LASER

Analog Laser Displacement Transducer



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LAS Series

Key-Features:

- Available measurement ranges: 10 to 13000 mm
- Resolution up to 2 μ m, linearity up to $\pm 6~\mu$ m
- 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



INTRODUCTION

LAS laser sensors cover measurement ranges from 1 to 13000 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.

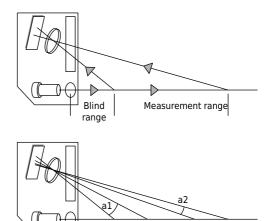
MEASURING PRINCIPLE

The triangulation principle is basic for this measurement method (exception LAS-TX). 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 color by a change of its internal sensitivity. This way influences due to the target color 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

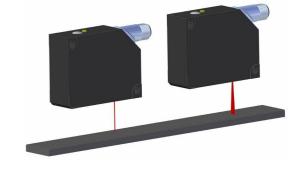
The object is sampled by a focussed laser beam. This version is the most preferred within the LAS series.

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).

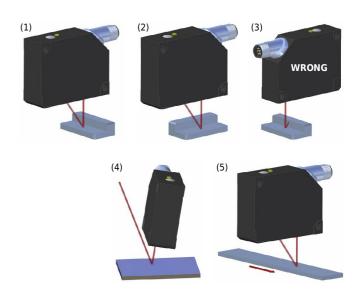
For triangulation sensors, there is a simple rule, that the distance between sensor and target should be as small as possible. The smaller the working range the better the linearity and accuracy.

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	LAS-TL
Smallest working range within the series *	[mm]	16	50	50	30	30
Largest working range within the series **	[mm]	550	550	200	1000	1000
Smallest measurement range within the series	[mm]	10	300	10	40	40
Largest measurement range within the series	[mm]	500	500	100	800	800
Measuring range teachable				•		•
Smallest linearity error within the series	[mm]	±0,006	±0,05	<0,045	±0,012	±0,012
Best resolution within the series	[mm]	0,002	0,010	<0,015	0,004	0,004
Highest sampling rate within the series	[ms]	<0,9	<0,9	<2	<0,9	<0,9
Spot laser		•			•	
Line laser				•		
Laser class		2	2	1	2	2
Output signal 010 V				•		
Output signal 420 mA		•	•	•		
Output signal 010 V and 420 mA						
Alarm output					PNP	PNP
Connector M8, 4-pole				•		
Connector M12, 5-pole						
Connector M12, 8-pole						•
Special properties		Very compact		Applicable for mat black surfaces		

		LAS-TX	LAS-T5	LAS-Z	LAS-L	
Smallest working range within the series *	[mm]	200	30	30	30	
Largest working range within the series **	[mm]	13000	600	1000	1000	
Smallest measurement range within the series	[mm]	3800	40	20	20	
Largest measurement range within the series	[mm]	12800	500	800	800	
Measurement range teachable		•				
Smallest linearity error within the series	[mm]	+/- 15	+/- 0,012	+/- 0,03	+/- 0,03	
Best resolution within the series	[mm]	1,000	0,004	0,010	0,010	
Highest sampling rate within the series	[ms]	10	<0,9	<10	<10	
Spot laser		•		•		
Line laser						
Laser class		2	2	2	2	
Output signal 010 V		■ (not for TX-13)	•			
Output signal 420 mA		•	•			
Output signal 010 V and 420 mA						
Alarm output		Push-pull		PNP	PNP	
Connector M8, 4-pole						
Connector M12, 5-pole		-	-	-	•	
Connector M12, 8-pole						
Special properties		Large working range at min. dimensions	Outstanding price- performance ratio	Discontinued model replaced by LAS-T5	Discontinued model replaced by LAS-TL	

^{*} corresponds to the blind range of the sensor



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 $[\]stackrel{\cdot}{**}$ corresponds to the blind range + the measurement range

TECHNICAL DATA - LAS-TM / LAS-TB SERIES

LAS-TM: Ultra-compact design

Measurement range teachable

Type of analog output

selectable

LAS-TB: Tailored for mat black surfaces

(with laser line)

Measurement range teachable

Type of analog output

selectable



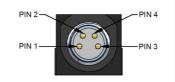


Spot laser		LAS-TM-10	LAS-TM-104	LAS-TM-300	LAS-TM-500			
Line laser				LAS-TML-300	LAS-TML-500	LAS-TB-10	LAS-TB-40	LAS-TB-100
Measuring range	[mm]	1626	16120	50350	50550	5060	60100	100200
Resolution *	[mm]	0,0020,005	0,0020,12	0,010,40	0,011,15	<0,015	0,0150,038	0,0390,15
Linearity error *	[mm]	±0,0060,015	±0,0150,35	±0,051,2	±0,083,5	<0,045	±0,0470,118	±0,1230,457
Min. teach-in range	[mm]	>1	>2	>5	>10	>1	>4	>5
Reponse time	[ms]		< 0,9			•	<2	
Sensor element			Photo diode array					
Alarm output					-			
Power-ON indicator					LED green			
Alarm indicator					LED red			
Pollution indicator					LED red flashing			
Supply	[VDC]				1228			
Max. current consumption	[mA]	10	00			80		
Load resistance	[Ω]			420 r	mA: <300, 010 V:	>100 k		
Light source				L	aser diode red, puls	ed		
Laser class				2			1	
Wavelength	[nm]				650			
Safety features				Protection agai	nst reverse polarity	and short circuit		
Housing material		Z	'n	1	AI.		Al	
Protection class					IP67			
Working temperature	[°C]				050			
Connection					M8 connector, 4-pole	2		
Beam diameter spot laser	[mm]	0,50,2	0,90,5	1,0	1,0			
Beam type, line laser ***								
Beam height	[mm]			4,09,0	4,011,0	0,10,18	0,110,45	0,20,74
Width	[mm]			2,0	2,01,0	1,1	1,7	2,83,7
Reflectivity of the target	[%]	>0,5 >0,8 >2						
Output signal **			420 mA, 010 V					

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

Electrical connection

LAS-TM / TML / TB								
Pin	Cable color	Function						
1	brown	V +						
2	white	Teach-in						
3	blue	GND						
4	black	Signal +						



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. $\,$ OV , 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.



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^{**} 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.

TECHNICAL DATA - LAS-T SERIES

LAS-T/ -TL: Universal analog output signal (current and voltage)

Measurement range teachable

Synchronization input



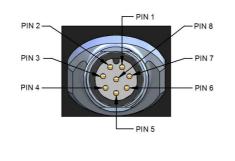


Spot laser		LAS-T-40	LAS-T-100	LAS-T-250	LAS-T-500	LAS-T-800	
Line laser		LAS-TL-40	LAS-TL-100	LAS-TL-250	LAS-TL-500	LAS-TL-800	
Measuring range	[mm]	3070	30130	50300	100600	2001000	
Resolution *	[mm]	0,0040,02	0,0050,06	0,010,33	0,0150,67	0,020,4	
Linearity error *	[mm]	±0,0120,06	±0,0150,2	±0,031,0	±0,052	±0,111,65	
Min. teach-in range	[mm]	>2	>3	>5	>10	>10	
Response time	[ms]		<	0,9		< 4	
Sensor element				Photo diode array			
Alarm output				PNP			
Max. switching current	[mA]			100			
Power-ON indicator				LED green			
Alarm indicator				LED red			
Pollution indicator				LED red, flashing			
Supply	[VDC]			1228			
Max. current consumption	[mA]			100			
Load resistance	[Ω]		4	20 mA: <300, 010 V: >10	00 k		
Light source				Laser diode red, pulsed			
Laser class				2			
Wavelength	[nm]			650			
Safety features			Protection a	against reverse polarity and	short circuit		
Housing material			Z	'n		Al	
Protection class				IP67			
Working temperature	[°C]			050			
Connection			M12 connector, 8-pole				
Beam diameter spot laser	[mm]	1,00,2	2,01,0	2,0	2,0	2,0	
Beam type line laser ***							
Beam height	[mm]	2,0	3,05,0	4,012	5,521	8,535	
Width	[mm]	1,00,2	2,01,0	2,5	3	2,5	
Output signal **				420 mA, 010 V			

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

Electrical connection

LAS-T/ LAS-TL							
Pin	Cable color	Function					
1	white	n. c.					
2	brown	V +					
3	green	420 mA					
4	yellow	Teach-in					
5	grey	Alarm					
6	pink	010 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.



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^{**} Automatic output selection: Depending on the connected impedance, current or voltage output becomes active. The output must be wired before switching on.

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

TECHNICAL DATA - LAS-TX SERIES

LAS-TX: Ultra-compact design

Large working range

Measurement range teachable

Type of analog output selectable

Phase comparison measurement



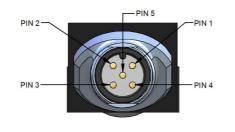
		LAS-TX-4	LAS-TX-13			
Measuring range	[mm]	2004000	20013000			
White 90%	[mm]	2004000	20013000			
Grey 18%	[mm]	2004000	2009000			
Black 6%	[mm]	2004000	2004000			
Resolution *	[mm]	1,3	5			
Linearity error *	[mm]	±15	±15			
Repeatability **	[mm]	±5	±15			
Min. teach-in range	[mm]	>1	100			
Sampling rate	[ms]	1	0			
Power ON indicator		LED (LED green			
Alarm indicator		LED red				
Alarm output		Push-pull				
Output current	[mA]	<100				
Pollution indicator		LED red, flashing				
Supply	[VDC]	15.	28			
Current consumption	[mA]	typ. 110 at 24	VDC, max. 250			
Load resistance	[Ω]	420 mA: <300,	010 V: >100 k			
Light source		Laser diode	red, pulsed			
Laser class			2			
Wavelength	[nm]	60	60			
Safety features		Protection against reverse	e polarity and short circuit			
Housing material		A	Al			
Protection class		IP67				
Working temperature	[°C]	-2550				
Connection		M12 connector, 5-pole				
Beam diameter spot laser	[mm]	520	550			
Analog output		420 mA or 010 V **** 420 mA				

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

Electrical connection

LAS-TX connector, 5-pole, K5P cable

Pin	Cable color	Function
1	brown	V +
2	white	Signal
3	blue	GND
4	black	Alarm
5	grey	Teach-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.



^{**} at 40 kLux ambient light

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

TECHNICAL DATA - LAS-T5 SERIES

LAS-T5: Low-price instruments for conventional applications.

Measuring range teachable.

Type of analog output selectable.



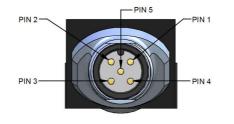
		LAS-T5-40	LAS-T5-100	LAS-T5-250	LAS-T5-500		
Measuring range	[mm]	3070	30130	50300	100600		
Resolution *	[mm]	0,0040,02	0,0050,06	0,010,33	0,0150,67		
Linearity error *	[mm]	±0,0120,06	±0,0150,2	±0,031	±0,052		
Minimum Teach-in-range	[mm]	>2	>3	>5	>10		
Response time	[ms]		<	0,9			
Sensor element			Photo di	ode array			
Power ON indicator			LED	green			
Alarm lamp			LED	red			
Pollution indicator			LED red	, flashing			
Supply	[VDC]		1228				
Max. current consumption	[mA]	100					
Load resistance	[Ω]	420 mA: <300, 010 V: >100 k					
Light source			Laser diode red, pulsed				
Laser class			2				
Wavelength	[nm]		6	50			
Safety features			Protection against reverse	e polarity and short circuit			
Housing material			Z	I n			
Protection class			IP	67			
Working temperature	[°C]		050				
Connection			M12 plug, 5-pole				
Beam diameter spot laser	[mm]	10,2	21	2,0	2,0		
Analogue output **			420 mA, 010 V				

 $[\]ensuremath{^{*}}\xspace$ Values for linearity and resolution are given for a mat white reference surface.

Electrical connection

LAS-T5 connector, 5-pole, K5P cable

	•	
Pin	Cable color	Function
1	brown	V +
2	white	Signal
3	blue	GND
4	black	n. c.
5	grey	Teach-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.



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

TECHNICAL DATA - LAS-Z, LAS-L SERIES

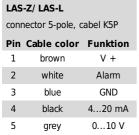
The production of this model will be discontinued soon. Please do not use this model for new constructions! The model is replaced by LAS-T5.

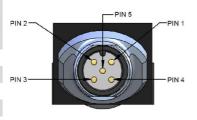


Spot laser		LAS-Z-20	LAS-Z-100	LAS-Z-120	LAS-Z-200	LAS-Z-400	LAS-Z-800	
Line laser		LAS-L-20	LAS-L-100	LAS-L-120	LAS-L-200	LAS-L-400	LAS-L-800	
Measurement range	[mm]	3050	30130	200320	50250	100500	2001000	
Resolution *	[mm]	0,01	0,050,07	0,20	0,10,3	0,20,5	0,62,5	
Linearity error *	[mm]	±0,03	±0,150,22	±0,60	±0,30,8	±0,82	±2,410	
Response time	[ms]			<	10			
Sensor element				Photo did	ode array			
Alarm output				PI	NP			
Max. switching current	[mA]			10	00			
Power ON indicator				LED (green			
Alarm indicator				LED	red			
Pollution indicator				LED red,	flashing			
Supply	[VDC]		1228					
Max. current consumption	[mA]			<1	.00			
Light source				Laser diode	red, pulsed			
Laser class				2	2			
Wavelength	[nm]			65	50			
Safety features			Pr	rotection against reverse	e polarity and short circ	uit		
Housing material				Z	n			
Protection class				IP	67			
Working temperature	[°C]			0	.50			
Beam diameter spot laser	[mm]	1,00,4	2,01,0	2,0	2,0	2,0	2,0	
Beam type line laser ***								
Beam height	[mm]	2,0	3,05,0	-	4,010,0	5,518,0	8,535,0	
Width	[mm]	1,00,4	2,01,0	-	2,5	2,5	2,5	
Analog output **				Dual output, 420) mA and 0 10 V			
RS485				upon r	equest			

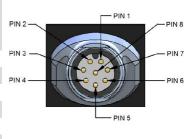
^{*} Values for linearity and resolution are given for a mat white reference surface.

ELECTRICAL CONNECTION





LAS-Z/ LAS-L with RS485				
connector, 8-pole, K8P cable				
Pin	Cable color	Function		
1	white	Rx/Tx-		
2	brown	V +		
3+8	green+red	n. c.		
4	yellow	Switching output		
5	grey	Alarm		
6	pink	Rx/Tx+		
7	blue	GND		

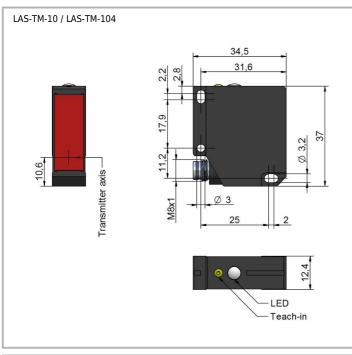


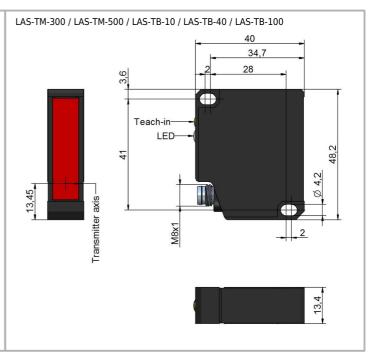


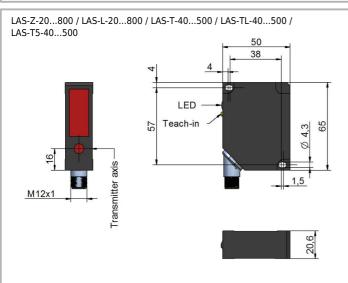
^{**} Automatic output selection: Depending on the connected impedance, current or voltage output becomes active. The output must be wired before switching on.

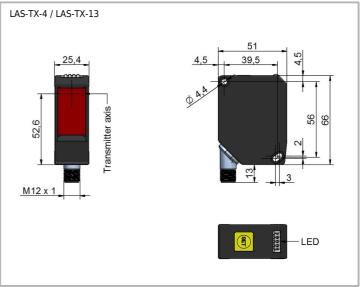
^{***} The detector calculates an optical (not a mathematical) averaging of the sampled surface, i.e. a kind of a surface integral.

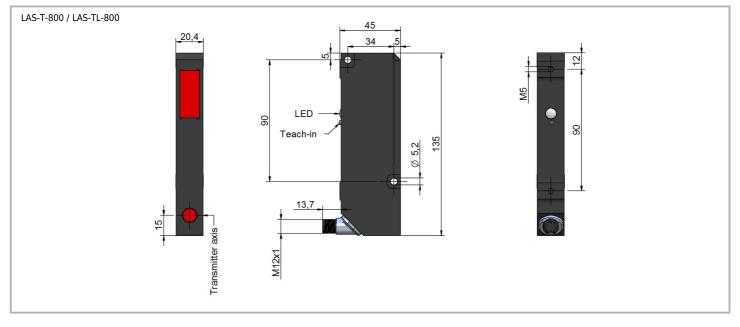
TECHNICAL DRAWINGS









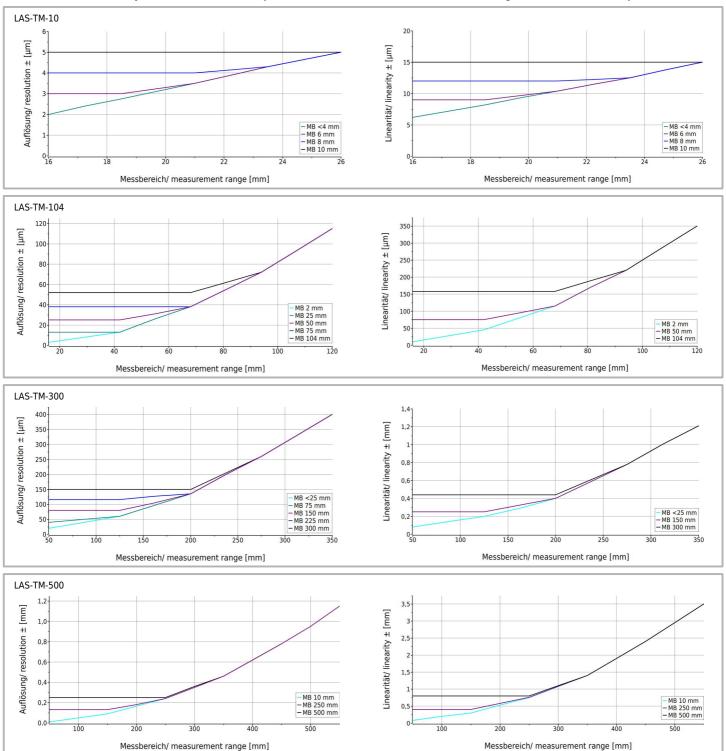




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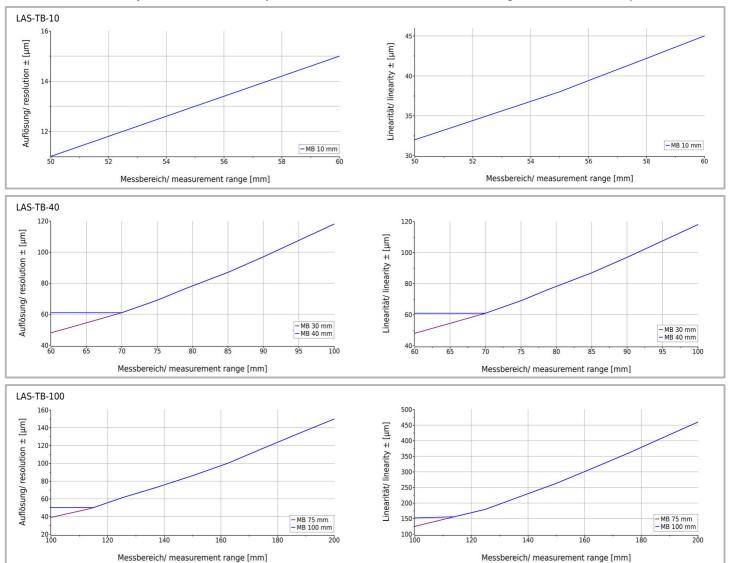
LINEARITY / RESOLUTION - LAS-TM SERIES

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.



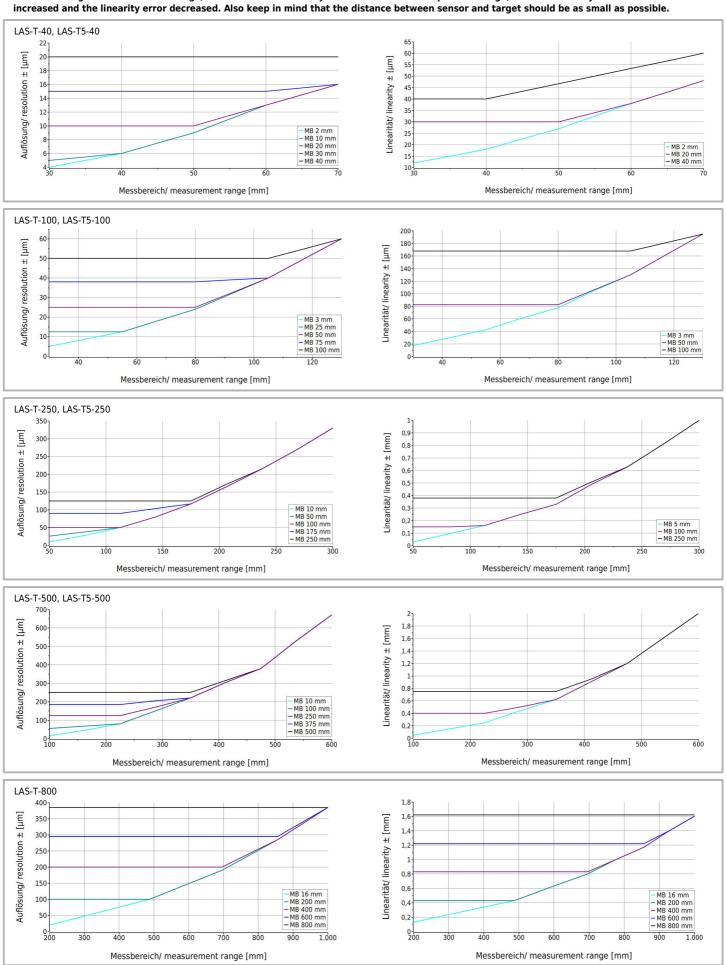
LINEARITY / RESOLUTION - LAS-TB SERIES

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.



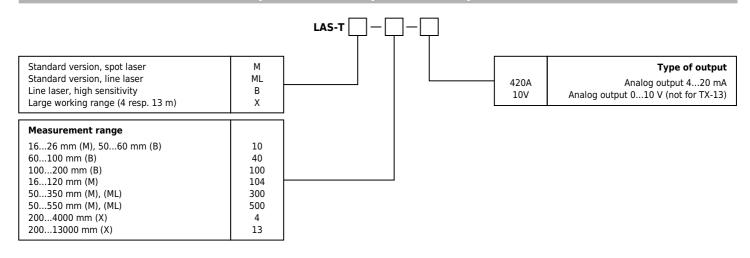
LINEARITY / RESOLUTION - LAS-T, LAS-T5 SERIES

When teaching the measurement range, it is recommended always to select the smallest possible range, because this way the resolution is

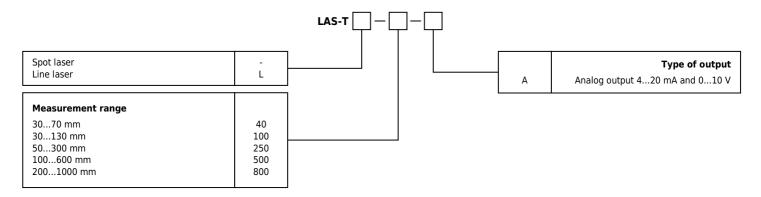


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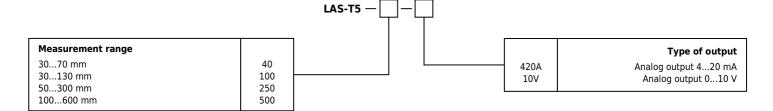
ORDER CODE LAS-TM / LAS-TML / LAS-TB / LAS-TX



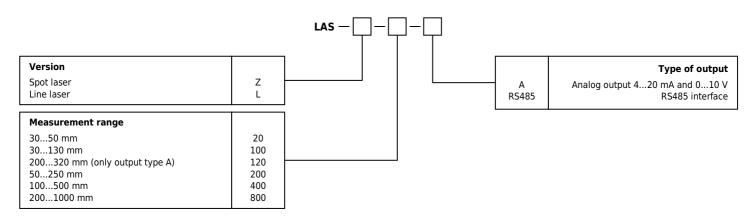
ORDER CODE LAS-T / LAS-TL



ORDER CODE LAS-T5



ORDER CODE LAS-Z / LAS-L (WILL BE DISCONTINUED SOON)





ACCESSORIES

Connection cable				
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			

Cable, 5-pole, shielded, with mating M12 connector				
for LAS-Z/L-A / LAS-T5 / LAS-TX 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					
Cable, 8-pole, shielded, with mating M12 connector					
for LAS-T and LAS-Z/L-RS485 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				

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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