and continuous measurement (distance tracking) in different modes are available. Before using the analog output, the measurement range must be scaled: 4 mA is assigned to the minimum, 20 mA to the maximum measurement range. All these settings are quickly performed by means of the WayCon configuration software included in the delivery.

DIFFERENT TYPES OF OUPUT

Analog output 4...20 mA

The analog output allows for transmission of the results by an analog 4...20 mA signal.

The current of the line is proportional to the detected distance.

The measurement range must be scaled during initial operation.

Connector 12-pole, M16

RS232 output

This classical low-price interface for short distances between sensor and PC/control-system/display

is ideally suited to laboratory and PC applications.

Data rate 38.4 kBaud max.

Connector 12-pole, M16

RS422 output

Differential interface with RS232 protocol, i.e. the data is transmitted by RS232, just that RXD and TXD are transmitted differential on RS422 basis.

Optimized for environment with background noise and long lines (up to 100 m).

Since standard PC's generally do not offer an RS422 interface, this type of communication

requires an RS422 interface card or a converter RS422-to- RS232.

Data rate 38.4 kBaud max.

Connector 12pole, M16

Profibus output

Plug-and-play interface for fieldbus applications.

Configuration by Profibus firmware data file (gsd file), available at www.waycon.de

Data rate 12 Mbaud max.

Connector: 1x 12-pole, M16, 2x 5-pole M12

SSI output

Synchronous interface for industrial applications.

24 bit, Gray-coded, 1 MHz max.

Connector: 1x 12-pole, M16, 2x 5-pole M12

Digital switching output

This output allows for supervision of the targets, e.g. with respect to the excess of preset thresholds. A corresponding measurement window must be parametrized beforehand, which determines the beginning and the end of the monitored range. The desired switching point can be set inside this range. The details are discussed in a separate manual included in the delivery.

Trigger input (not for models with heating)

A distance measurement can also externally be initiated by a signal (voltage pulse 3..24 V), transmitted via trigger input. The user has to configure the desired delay as well as the pulse edge for triggering. All details are described in the manual included in the delivery.

INCLUDED IN DELIVERY

- **LLD sensor**
- **Manual**
- **WayCon CD with LLD-configuration software „LLD-communication & data acquisition“**

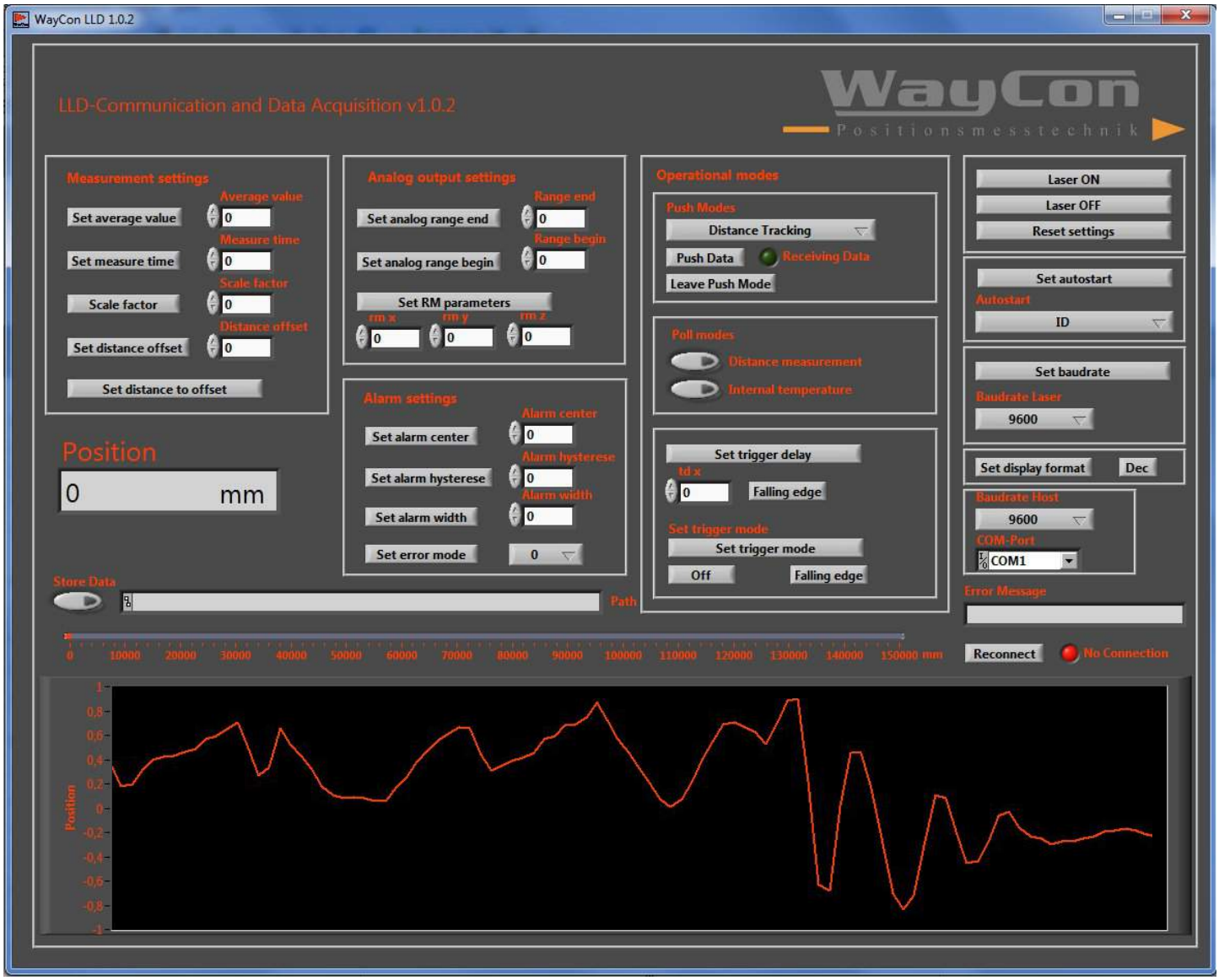
CONFIGURATION-SOFTWARE

Before starting to work with the LLD-Sensor, the user has to select the operational mode, either via a terminal program like „Hyperterminal“ (WinXP), normally included in a Win32 operating system, or by performing the configuration by means of the conveniently designed user interface of the WayCon software, available in English language.

The latter choice uses the serial interface and is therefore possible only for the RS232 or RS422 LLD-Laser sensors, (not for the Profibus, SSI version).
Please be aware that normal PC's and Laptops do not have a RS422 interface and hence a RS422/RS232 converter is required. When establishing the connection, the distance between converter and PC (RS232 line) should be kept as short as possible. The possibly long and EMI (electromagnetic interference) loaded distance between converter and LLD-sensor thus represents the RS422 line.

The parameters shown in the graphic user interface correspond to the parameters described in the manual of the sensor. For stand-alone operation (i.e. without connection to a PC or a PLC), essential parameters are Autostart and Analog Range Begin/End, used to configure the sensor for instantaneous automatic selection of the measurement mode after switching on.

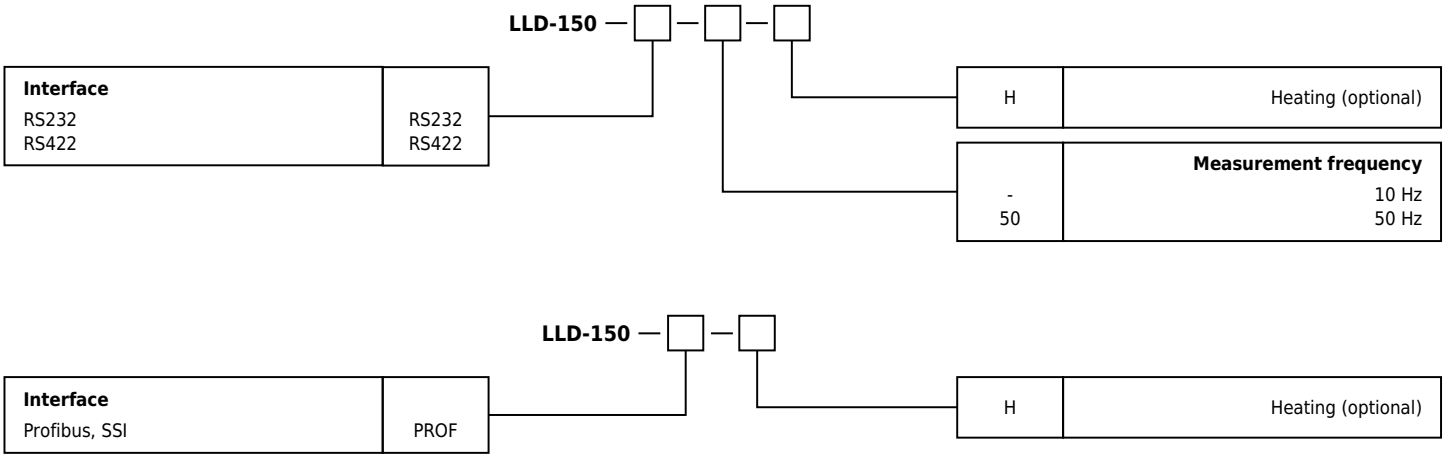
The WayCon Configuration Software furthermore offers the possibility to save measured distances in ASCII format by means of a data logger.



CONFIGURATION-SOFTWARE

As described above the LLD-Sensor has to be switched into the operational mode, before measurements can be made. WayCon offers the possibility for the RS232- and RS422-based laser sensors to make a pre-configuration. In this case the desired measurement range is required, e.g. 5 m measurement range begin, 25 m measurement range end. After this configuration by WayCon 4 mA will be the output at the measurement range begin and 20 mA at the measurement range end. The laser sensor can then be used right after unpacking, without any additional adjustments.

ORDER CODE



OPTIONS AND ACCESSORIES

Accessories RS232 / RS422	
KAB-LLD-2M	Interface cable 2 m
KAB-LLD-5M	Interface cable 5 m
KAB-LLD-10M	Interface cable 10 m
LLD Aktivierung	Pre-configuration by WayCon for RS232, RS422 models

Option for all models	
H	Heating

Target Board (for measurement distances 30 m and greater)	
ZT51_WEISS	Target board for Laser Type LLD

Accessories Profibus	
KAB-LLD500-2M-S	Interface cable 2 m, supply
KAB-LLD500-5M-S	Interface cable 5 m, supply
KAB-LLD500-10M-S	Interface cable 10 m, supply
94133	Profibus OUT M12 connector, male
94136	Profibus IN M12 connector, female
94145	Profibus M12 terminating resistance
K5P2M-B-M12-PROF	Cable 2 m, female connector 5-pol. M12, open ends
K5P2M-SB-M12-PROF	Cable 2 m, female 5-pol. M12, male 5-pol. M12
K5P2M-B-M12-PROF	Cable 2 m, male connector 5-pol. M12, open ends
K5P5M-B-M12-PROF	Cable 5 m, female connector 5-pol. M12, open ends
K5P5M-SB-M12-PROF	Cable 5 m, female 5-pol. M12, male 5-pol. M12
K5P5M-S-M12-PROF	Cable 5 m, male connector 5-pol. M12, open ends
K5P10M-B-M12-PROF	Cable 10 m, female connector 5-pol. M12, open ends
K5P10M-SB-M12-PROF	Cable 10 m, female 5-pol. M12, male 5-pol. M12
K5P10M-S-M12-PROF	Cable 10 m, male connector 5-pol. M12, open ends



General safety instructions

Attention radiation laser.

Do not stare into beam.
Do not point the laser beam towards someone's eye.
It is recommended to stop the beam by a matte object or matte metal shield.
Laser regulations require the power to the sensor be switched off when turning off the whole system this sensor is part off.

Subject to change without prior notice.

WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.de

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Köln
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
Fax +49 (0)2232 56 79 45

LASER

Laser Displacement Sensor



Series LLD-500

Key-Features:

- *Measuring on hot surfaces and in bright environments*
- *Measurement range 0.1 to 500.0 m*
- *Measured value resolution: ± 0.1 mm,*
- *Accuracy: ± 1.0 mm (at 20 Hz)*
- *Switching output*
- *Protection class IP67*
- *Working temperature -10 to 60 °C, -40°C (option H)*
- *Maximum measuring frequency: 100 Hz (adjustable)*
- *Analog output 4...20 mA*
- *available digital outputs RS232, RS422, RS485, SSI and Profibus*

Content:

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Technical drawing	***....2***
Types of output & Operation	***....3***
Order code & Accessories	***....5***

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WayCon Positionsmesstechnik

TECHNICAL DATA

Measurement range *	0.15...100 m on natural, diffuse reflecting surfaces (on target board 3M 3279 special up to 500 m)
Resolution	±0.1 mm
Measurement accuracy **	±1 mm at measurement frequency <20 Hz , ≤2.5 mm at measurement frequency >20Hz
Measurement time	minimum 10 ms
Measurement frequency	adjustable up to 100 Hz
Power supply	10...30 VDC
Power consumption	<10 W
Power consumption Option H (with heating)	<42 W (at 24 V)
Analog output (parameterise using RS232)	4...20 mA , error handling with 3 mA/21 mA, total output error for 20 mA: +15% at a temperature of 25°C
Digital interfaces	RS232, RS422, RS485, SSI and Profibus
Transfer rate	Profibus: 9.6 kBaud...12 MBaud, SSI: 200, 250, 300 kHz
Switching output	3x „High side“, load up to 0.2 A
Trigger	1 x trigger in/out, 3...30 VDC
Connection ***	1 x 12-pole M16, 2 x 5-pole M12 B-coded, 1 x 5-pole M12 A-coded
Wavelength	635 nm
Laser class	2
Laser spot in 10 m distance	4 mm x 5 mm
Protection class	IP67, for outdoor applications and difficult environmental conditions an additional housing/protection is recommended
Storage temperature	-40...+70 °C
Working temperature	-10...+60 °C
Working temperature, Option H(with heating)	-40...+60 °C
Humidity	15%...90%, no condensation
EMC	EN 61326-1
Weight ***	approx. 700 g

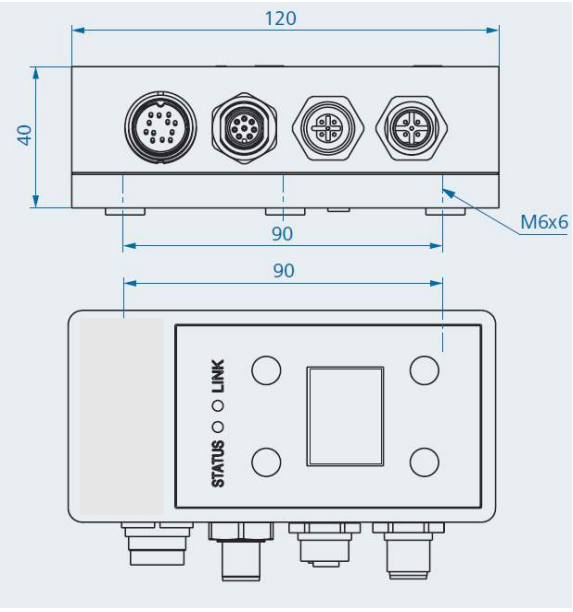
* Measurement range depending on measuring frequency, target reflectivity, stray light and environmental conditions

** depending on target reflectivity, stray light and environmental conditions

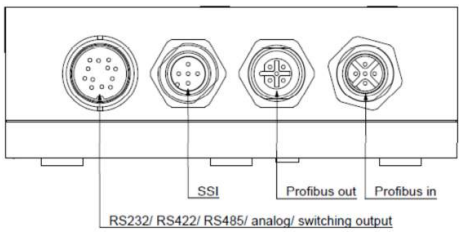
*** depending on device type / configuration

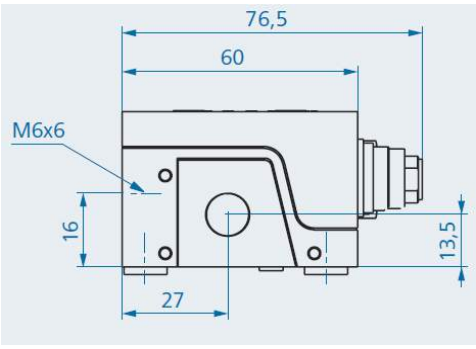
TECHNICAL DRAWING

LLD-500



This technical drawing shows all connector and interface options that are available for the LLD-500 product series.





The LLD-500 can be screwed on using 3 (underside) or 2 M6 fastening screws respectively (length to be chosen depending on the counter piece). 3 M6 fastening screws plus washers and washer springs are included in the scope of delivery.

DIRECT CONTROLLING

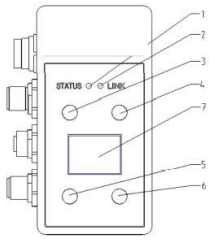
The LLD-500 can directly be parameterized and set for measurements without an additional PC.

Precondition is that it is supplied with voltage through the interface cable.
The LLD-500 is ready for operation when the green STATUS LED is lit.

The individual menu items can be selected using 4 membrane keys, each 2 above and 2 below the OLED display.

The user language is English.

The display can be deactivated during the measurement.
It can be switched on again by pressing key T3 or T4.



1 Status LED off Power supply off
red Power supply on, not ready for operation
green LUMOS ready for operation

2 LINK LED off no data transfer
green, flashing data transfer (Profibus/serial) active

3 key T1 Function see display indication
4 key T2 Function see display indication
5 key T3 Function see display indication
6 key T4 Function see display indication

7 Display

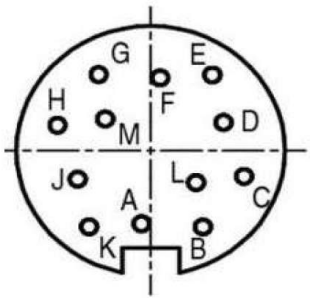


STOP Measurement will be stopped

Disp. Display will be disabled
The display can be enabled with key T4 or T3.

ELECTRICAL CONNECTION

PIN	Color code	RS232	RS422	RS485	Description
A	white	RxD	Rx+	n.c.	RS232 Receiver data/ RS422 Receiver data +
B	brown	n.c.	Rx-	n.c.	RS422 Receiver data -
C	green	TRIG	TRIG	TRIG	Trigger input / output
D	yellow	QA	QA	QA	Analog output (3 mA … 21 mA)
E	grey	n.c.	Tx-	B	RS232 Transmitter data/ RS422 Transmitter data -
F	pink	TxD	Tx+	A	RS422 Transmitter data +
G	blue	Q3	Q3	Q3	Switching output Q3
H	red	VCC	VCC	VCC	Supply voltage 10 …30 VDC
J	black	GND_{power}	GND_{power}	GND_{power}	Ground supply voltage
K	violet	Q2	Q2	Q2	Switching output Q2
L	grey/ pink	GND_{Signal}	GND_{Signal}	GND_{Signal}	Ground output signal, analog
M	red/ blue	Q1	Q1	Q1	Switching output Q1

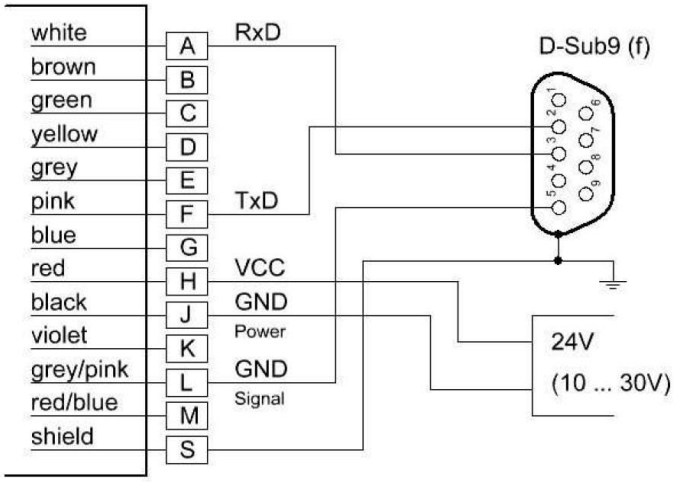


- The shield of the device cable is to be connected to the shield connector of the equipment, e.g. PLC.
- Inverse polarity protection is provided.
- Over-voltage protection is provided up to a maximum of 30 V DC.

SERIAL INTERFACE RS232

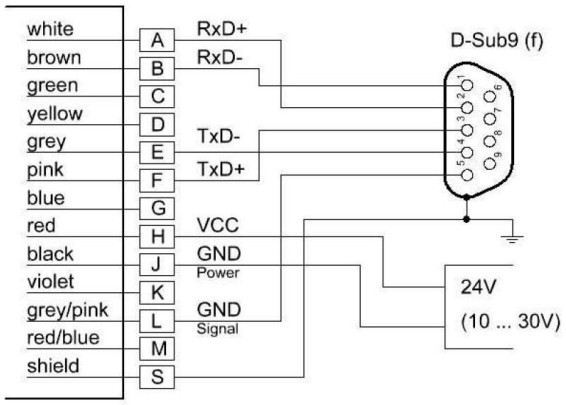
The serial interface RS232 can be used for

- Measured data transmission
- LLD500 parameterization:
  by using the serial interface or the display.
  Precondition for programming
  via serial interface is a connection provided
  by a terminal program (e.g. HyperTerminal).

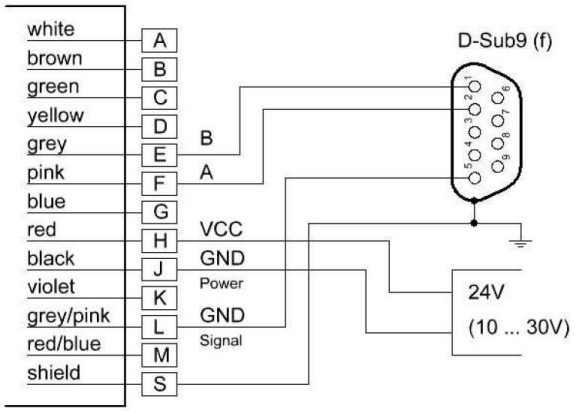


SERIAL INTERFACES RS422, RS485

RS422



RS485



SWITCHING OUTPUT

The switching outputs Q1, Q2 and Q3 show distance information as logic switching information. They signalize when values are above or below a preset switching range subject to hysteresis. Hence, they are perfectly suitable for the direct further processing of monitoring variables such as filling level or object detection. Parameterization is done via the serial interface.

A load resistance of > 150 Ohms/ 6 W (30 V max. operating voltage: 0.2 A max. load current) must be switched against GND_{power} at the switching output. It is essential that the load current of 0.2 A is not exceeded.

You will find a detailed description of the settings in the manual.

TRIGGER INPUT

The LLD-500 Trigger can be used as input or output.

1) Trigger input / external trigger function:
External trigger signal will be sent → start of measurement DM in accordance with parameter TRI.

2) Trigger output / e.g. connection between 2 LLD-500:
The output trigger signal of the 1. LLD-500 (parameterized with TRO) starts a single measurement DM of the second LLD-500 (parameterized with TRO).

You will find a detailed description of the settings in the manual.

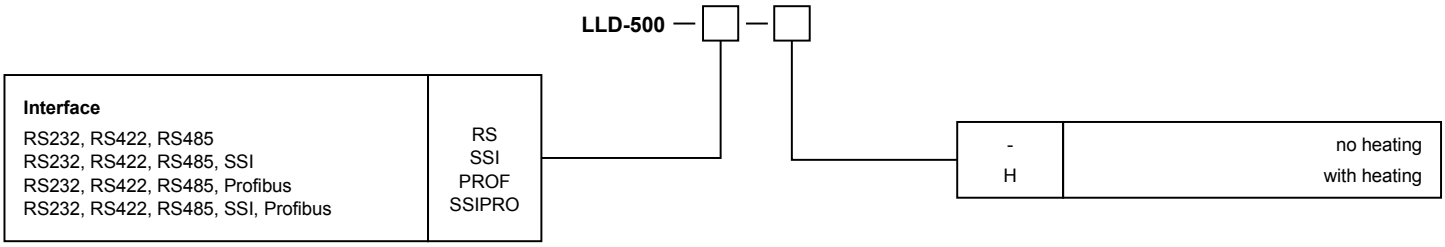
LASER BEAM IMAGE

The laser beam of the LLD-500 has a divergence of 0.13 mrad x 0.17 mrad (width x height). The diameter of the laser spot on the exit lens measures 4 mm.
The table below shows the size of the laser spot in dependence on the distance. The laser spot has an elliptical shape.

Distance	Laser spot width	Laser spot height
1 m	5 mm	5 mm
5 m	3 mm	3 mm
10 m	4 mm	5 mm
50 m	6 mm	7 mm
100 m	26 mm	34 mm
200 m	52 mm	68 mm
400 m	104 mm	134 mm
500 m	130 mm	170 mm

The above-mentioned laser spot holds approx. 50 % of the entire laser energy. An aura with less energy forms around that spot.

ORDER CODE



CABLES AND ACCESSORIES

Cable LLD-500	
KAB-LLD500-2M-S	Interface cable 2 m, straight connector
KAB-LLD500-5M-S	Interface cable 5 m, straight connector
KAB-LLD500-10M-S	Interface cable 10 m, straight connector
KAB-LLD500-2M-SW	Interface cable 2 m, angular connector
KAB-LLD500-5M-SW	Interface cable 5 m, angular connector
KAB-LLD500-10M-SW	Interface cable 10 m, angular connector

Cable LLD-500-SSI	
KAB-LLD500-2M-S-SSI	Interface SSI cable 2 m, straight connector

Accessories	
ZT51_WEISS	Target board for Laser type LLD
Stautubus	light protector against stray light, Ø100 mm
3M 3279 special	Reflective tape, 300 x 300 mm

Cable LLD-500-PROF	
K5P2M-B-M12-PROF	Cable 2 m, female connector 5-pol. M12, open ends
K5P2M-SB-M12-PROF	Cable 2 m, female 5-pol. M12, male 5-pol. M12
K5P2M-B-M12-PROF	Cable 2 m, male connector 5-pol. M12, open ends
K5P5M-B-M12-PROF	Cable 5 m, female connector 5-pol. M12, open ends
K5P5M-SB-M12-PROF	Cable 5 m, female 5-pol. M12, male 5-pol. M12
K5P5M-S-M12-PROF	Cable 5 m, male connector 5-pol. M12, open ends
K5P10M-B-M12-PROF	Cable 10 m, female connector 5-pol. M12, open ends
K5P10M-SB-M12-PROF	Cable 10 m, female 5-pol. M12, male 5-pol. M12
K5P10M-S-M12-PROF	Cable 10 m, male connector 5-pol. M12, open ends

94133	Profibus OUT M12 connector, male
94136	Profibus IN M12 connector, female
94145	Profibus M12 terminating resistance



General safety instructions

Attention radiation laser.
Do not stare into beam.
Do not point the laser beam towards someone's eye.
It is recommended to stop the beam by a matte object or matte metal shield.
Laser regulations require the power to the sensor be switched off when turning off the whole system this sensor is part off.

Subject to change without prior notice.

WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.biz

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Köln
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
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