

Sensor **Partners**

Laser Distance Meter SP LAM 301



You are advised to carefully read this User Manual before you start using the SP LAM 301 Laser Distance Meter.

This is necessary to help you exploit all the capabilities which your new Laser Distance Meter offers.

We reserve the right to make changes or enhancements in product design as part of ongoing technical progress.

Editorial deadline: May 2007

Documentation number: 012861-001-98-02-0507-en

Sensor Partners BV
James Wattlaan 7
5151 DP Drunen
Holland

Phone: +31 (0) 416-378239

Fax: +31 (0) 416-377439

Web: www.sensor.nl

E-Mail: info@sensor.nl

Revision state

Date	Revision	Explanatory note
May 2007	001	First compiled




Note

No part of this User Manual may be reproduced in any way (by photographing, photocopying, microfilming or any other technique), unless written approval of Sensor Partners BV has been procured, nor may it be processed, duplicated or disseminated with the help of electronic systems.

Proper care was used in compiling this document. No liability will be accepted in the event of damage resulting from failure to observe advisory notes or information provided in this User Manual.

This document uses the following graphic, information and warning symbols to highlight significant description parts:

Pictograms and symbols provided for reference

- Enumeration
-  Note/Important/Important note
- Reference to (passage of text or illustration)

Warning symbols



Warning alerts to situations involving potential danger to people's health if notes of this kind are disregarded.



Caution warns of potential damage to the product.



Laser warns of potential exposure to emerging visible and invisible laser radiation.



Information highlights important details.

1	General	9
2	Safety Notes	11
2.1	Basic Information.....	11
2.2	Laser Classification.....	11
2.2.1	Safety Notes Regarding Laser Class 1	11
2.2.2	Safety Notes Regarding Laser Class 2	11
2.3	Electric Power Supply Requirements.....	11
2.4	Important Operating Advice	12
2.5	Warning Signs & Nameplates.....	12
3	Intended Purpose	13
3.1	General Product Description	13
3.2	Conforming Use	13
3.3	Non-Conforming Use/Error Sources	14
4	Product Description	15
4.1	Scope of Delivery.....	15
4.2	Technical Data	16
4.3	Product Description & Function Elements.....	18
4.3.1	Function Elements	18
4.3.2	Models & Equipment Features	19
4.4	Mechanical Integration Requirements	20
4.5	Connector Pin Assignments	21
4.5.1	Main Connector Port (M18)	21
4.5.2	SSI Port (M12).....	22
4.5.3	Profibus Port (M12)	22
4.6	Status Display	23
4.7	Pilot Laser.....	24
4.8	Accessories.....	24
4.8.1	Adapter Plate.....	24
4.8.2	Anti-Dust Tube	24
5	Interface Description.....	25
5.1	Main Connector Port.....	25
5.1.1	RS232 or RS422 Interface	25
5.1.1.1	Communication Protocol	25
5.1.1.2	Wiring.....	26
5.1.1.3	Automatic Baud Rate Detection	27
5.1.2	Q1 and Q5 Switching Outputs	27
5.1.3	Analog Output QA	28
5.1.4	Trigger Input.....	28
5.2	SSI Interface	28
5.2.1	Specification.....	28
5.3	Profibus Interface.....	29
5.3.1	ID Number	29
5.3.2	Connection Requirements.....	29
5.3.3	GSD File	29

5.3.4	Slave Address	29
5.3.5	Bus Termination.....	29
5.3.6	Baud Rate.....	30
5.3.7	Segment Length	30
5.3.8	Electrical Connection	30
5.3.9	Profibus Firmware Installation	31
5.3.9.1	Preparation.....	31
5.3.9.2	Firmware Installation	31
5.3.10	Firmware Update via Profibus.....	34
5.3.11	SL4 Service Program	34
5.3.11.1	Setting a Profibus Slave Address on the SP LAM 301PB	34
5.3.11.2	Parameter Dialog	35
5.3.11.3	Diag Common	36
5.3.11.4	Diag Alarm	36
5.3.11.5	Service	36
6	Starting Up.....	37
6.1	Preparative Action before Installation.....	37
6.2	Checklist on Installation Work.....	37
7	Measurement	39
7.1	Identification	39
7.1.1	ID Identification	39
7.1.2	ID?-Online Help	39
7.2	Operation Mode.....	40
7.2.1	DM – Single Distance Measurement.....	40
7.2.2	DT – Continuous Distance Measurement.....	40
7.2.3	DF – Single Distance Measurement with External Triggering	40
7.2.4	VM – Single Speed Measurement	40
7.2.5	VT – Continuous Speed Measurement	40
7.3	Status.....	41
7.3.1	TP – Internal LDM Temperature.....	41
7.3.2	PA – All-Parameter Display	41
7.3.3	HW – Hardware Diagnosis	41
7.4	Parameter Setup	41
7.4.1	AS – Autostart Function	41
7.4.2	PL – Pilot Laser	42
7.4.3	PR – Reset to Factory Settings.....	42
7.4.4	DR – Trigger Cold Start	42
7.4.5	SF – Scale Factor.....	43
7.4.6	OF - Offset	43
7.4.7	SO - Set Offset	43
7.4.8	MW – Measurement Window.....	43
7.4.9	MF – Measurement Frequency [Hz]	44
7.4.10	SA – Average.....	44
7.4.11	TD – External Trigger Delay [ms] & Trigger Level [Flanke]	44

7.4.12	SE - Error Mode	45
7.4.13	Q1/Q7 – Switching Output.....	45
7.4.14	QA – Analog Output	45
7.4.15	BR – Baud Rate.....	46
7.4.16	SD – Serial Interface Termination Character	46
7.4.17	TE – Serial Interface Termination Character	47
7.4.18	SC - Format SSI.....	47
7.4.19	BB – Field Bus Baud Rate	47
7.4.20	AB – Bus Address	47
8	Preventive Maintenance & Care.....	49
8.1	User Maintenance Actions	49
8.2	Software Update	49
8.3	Preventive Maintenance by Sensor Partners BV.....	49
9	Malfunction & Error Messages	51
9.1	Malfunction.....	51
9.2	Operating Advice.....	51
9.2	Error Messages.....	51
10	EC Declaration of Conformity.....	53
11	List of Abbreviations & Glossary.....	55
Exhibit 1	Adapter Plate.....	57
Exhibit 2	Anti-Dust Tube	59

1 General

The SP LAM 301 Laser Distance Meter has been developed for use in industrial applications. Its purpose is to allow non-contact measurement of distance and speed within a great working range. Little time and no reflector is required to locate any kind of diffusely reflecting target surface.

Available interfacing tools are RS232, RS422, SSI or Profibus, depending on the particularly requested model. These tools are intended for easy installation and start-up of the Laser Distance Meter. A LED display is located on the back panel to facilitate visual tracking of the current work status during normal operation. Compact and robust design, easy mechanical attachment, low power consumption, selectable switching outputs and options for specific user settings are the distinguishing features of the SP LAM 301. Together they create a broad diversity of potential applications in industrial environments.



- Process monitoring in steel works and rolling mills
- Fill-level measurement
- Monitoring of moving objects
- Positioning of cranes and loading equipment
- Measurement of otherwise inaccessible target points, for example, inside of hollow bodies such as tubes or containers
- Position monitoring of road vehicles and ships

Standard SP LAM 301 delivery includes integral heating, status display and a telescopic sight. Of modular setup, the Distance Meter readily accepts accessories or custom-manufactured modules for specific applications.

2 Safety Notes



2.1 Basic Information

Safety notes and operating advice must be read carefully and followed at any time during practical use of the SP LAM 301.

There is danger of laser radiation or electric shock.

For necessary repairs, the SP LAM 301 may not be opened by anyone other than manufacturer personnel. Unauthorized intervention will void any claims for warranty.



Specified operating requirements (→section 4.2) must be met.

Failure to comply with these safety notes or non-conforming product usage may cause physical injury to the user or damage to the SP LAM 301. Connectors must not be plugged or unplugged with the SP LAM 301 in powered state. Remember to turn power off before you begin any kind of work for establishing connections.

2.2 Laser Classification

The SP LAM 301 is equipped with two lasers:

- Laser for measurement → laser class 1
- Pilot laser → laser class 2

2.2.1 Safety Notes Regarding Laser Class 1

The laser for measurement qualifies as a class 1 laser device in accordance with standard EN 60825-1:2003-10. Laser radiation emitted by class 1 lasers is entirely harmless to the human eye so eye damage can be ruled out for this category.

2.2.2 Safety Notes Regarding Laser Class 2

The pilot laser qualifies as a class 2 laser device in accordance with standard IEC825-1/DIN EN 60825-1:2001-11 and as a class II device under FDA21 CFR. In the event of accidental short-time exposure, the human eye is normally protected by its own lid-closing reflex and preventive reaction. The natural lid-closing reflex may however be impaired by the influence of medication, alcohol or drugs. Despite that, one should refrain from directly looking into the laser beam. Do not point the laser beam onto people.

Warning: Class 2 laser radiation – do not look into the beam!



2.3 Electric Power Supply Requirements

For normal operation of the SP LAM 301, direct voltage supply of 10 V to 30 V is required.

For operation with heating, direct voltage of 24 V should be available.

Use only the dedicated connector port for power supply.

Observe specified limit values for input voltages.

Outputs must not be used as inputs.



All outputs are short-circuit proof.

The LDM casing is electrically isolated from the sensor electronics. Immunity to electrostatic discharges (ESD) is 4 kV according to EN 61000-4-2.

2.4 Important Operating Advice

To be able to exploit all capabilities and performance features and achieve a long service life of the system, you should follow all of the following rules:

- The SP LAM 301 must not be powered up if optical surfaces are found to be misted up or contaminated!
- Optical surfaces must not be contacted with bare hands!
- Use utmost caution when removing dust or dirt from an optical component!
- Prevent shock impacts during operation and transportation of the SP LAM 301!
- Protect the SP LAM 301 from overheating!
- Protect the SP LAM 301 from strong temperature variations.
- The SP LAM 301 provides splash-proofness and dust-proofness under IP67 internal protection level.

These safety and advisory notes must be read carefully and followed during practical use of the SP LAM 301.



2.5 Warning Signs & Nameplates

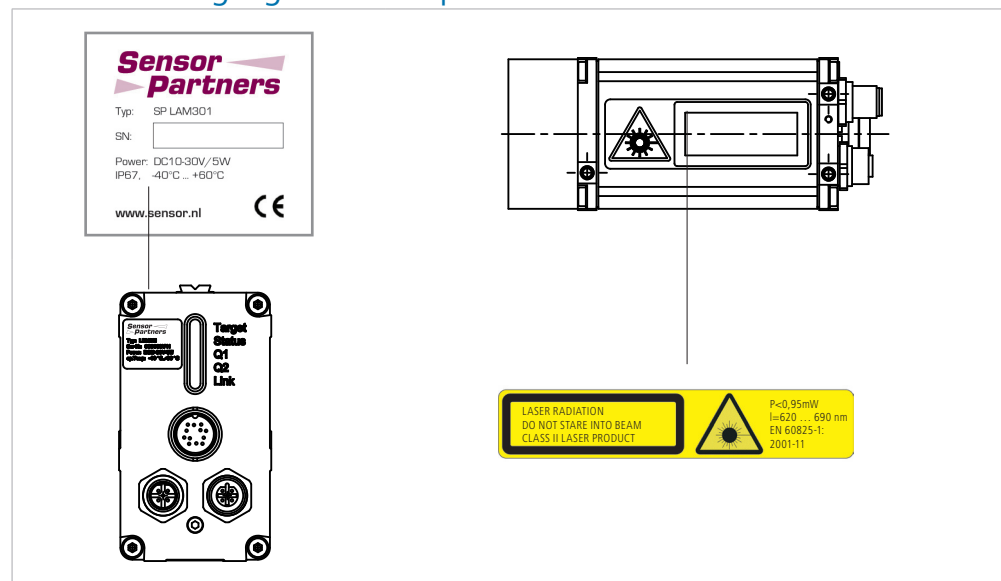


Fig. 1: SP LAM 301 - Warning Signs & Nameplates

3 Intended Purpose

3.1 General Product Description

The SP LAM 301 is a Laser Distance Meter for determining the distance to objects in motion or stationary with centimeter accuracy for:

- natural surfaces with 90% reflectance in the range of 0.5 m to 300 m
- reflector surfaces (e.g. Scotchlite 3000x) from 300 m to 3000 m and
- speed measurement in the range of 0 m/s to 100 m/s (at 0.5 m to 700 m distance).

With the help of a red laser sighting point (pilot laser) a given target can be unequivocally identified. The actual range of measurement depends on the reflectivity and the surface quality of a target being measured.

The SP LAM 301 relies on the time-of-flight-measurement principle for operation. It is available with RS232 or RS422, depending on the Customer's request. Product manufacturing includes the installation of a requested configuration. Once installed, the interface cannot be replaced with another type.

(→ section 4.1 Scope of Delivery)

The SP LAM 301 has two switching outputs and one external trigger input (all of them parameterizable).

A distance measurement can be triggered:

- via RS232 interface or RS422 interface
- via Profibus DP-V0
- by an external source (in external trigger mode)
- via SSI.

The SP LAM 301 is delivered in a stable cardboard box with adequate padding which can also be used for protected transportation of the Laser Distance Meter.

3.2 Conforming Use

- Measurement of distance and speed and output of measured data via RS232 or RS422 interface or SSI or Profibus
- Special measuring functions
- Compliance with environmental requirements, operating temperature and storage temperature
- Operation in industrial environments that meet IP67 internal protection standard requirements (allowing for splashes of water and spray)
- Operation at correct voltage level
- Applying only specified signal levels to data lines
- Measurement through an optically transparent medium such as glass, optical filters or plexiglass should be performed with the measuring window function turned on.

3.3 Non-Conforming Use/Error Sources

- Operate the SP LAM 301 only in accordance with its intended purpose and in a proper working condition.
- Safety devices must not be defeated.
- Information and warning signs must not be removed.
- Repair work on the SP LAM 301 may not be performed by anyone other than personnel from Sensor Partners BV.
- Do not operate the SP LAM 301 in an explosive environment.
- In order to obtain precise measurement results, make sure you follow these rules:
 - Measurement against the sun or other strong sources of light may lead to faulty readings.
 - Measurement of target surfaces with poor reflectance, but otherwise surrounded by a highly reflecting environment, may lead to faulty readings.
 - Measurement of strongly reflecting surfaces may lead to faulty readings.
 - Measurement through an optically transparent medium such as glass, optical filters, plexiglass, etc. may lead to faulty readings.
 - Rapidly changing conditions of measurement (e.g. jumps in distance) may lead to faulty readings.

4 Product Description

4.1 Scope of Delivery

Description	Bestell-Nr.
SP LAM 301.100 RS232	012861-005-22
SP LAM 301.200 RS422	012861-009-22
SP LAM 301.101 SSI, RS232	012861-013-22
SP LAM 301.102 PB, RS232	012861-017-22
CD with Customer documentation	
2m combi-cable	012840-144-24
5m combi-cable	012840-145-24
10m combi-cable	012840-146-24
"red.dot" telescope	98911
100mm anti-dust tube	012861-025-10
Adapter plate	012861-020-26
PB-In-Out, 5m cable	012840-170-24
PB-In, 5m cable jack	012840-165-24
PB-In, 10m cable jack	012840-166-24
PB-Out, 5m cable connector	012840-160-24
PB-Out, 10m cable connector	012840-161-24
Protective cap for PB jack	94366
Protective cap for PB connector	94363
Jack, 12-pole	94477
PB 12V terminating resistor	94145
PB-jack, 5-pole	94136
PB-connector 5-pole	94133

Product configuration

Integrated pilot laser, status display and heating are standard equipment items of all SP LAM 301 models. An overview of the various models and their configuration is contained in the following table. On special request, SP LAM 301s can also be manufactured to provide a divergence of 10 mrad and/or a measuring rate of 10 kHz.

Model		Interface (x)		Divergence (y)		Measuring rate (y)		Interface (z)	
Description	Ordering code	RS232	RS422	2 mrad	10 mrad	2 kHz	10 kHz	SSI	Profibus
LAM301.100	012861-005-22								
LAM301.200	012861-009-22								
LAM301.101	012861-013-22								
LAM301.102	012861-017-22								

Table 1: Basic unit configurations

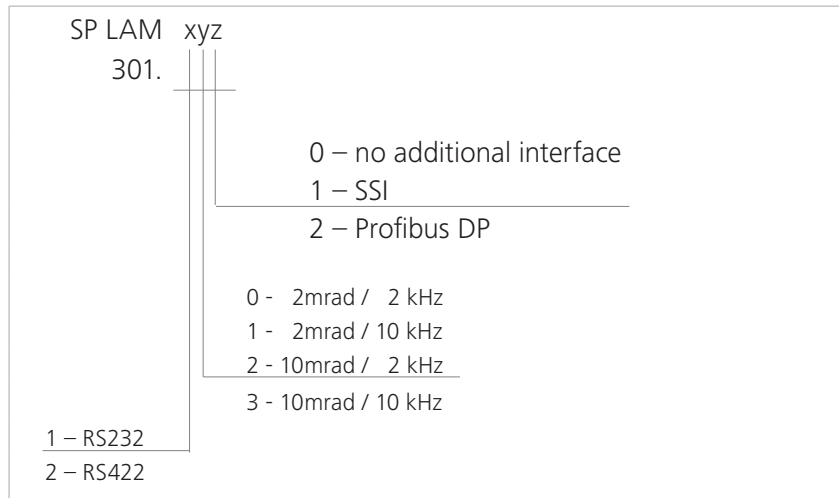


Fig. 2: SP LAM 301 - product identifier

4.2 Technical Data

Measuring features	
Measuring principle	Laser-pulse-time-of-flight measurement
Measured quantity	Distance
Measuring range ^{*1}	0.5 m to 300 m on natural surfaces ^{*2} 0.5 m to 3000 m on target board
Measuring accuracy	± 20 mm (for measured-value output at 100 kHz) ± 60 mm (for measured-value output at 2 kHz)
Measured-value resolution	1 mm
Measuring time	Standard version: 0.5 ms Special version: 0.1 ms
Measured quantity	Speed ³
Measuring range	0 ms ⁻¹ to 100 ms ⁻¹
Measuring time	0.1 s to 0.5 s
^{*1} depending on target reflectance, stray-light influences and atmospheric conditions	
^{*2} natural, diffusely reflecting surfaces	
^{*3} distance range to targets being measured: 0.5 m to 700 m	

Laser	
Laser for measurement	
Laserklassifizierung	Laser class 1 under EN 60825-1:2003-10
Laser beam divergence	Standard version: 1.7 mrad Special version: 10 mrad
Wavelength	905 nm (infrared, invisible)
Pilot laser	
Laser classification	Laser class 1 under EN 60825-1:2003-10
Wavelength	635 nm (red)

Electric power requirements	
Supply voltage	10 V to 30 V DC
Power consumption	< 5 W (without heating) 11.5 W (with heating, 24 V)

Interfaces/terminals	
Terminals	1 x 12-pole (BINDER-series 723) M18 2 x 5-pole (BINDER-series 766) M12 B-encoded
Serial interfaces	RS232 and RS422 with 9.6 kbaud to 460.8 kbaud Format: 8N1, ASCII transmission protocol
Profibus	
Profibus	DP-V0 slave IEC 61158 / IEC 61784
Transfer rate	9,6 kbaud to 12 Mbaud
Ident number	0x0AA2
Baud rate detection	Automatic
Terminating resistor	External
Slave address	Selectable via SSA command
GSD file	LDM30AA2.GSD, class 1/2 PNO-profile encoder
	Configuration of measured quantities, switching outputs, trigger input and powering-up characteristics
	Output of measured distance values or error message, query for inner device temperature
	Storage of all parameters and PB address in NVRAM
SSI	
Transfer rate	50 kHz to 1 MHz, 25 µs pause
Signal input/output	Differential signal (RS422)
	24 bits, binary or gray-encoded
	1 validity bit
Electrical isolation	500 V for signal input
LSB	Bit 0
MSB	Bit 23
Switching output	2 x "high-side switch" up to 0.2 A load capacity sustained short circuit proof selectable window functions
Analog output	4 mA to 20 mA
Trigger for device synchronization	1 x trigger In/Out, up to 30 V DC load capacity edge and delay selectable
Operating modes	Single measurement continuous measurement mean value external triggering selectable near-field suppression and window functions

Environmental & operating requirements	
Operating temperature	- 40 °C to + 60 °C
Storage temperature	- 40 °C to + 70 °C
Rel. air humidity	15 % to 90 %
Phys. dimensions (L x W x H)	136 mm x 57 mm x 104 mm
Weight	About 800 g (depending on configuration)
Type of protection	IP67
EMC	EN 61000-6-2, EN 55011

4.3 Product Description & Function Elements

4.3.1. Function Elements

The casing consists of a robust, corrosion-resistant extrusion-molded aluminum structure with a front cover plate and a back cover plate equally corrosion-resistant. On each lateral side and on the underside of the SP LAM 301 casing there are three support pads with mounting holes (M4) for mechanical attachment of the SP LAM 301 (→ Fig. 5 and 6).

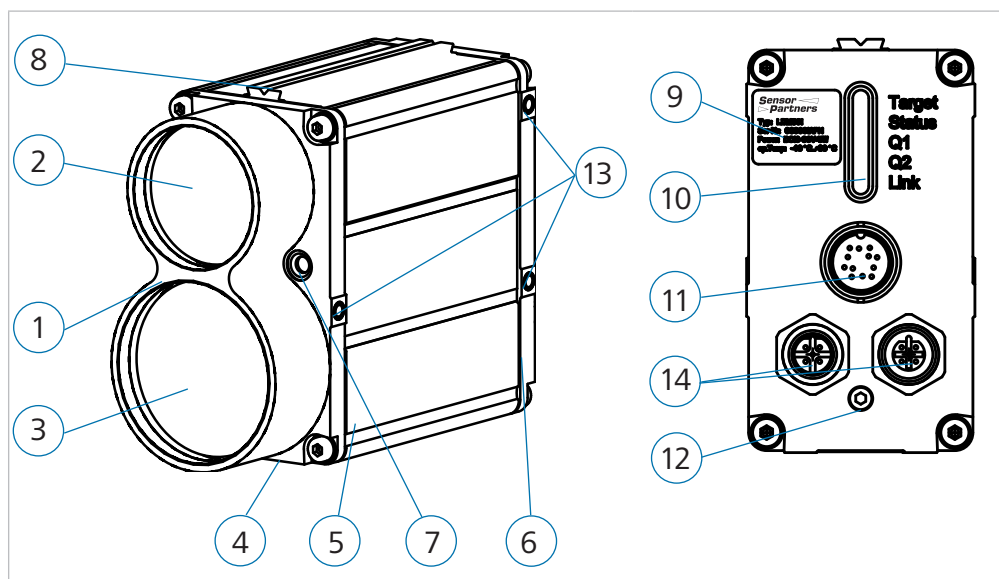
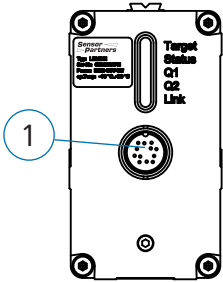
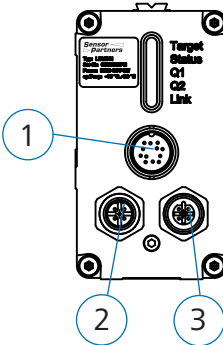
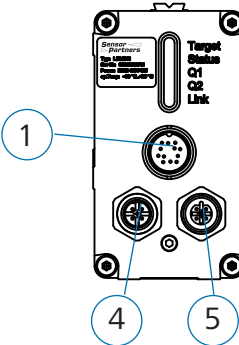


Fig. 3: SP LAM 301 function elements

Legend

- | | | | |
|---|---|----|--|
| 1 | Front tube | 9 | Nameplate |
| 2 | Transmitter optics | 10 | Status display |
| 3 | Receiver optics | 11 | Main connector port (M18) |
| 4 | Front cover plate (anodized) | 12 | Service screw |
| 5 | Receiver optics 5 Casing (aluminum, extruded) | 13 | Support pads with M4 x 6 threaded inserts |
| 6 | Back cover plate (anodized) | 14 | optionale Anschlüsse (Profibus, SSI) (→ Fig.: 4) |
| 7 | Pilot laser | | |
| 8 | 11-mm rail | | |

4.3.2 Models & Equipment Features

Model	SP LAM 301.100 SP LAM 301.200	SP LAM 301.101	SP LAM 301.102
Interface	RS232 (SP LAM 301.100) RS422 (SP LAM 301.200)	RS232	RS232
Interface		SSI	Profibus
			
Terminals	① Main connector port	① Main connector port ② M12 dummy plug ③ SSI (M12-jack)	① Main connector port ④ Profibus-IN (M12-plug) ⑤ Profibus-OUT (M12-jack)

Note: For reasons of sealing, plug 2 is also installed for SP LAM 301.101 (SSI)!

Fig. 4: Rear panel of the various SP LAM 301 models

4.4 Mechanical Integration Requirements

For integration of the SP LAM 301 Laser Distance Meter, three different versions of mechanical attachment are available.

1. Attachment to a lateral surface
For attachment to a desired one of the two lateral surfaces, the SP LAM 301 provides three support pads (→ Fig. 6, reference 1) with mounting holes (M4 x 6)
2. Attachment to casing bottom
Likewise, the SP LAM 301 provides three support pads (→ Fig. 5, reference 1) with mounting holes (M4 x 6) for attachment to the bottom face of its casing
3. Attachment via adapter plate (replacement of LDM300C)
To replace an LDM300C with an SP LAM 301, an adapter plate is required. This plate must be screwed to the bottom side of the SP LAM 301 (→ Fig. 5, reference 1). The adapter plate is specifically shaped and sized to allow the SP LAM 301 to be attached to the mechanical fixing points of an LDM300C.

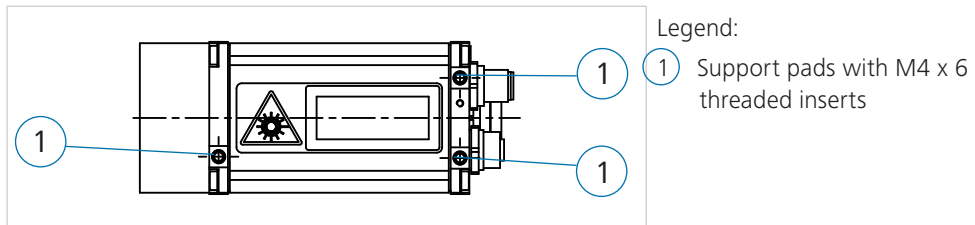


Fig. 5: Mechanical fixing points on bottom face

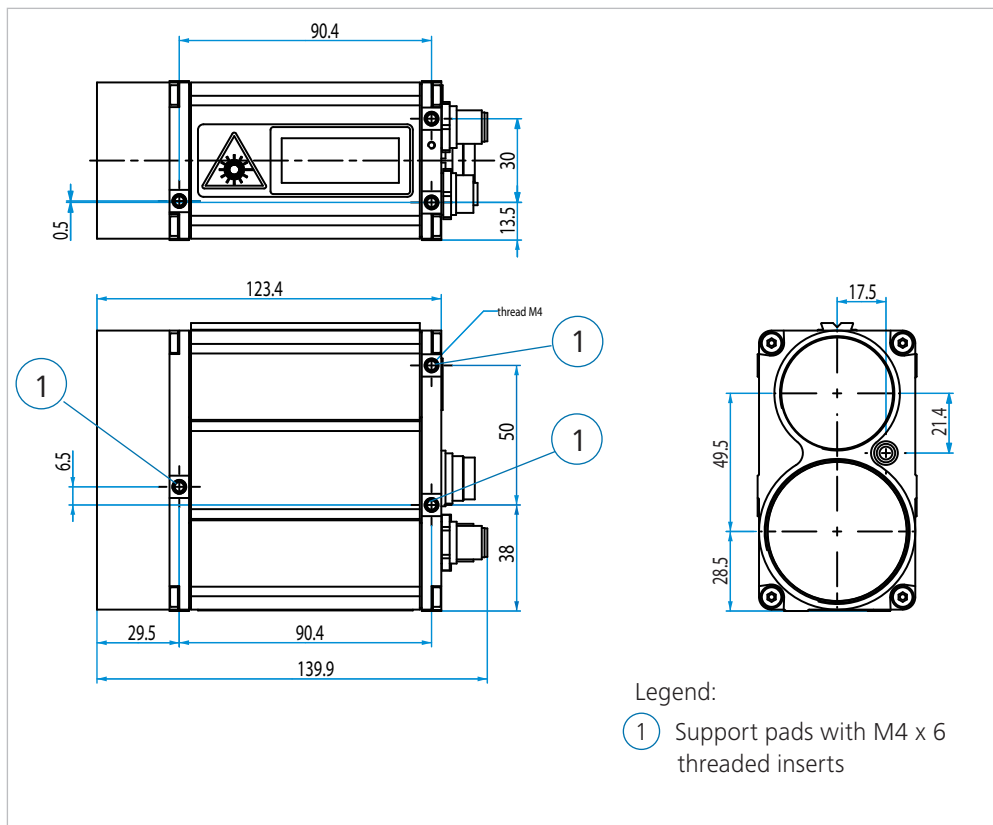


Fig. 6: Fitting dimensions of the SP LAM 301, zero-point location (dimensions in mm)

Zero-point of the SP LAM 301 is identical with the outer surface plane of the front cover plate.

4.5 Connector Pin Assignments

Depending on the implemented configuration version of the various SP LAM 301 models, different terminal facilities are available for connections. All models share the same type of main connector port (Fig. 4, reference 1).

4.5.1 Main Connector Port (M18)

The main connector port (Fig. 3, Ziffer 11) includes the terminal points for voltage supply, for serial data communication, for the two switching outputs, one analog output and for one trigger input.

A shielded cable must be used for connection. This cable is optionally available from Sensor Partners BV.

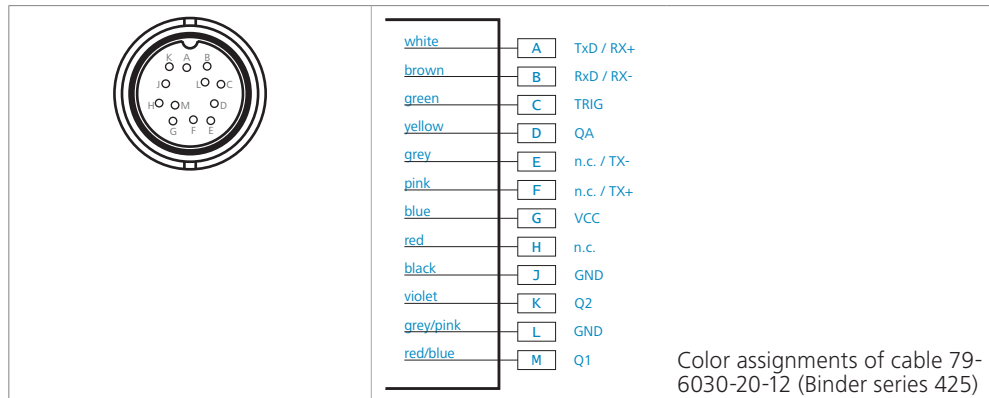


Fig. 7: Terminal diagram of main connector port

Pin	Color code of combi cable Ord.-No. 012840-14x-24	RS232	RS422	Description
A	White	TxD	RX+	RS232 send data / RS422 receive data +
B	Brown	RxD	RX-	RS232 receive data / RS422 receive data -
C	Green	TRIG	TRIG	Trigger input
D	Yellow	QA	QA	Analog output (4 ... 20 mA)
E	Grey	n.c.	TX-	RS422 send data -
F	Pink	n.c.	TX+	RS422 send data +
G	Blue	VCC	VCC	Supply voltage
H	Red	n.c.	n.c.	not connected
J	Black	GND	GND	GND
K	Violet	Q2	Q2	Switching output Q2
L	Grey/pink	GND	GND	GND
M	Red/blue	Q1	Q1	Switching output Q1

Table 2: Pin assignments of main connector port

4.5.2 SSI Port (M12)

Connection to the SSI interface is accomplished via a 5-pole, B-encoded M12 male connector. Shielded cables should be used for connection.

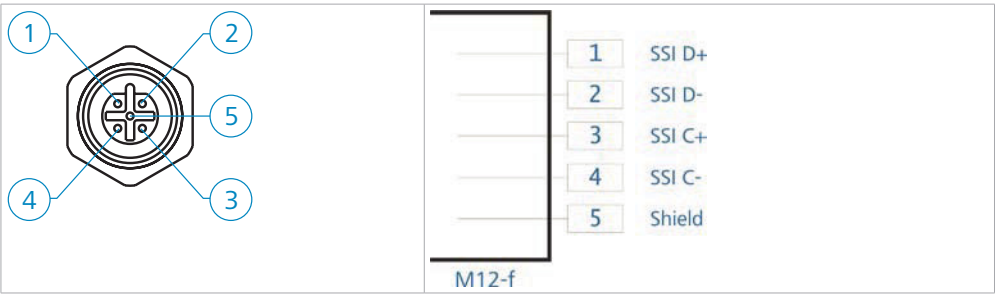


Fig. 8: connection diagram

4.5.3 Profibus Port (M12)

Profibusses connection is via B-encoded 5-pole M12 connectors. Shielded cabling should be used.

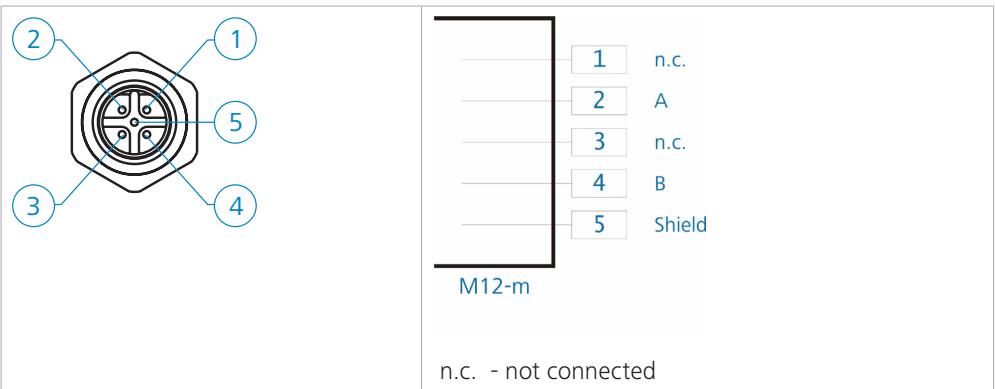


Fig. 9 Profibus-IN connection diagram

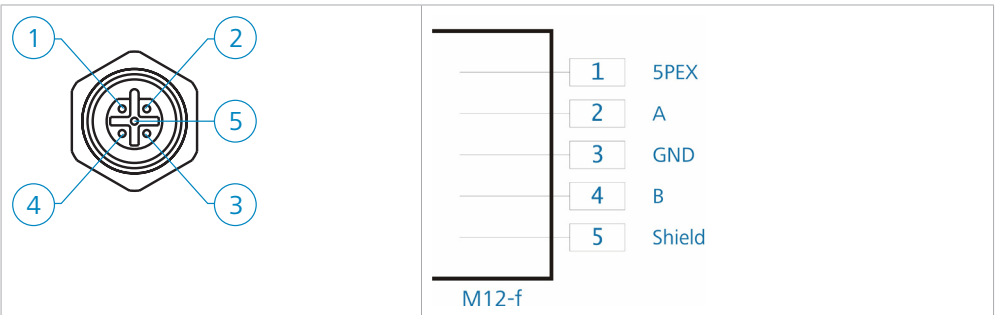


Fig. 10: Profibus-OUT connection diagram

4.6 Status display

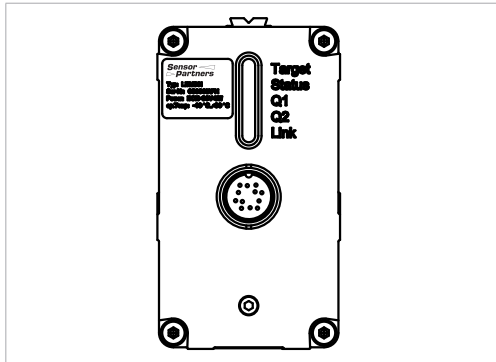


Fig. 11: Status display

LED	Function	Display	Status
Target	Reflectance	Off	No signal
		Red blinking	Very weak signal
		Red	Weak signal
		Yellow	Signal available
		Green	Good signal
		Green blinking	Very good signal
Status	Readiness for action	Off	No operating voltage
		Red	Technical defect, operating voltage supplied
		Green	Ready for action
Q1	Switching output 1	Off	Off
		Yellow	Operating voltage supplied
Q2	Switching output 2	Off	Off
		Yellow	Operating voltage supplied
Link	Interface status	Off	No field bus
		Red	Profibus error
		Yellow	Operating voltage supplied, Profibus inactive
		Green	Operating voltage supplied, Profibus working

Tabelle 3: Status display - functions

4.7 Pilot Laser

The pilot laser (→ Fig. 2, Ziffer 7) is intended to support alignment to a given target point during start-up action of the SP LAM 301. It qualifies as a class 2 laser device and operates at 635 nm (red) in the visible range. The pilot laser is not aligned to emit in a direction parallel with the measurement laser. Instead, its beam intersects with that of the measurement laser at a distance of 75 m.

Fig. 9 shows the tolerance on pilot laser position in relation to the invisible measurement laser as a function of the distance to an object being measured:

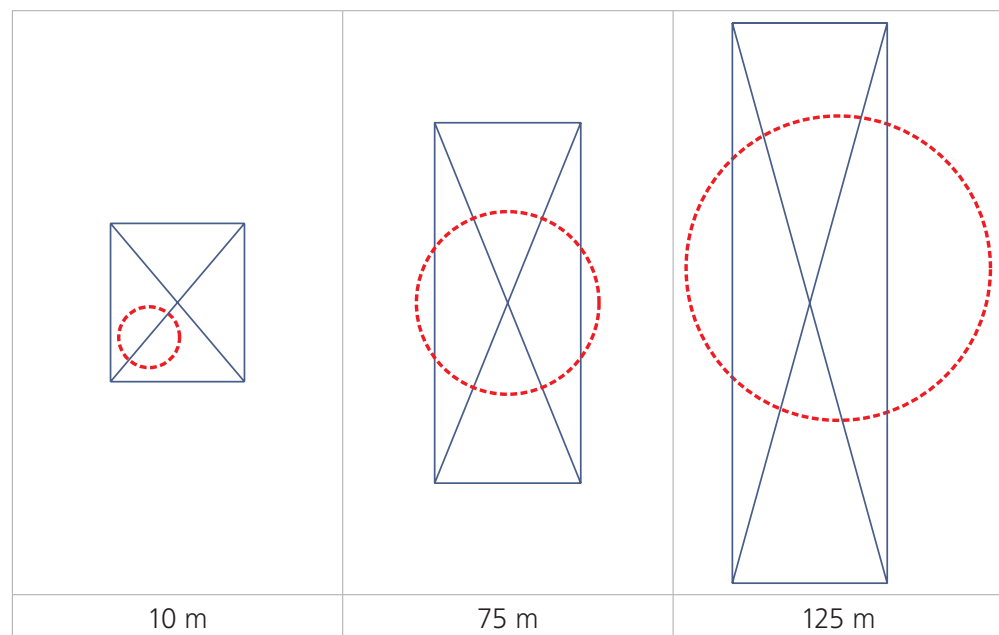


Fig. 12: Tolerance on pilot laser position relative to measurement laser

4.8 Accessories

4.8.1 Adapter Plate

An adapter plate can be supplied for mechanical attachment of the SP LAM 301. Once screwed to the bottom of the SP LAM 301, it will provide various application options, including a 1/4 -20 UNC tripod socket. (drawing → Exhibit 1)

4.8.2 Anti-Dust Tube

The purpose of the anti-dust tube is to protect the receiver channel from contamination and laterally incident steady light and potential impairment of measuring performance. (drawing → Exhibit 2)

5 Interface Description

For interfacing, the SP LAM 301 provides a main connector port (→ Fig.: 3, reference 11) with RS232 or RS422 interface and an additional SSI interface (→ Fig.: 4, reference 16) or Profibus interface (→ Fig.: 4, reference 18,19), depending on the Customer's request.

5.1 Main Connector Port

5.1.1 RS232 or RS422 Interface

5.1.1.1 Communication Protocol

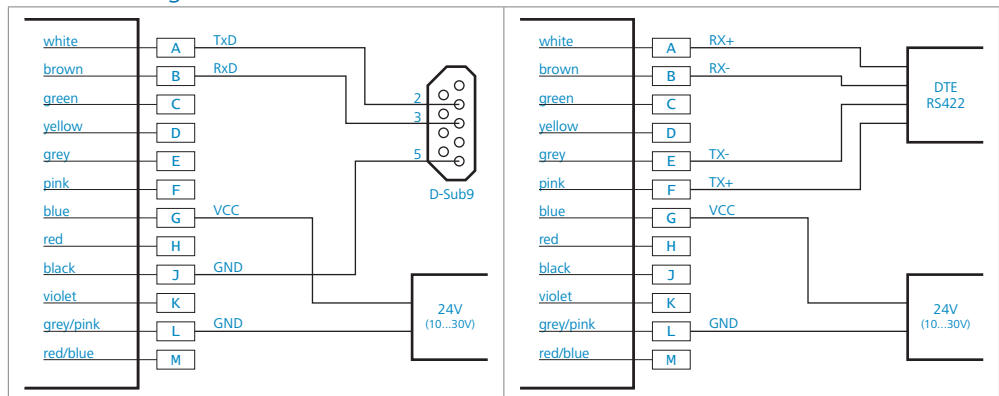
- Interface settings: asynchronous, 8 data bits, no parity, 1 stop bit
- Communication protocol format/syntax: 7-bit ASCII
- Proprietary communication protocol
- Commands are case-sensitive (no distinction between small lettering and capital lettering)
- Period "." (0x2E) serves as decimal separator for output of numbers
- Enter (0x0D) is used as command (send command) termination character
- With multi-value parameters, space (0x20) is used between each two values
- A parameterization command with new parameters triggers a response command with these parameters
- A parameterization command without new parameters triggers a response command with (most recent) parameters
- A parameterization command with parameters out of valid setting ranges triggers a response command with (most recent) parameters
- An unknown command and a faulty parameter format is quitted via "?" (0x3f)

Command group	Command	Description	Standard(s)	Range(s)
Operation Mode	DM	Single distance measurement	-	-
	DT	Continuous distance measurement	-	-
	DF	Single distance measurement with external triggering	-	-
	VM	Single speed measurement	-	-
	VT	Continuous speed measurement	-	-
Status	TP	Internal device temperature in °C	-	-
	PA	All-parameter display	-	-
	HW	Hardware diagnosis	-	-
Setup parameter	PR	Reset to factory settings	-	-
	DR	Triggers a cold start	-	-
	ASs	Autostart function	ID	ID, ID?, DM, DT, DF, VM, VT, TP, HW, PA, MF, TD, SA, SF, MW, OF, SE, Q1, Q2, QA, BR, SD, TE, BB, AB, SC, PL, AS
	MFx	Measuring frequency [Hz]	2000	1 to 2000

Command group	Command	Description	Standard(s)	Range(s)
	TDx y	External trigger delay [ms] and trigger level [edge]	00.00 0	0 ... 300.00 0 oder 1
	SAx	Mean value	20	1...30000
	SFx	Scale factor	1	± 0.001 ... 10
	MWx y	Measuring window at beginning and end	-5000.000 +5000.000	± float 32 ± float 32
	OFx	Distance offset	0.000	± float 32
	SO	Single distance measurement and acceptance as distance offset	-	-
	SEx	Error mode for Q1, Q2 and QA	1	0 ... 2
	QAx y	Analog output with lower and upper limit	1.000 300.000	± float 32 ± float 32
	Q1w x y z	Q1 switching output with trigger threshold, switching range, hysteresis and switching state	0.000 0.000 0.000 1	± float 32 ± float 32 ± float 32 0 oder 1
	Q2 w x y z	Q2 switching output with trigger threshold, switching range, hysteresis and switching state	0.000 0.000 0.000 1	± float 32 ± float 32 ± float 32 0 oder 1
	BRx	Baud rate	115200	9600, 19200, 38400, 57600, 115200, 230400 oder 460800
	SDx y	Output format of serial interface	0 0	0 ... 2 0 ... 3
	TEx	Terminating character for output via serial interface	0	0 ... 9
	SCx	SSI format	0	0 ... 1
	PLx	Pilot laser	2	0...3
	BBx	Field bus baud rate	0	0
	AB	Bus address	0	0

Table 3: Command summary table

5.1.1.2 Wiring



RS232 wiring on D-Sub9

RS422 wiring

Fig. 13: Wiring serial interface

5.1.1.3 Automatic Baud Rate Detection

The SP LAM 301 is capable of synchronizing its baud rate to that of a remote station (e.g. PC with terminal program).

This requires space (0x20) to be permanently sent to the SP LAM 301 during a powering-up routine. The SP LAM 301 uses its own internal evaluation procedure to identify the baud rate the remote station is working at.

Short instructions:

1. Turn SP LAM 301 off
2. Remote station permanently sends space characters to SP LAM 301
3. Turn SP LAM 301 on
4. SP LAM 301 identifies and outputs baud rate

Once identified, a baud rate will also be preserved after turning power off!

5.1.2 Q1 and Q2 Switching Outputs

The purpose of Q1 and Q2 is to represent distance readings as logic operation data. They report events of positive or negative excession of a preset switching range with a certain amount of hysteresis.

Accordingly, they are perfectly suited for direct reprocessing of monitored quantities such as filling level or for detection of objects.

Parameter settings are made via the serial interface.

The command to achieve this is Q1w_x_y_z (where “_” is equivalent to space (0x20)).

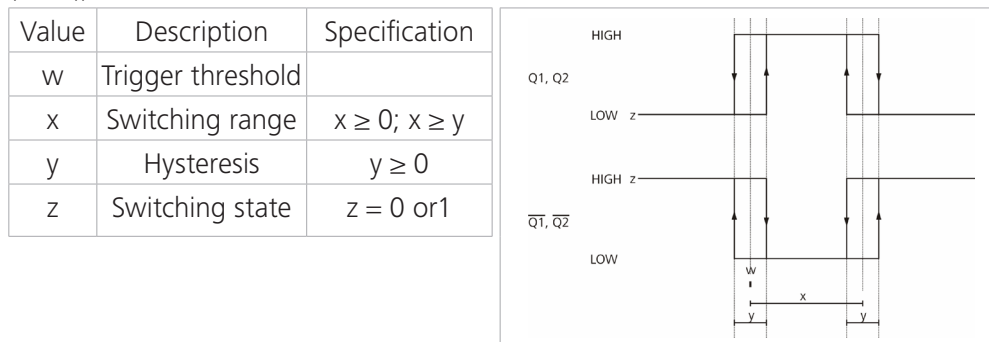


Fig. 14: Switching characteristics of SP LAM 301

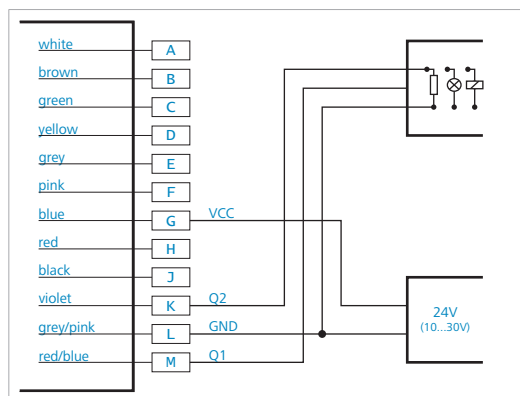


Fig. 15: Example of SP LAM 301 switching output wiring

5.1.3 Analog Output QA

The analog output allows standardized analog data transfers from or to a remote location over greater distances using a two-wire transmission line. The current which is injected into this line at levels from 4 mA to 20 mA is proportional to the measured distance within a selectable distance interval. Parameter settings can be made via the serial interface.

The command to achieve this is QAx_y (where "_" is equivalent to space (0x20)). Parameter settings for current output in the event of measurement failure can be made using the command SEx.

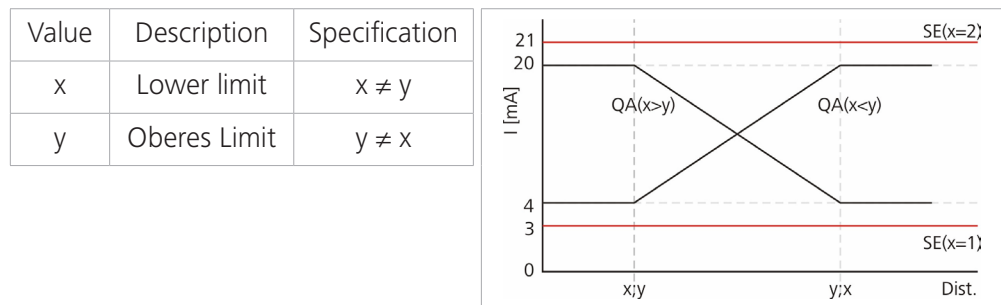


Fig. 16: Signal diagram of SP LAM 301 analog output

The value of output current (in mA) is calculated as follows:

$$x < y \quad QA \text{ [mA]} = 4 \text{ mA} + 16 \cdot \frac{\text{Dist.} - x}{y - x} \cdot \text{mA}$$

$$x > y \quad QA \text{ [mA]} = 20 \text{ mA} - 16 \cdot \frac{\text{Dist.} - y}{x - y} \cdot \text{mA}$$

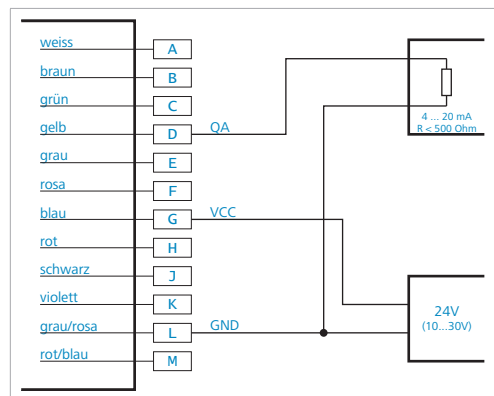


Fig. 17: Example of SP LAM 301 analog output wiring

5.1.4 Trigger Input

The trigger input allows a single distance measurement to be triggered by an external signal that is applied as a voltage pulse. Selectable parameter settings are a value for delay in triggering (Trigger Delay) and the edge on which triggering is to occur (Trigger Level).

Parameter settings for trigger input can be made via the serial interface.

The command to achieve this is TDx_y (where "_" is equivalent to space (0x20)).

The trigger function is enabled in DF measuring mode.

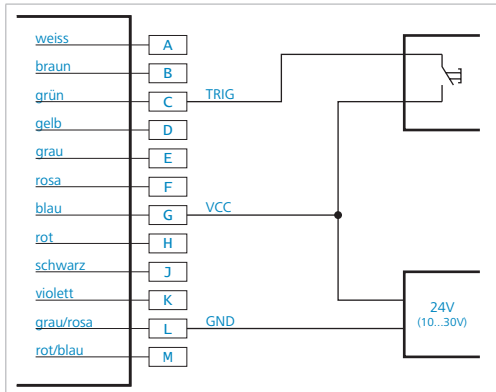


Fig. 18: Example of SP LAM 301 trigger input wiring

5.2 SSI Interface

5.2.1 Specification

Optionally, the SP LAM 301 can be equipped with an SSI data interface (SSI=Synchronous Serial Interface).

At the request of an SSI clock generator a distance measurement cycle will start, sending related data which are present at the shift register bit-by-bit to a controller. Depending on the length and quality of selected data lines, actual transfer rates may range from 50 kHz to 1 MHz with 25 μ s pause time between two bit sequences. The data length is 24 bits plus one validity bit.

The format can be binary or gray-encoded.

For parameter settings via the serial interface, the SCx command is available

SCx	x=0...binary, 25 bits, one validity bit
	x=1...gray, 25 bits, one validity bit

Bit sequence:

24	23	2	1	0
MSB	Bits 1 – 24 distance depending on preset scale factor				LSB

Bit 0: Error bit

5.3 Profibus Interface

5.3.1 ID Number

The SP LAM 301 has been registered under ID number 0AA2 (hex) with Profibus Nutzerorganisation e.V. (Profibus user organization, registered society).

5.3.2 Connection Requirements

The SP LAM 301 may be connected to any kind of Profibus DP structure, the requirement being that the selected Profibus DP master is capable of sending a parameterization telegram, and the master's pertaining editing tool (typically, editing software) will support the representation of parameters that are contained in the respective device master file (GSD file).

5.3.3 GSD File

The GSD file is named LDM30AA2.GSD.

A GSD file includes the two files SP LAM 301.dib and SP LAM 301.bmp. These are intended for representation of the SP LAM 301 in the editing tool. For integration of these files, please consult the special editing tool documentation.

5.3.4 Slave Address

To facilitate multiple-participant bus communication, the Profibus slave address can be set in a range of 0 to 125. A desired address can be set via the Profibus, using the SSA command. For information on how to change the slave address via the editing tool, you should consult the special editing tool documentation. Address 4 is set in as-shipped state of the SP LAM 301.

The slave address is permanently maintained in the EEPROM. It will also be preserved in the event of a voltage failure.

Where more than one slave (SP LAM 301) are to share a common Profibus, the various slaves must be connected one after the other and be assigned different addresses.

5.3.5 Bus Termination

For SP LAM 301 operation, an external bus terminator must be installed. Voltage supply of 5 V required for the terminator is available at Profibus-OUT. This 5 V supply is electrically isolated from general voltage supply (VCC) and rated for a current load up to 100 mA.

The terminating resistor is available as an accessory item.

5.3.6 Baud Rate

The SP LAM 301 has its own device for automatic detection of the following baud rates: 9.6 / 19.2 / 93.75 / 187.5 / 500 k baud and 1.5 / 3 / 6 / 12 Mbaud.

5.3.7 Segment Length

The maximum allowed segment length between to Profibus participants depends on the selected baud rate. The following rules on segment lengths must be fulfilled:

Baud rate [baud]	Segment length [m]
9.6 k – 93.75 k	1200
187.5 k	1000
500 k	400
1.5 M	200
3 M – 12 M	100

To comply with these segment rules, use of cable type A is strongly recommended.
Distinguishing features of cable type A are:

Wave resistance	135 to 165 Ω
Capacitance per unit length	≤ 30 pf/m
Loop resistance	≤ 110 Ω /km
Cable wire diameter	$> 0,64$ mm
Cable wire cross-section	$> 0,34$ mm ²

5.3.8 Electrical Connection

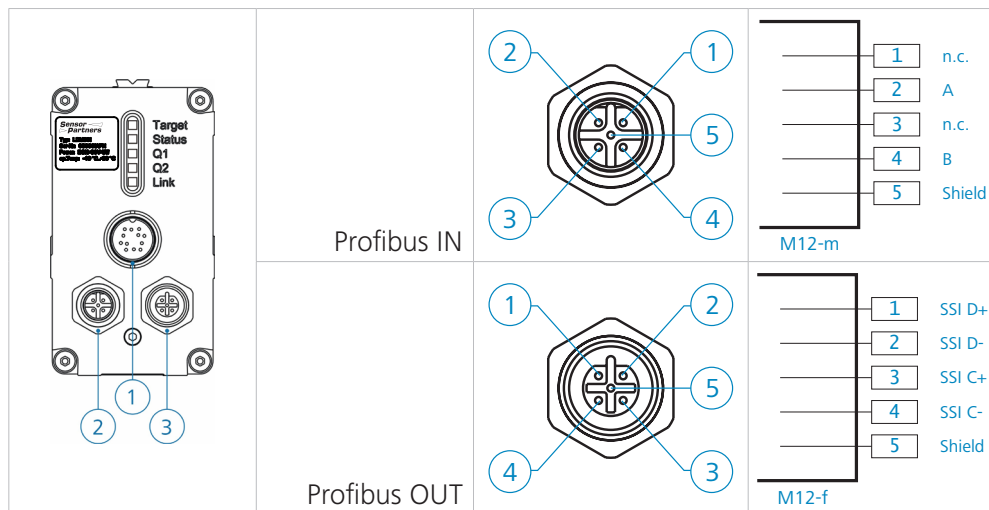


Fig. 19: Pin assignments of M12 connector port

5.3.9 Profibus Firmware Installation

For installation of the Profibus firmware, a PC with Windows 2000 or higher, a Profibus master from Softing, the SL4.exe service program from Sensor Partners BV and related connection cabling are required.

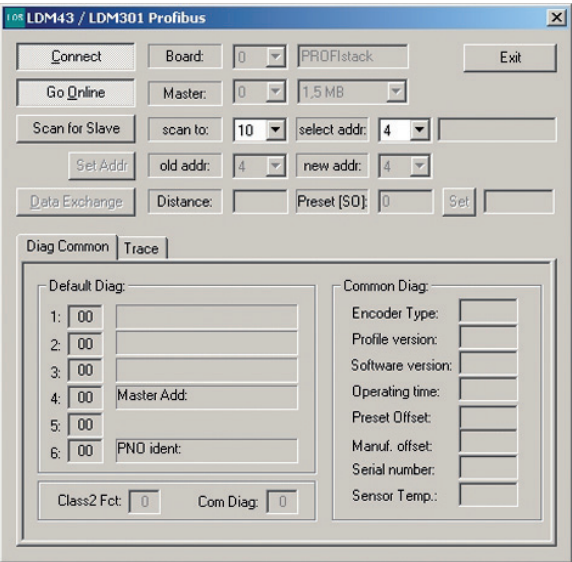
5.3.9.1 Preparation

- Install driver according to manufacturer specifications (Softing)
- Copy SL4.EXE service program and papi.dll file to PC.
- Provide supply of 24 V operating voltage (approximate value).
- Establish Profibus connection between SP LAM 301 and PB master.
- Extend PB to next PB participant or terminate PB at the SP LAM 301 with a terminating resistor (ordering code: 94145).
- Make sure that you use at least version 2.xx or a higher version of the SL4.EXE program.

5.3.9.2 Firmware Installation

Starting SL4.EXE

- 1. Press button “Connect”



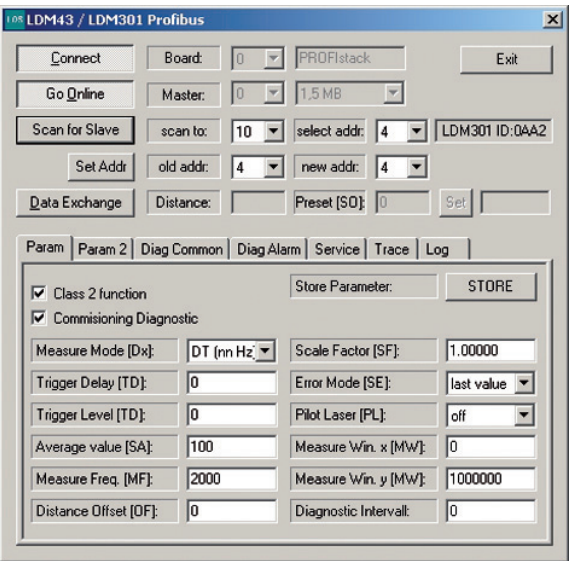
The selected board will turn active and the 'Go Online' button enabled on successful completion.

In the event of problems, you may click on the 'Trace' tab rider with the mouse, in order to have the properties page displayed. It provides additional reported details on the Profibus.

- 2. Press button “Go Online”

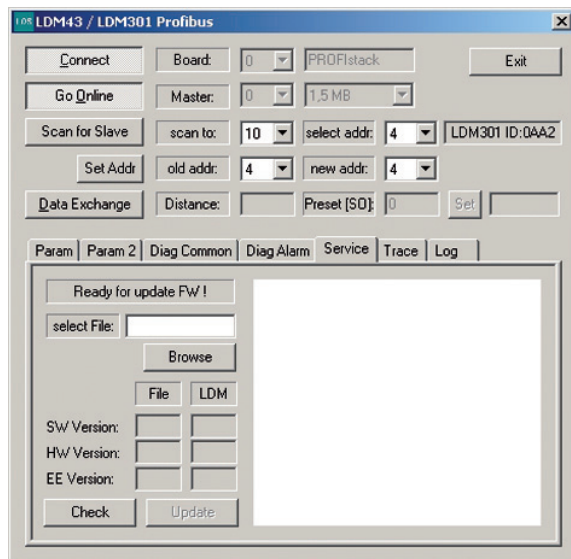
The PB master turns active on the bus. After about two seconds, the 'Scan for Slave' button is enabled. The bus can now be browsed for slaves. A slave search always begins with address 0, omitting the master address. The greatest involved slave address can be defined, in order to shorten the search procedure..

- 3. Press button “Scan for Slave”

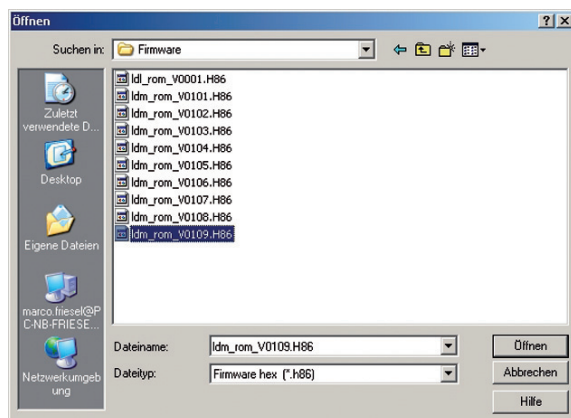


The bus will be scanned and the first encountered SP LAM 301 selected as slave. If a change is made in the slave address ('select addr:'), a diagnostic request will be sent to the slave and the response will display the slave's PNO ident

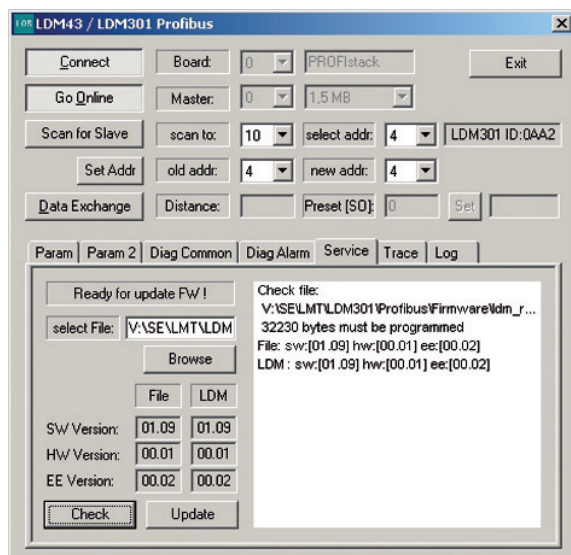
4. Select 'Service' Property Page. The screen displays:



5. Click 'Browse' button to select the firmware file for loading (LDM_ROM.H86). The screen displays:



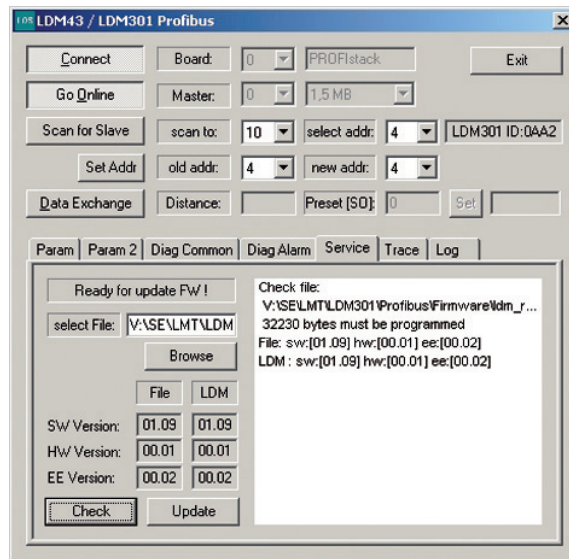
6. Actuate button 'Check'. The result should approximately look like this:



The hardware versions must be identical for a given file and physical assembly. The assembly must be accessible and switchable to update mode on the Profibus (loader available). The currently installed firmware version is displayed below "LDM".

If all settings were found to be correct, the 'Update' button will be enabled

7. Actuate button "Update". The screen displays:



The firmware is loaded.

Status reports are given in the right sub-screen.

5.3.10 Firmware Update via Profibus

The actual application is installed and updated via the Profibus.

To perform a software update, the SP LAM 301 need not be de-installed or disassembled. A firmware update is basically performed in the same manner as software installation (→ section 5.3.9 Firmware Installation).

5.3.11 SL4 Service Program

Once a Profibus master from "Softing" and a related driver (→ Pkt. 5.3.9) are installed, you can launch the service program for LDM30PB (SL4.EXE).

No special installation procedure is required for the program itself (statically linked).

Only "papi.dll" for the Profibus must be contained in the same directory.

Refer to section 5.3.9 for information on how to activate the assembly on the Profibus.

5.3.11.1 Setting a Profibus Slave Address on the SP LAM 301PB

Perform steps 1 to 3 of section 5.2.9. An SP LAM 301PB assembly must have been found on the bus. Its Profibus address can now be modified between 0 and 125 as necessary to account for other participants in bus communication. To make a new address setting, click 'old addr:' to have the previous address setting displayed and click 'new addr:' to select a desired new address. Then actuate button 'Set Addr'. The new address will be transmitted to the PB slave with the help of a 'Set Slave Address' (SSA) Profibus global control tool. The PB slave will work with a new address immediately on receiving it. The new address stays permanently stored in the EEPROM and will also be restored as the new slave address following a power failure.

5.3.11.2 Parameter Dialog

A PB master uses the GSD file to edit parameters for the slave. It must send these at least once to the slave in order to enable the slave to operate in cyclic data exchange mode. Because the slave has been programmed with adequate tolerance, it can be operated with only 7-byte standard PB parameters (i.e. involving no specific user profile parameters). The SL4 generates a complete specific encoder profile set of parameters. This parameter set will be sent to the slave immediately following a change in date (provided that Data Exchange is active).

On pressing button "Store", these parameters will be saved to the EEPROM to stay permanently stored there and be restored as the starting parameters for a restart. They will also be used if the master sends no (user) parameters.

Profibus parameter settings cannot be read back! For this reason, the parameter settings at the moment of SL4 triggering do not match the parameter settings kept in the slave.

Parameter page 1:

Class 2 function:	Selects slave type according to encoder profile
Commissioning Diagnostics:	Sends more than six standard diagnose bytes (16 bytes for class 1 slave, 77 bytes for class 2 slave)
Measure Mode:	Operating (trigger) mode of laser (DF, DT)
Triggerdelay und Level:	Transfers values directly to command TDx (only for DF external)
Averaging:	Transfers value to command SAn (number of values for averaging)
Measuring Frequency:	Number of measurement cycles per second (1 to 2000 or to 1000, respectively). Is transferred to command MFnn.
Offset	A measured value can be assigned a certain offset (corrective value). This value will not be transmitted to the laser module. Instead, it is processed in the very PB assembly.
Scale Factor:	Available scaling factors from -10.0 to +10.0 Up to five post-comma digits can be processed.
Error Mode:	Selects distance value in the event of an error.
Pilot Laser:	Turns pilot laser on, off or into blinking mode.
Measuring Window:	Defines starting point and end point of measuring window.
Diagnostic Interval:	0: sets output of diagnostic data in the case of alarms only 1 to 10000: sets output of diagnostic data at intervals of n x 100ms.

Parameter page 2:

Alarm 1/2:	Sets switching threshold for output n in distance units. Is transferred to command Qn.
Active Range Alarm 1/2:	+/- range for switching outputs in distance units. Is transferred to command Qn.
Hysteresis Alarm 1/2:	+/- hysteresis for switching outputs in distance units, is transferred to command Qn.
Active Range Level Alarm 1/2:	0 or 1 for switching outputs in active range, is transferred to command Qn.

5.3.11.3 Diag Common

General diagnostic data fully comply with the standard profile. They are updated with each Profibus diagnosing request.

The use of "Diag Common" data presumes availability of class 2 functionality and a commissioning diagnostic function. In the case of errors (Enn), an alarm message will be transmitted as Extended Diagnosis containing the full set of diagnostic data. In order to have the current temperature and operating time values displayed, Diagnostic Interval must be set to a value unequal "0".

A Diagnostic Interval setting of 100 will cause a 10 sec updating of data.

Please note that the laser must register and transfer a temperature value in DF modes as a precondition for temperature output. This means that temperatures will not be transmitted unless values were recorded.

5.3.11.4 Diag Alarm

Alarm messages by the laser module are output once in the form of EXT.DIAG.

Active alarms are marked by X instead of -. Alarms are counted, but never saved.

E98 shows problems in communication with the laser module.

Errors are reported as Ext.Diag on occurrence. This is followed by an attempt to re-trigger the laser. As a result, permanently repeating errors will positively increment the content of the related error counter.

5.3.11.5 Service

This function is intended for firmware updates of the assembly (also refer to sections 5.2.9, 5.2.10). As a precondition for updating, the assembly must be connected to the Profibus and be operational. The text field in top left position of the service page shows necessary actions and prerequisites for updating. Once everything is prepared, the Update button can be enabled.

Use the Browse button to select a desired firmware file (e.g. SP LAM 301_V0100.H86) on the harddrive, diskette, etc.

Use the Check button to check the

- a) firmware file and
- b) connected device (SP LAM 301)

for software revision, hardware revision and EEPROM layout revision.

If an SP LAM 301 was acknowledged and the file found to be no SP LAM 301 firmware file or the hardware versions not to match each other, the Update button will remain disabled.

On clicking of the Update button, the firmware will be updated. The loader in SP LAM 301 is activated for this purpose. It has a 0.xx software revision. The previous firmware is deleted, and the new one is loaded and launched.

6 Starting Up

6.1 Preparative Action before Installation

- Remove SP LAM 301 packing with utmost caution
- Check for completeness of scope of delivery
- Inspect Laser Distance Meter and accessory items for visible damage
- Inspect connector terminals and cabling for visible damage

6.2 Checklist on Installation Work

The table below contains a proposal for SP LAM 301 start-up work. It does not claim to be complete. To provide specific user cabling is the responsibility of the user and assumed to be available. It is also the user's responsibility to make application-adapted parameter settings of the Profibus (optional), notably, of the slave address.

No.	Working step
1	Unpack SP LAM 301, inspect for visible damage
2	LMechanically fix LADM30 in working position, use three M4 threaded holes of one of three available mounting pads of the SP LAM 301 for this purpose (→ refer to section 4.4)
3	Insert connector in main connection port and screw connector firmly on. Make sure you do this in power-off state!
4	Install and firmly screw Profibus and SSI connectors (optional)
5	Turn on voltage supply. Status LED must light green
6	Make SP LAM 301 parameter settings via RS232/RS422
7	Direct SP LAM 301 onto target, using the sight pointer or additional sighting device on 11mm-rail
8	Select distance measurement mode
9	Trigger distance measurement (laser turns on, measurement cycle is launched via Profibus or SSI)
10	Use visible laser (pilot laser) to sight a given target
11	Lock the SP LAM 301
12	Final visual inspection

7 Measurement

7.1 Identification

7.1.1 ID – Identification

In response to an ID command, the SP LAM 301 outputs its manufacturing data in this order: product type, firmware version, firmware data, firmware time, fabrication number, date of manufacture and time of manufacture.

Example:

```
SP LAM 301 1.1.16(R) 27.03.2007 11:31 060001 11.04.2007 08:56
```

7.1.2 ID? – Online Help

On triggering an ID? command, the user will be displayed an overview of all available operations and parameters. These are explained in the following sections.

Operation Mode

```
DM[Enter].....single distance
DT[Enter].....continuous distance internal trigger
DF[Enter].....continuous distance external trigger
VM[Enter].....single velocity
VT[Enter].....continuous velocity internal trigger
```

Status

```
TP[Enter].....internal temperature [°C]
HW[Enter].....hardware status
PA[Enter].....display parameter
```

Setup Parameter

```
AS[Enter]/ASxyz[Enter].....display/set autostart command
PL[Enter]/PLx[Enter].....display/set pilot laser
PR[Enter].....reset parameter
DR[Enter].....reset device
SF[Enter]/SFx[Enter].....display/set scale factor
OF[Enter]/OFx[Enter].....display/set user offset
SO[Enter].....set user offset from distance
MW[Enter]/MWx y[Enter].....display/set measure window
MF[Enter]/MFx[Enter].....display/set measure frequency
SA[Enter]/SAx[Enter].....display/set average value
TD[Enter]/TDx y[Enter].....display/set trigger delay level
SE[Enter]/SEx[Enter].....display/set error mode
Q1[Enter]/Q1w x y z[Enter]..display/set digital output Q1
Q2[Enter]/Q2w x y z[Enter]..display/set digital output Q2
QA[Enter]/QAx y[Enter].....display/set analog output QA
BR[Enter]/BRx[Enter].....display/set baud rate RS232/422
SD[Enter]/SDx y[Enter].....display/set data format RS232/422
TE[Enter]/TEx[Enter].....display/set terminator RS232/422
BB[Enter]/BBx[Enter].....display/set baud rate bus
AB[Enter]/ABx[Enter].....display/set address bus
SC[Enter]/SCx[Enter].....display/set SSI format
```

7.2 Operation Mode

7.2.1 DM – Single Distance Measurement

The SP LAM 301 performs exactly one measurement, on completion of which it will wait for next instructions.

The time a measurement cycle requires depends on the number of SA measurement value settings and the preset measuring frequency (MF).

7.2.2 DT – Continuous Distance Measurement

The SP LAM 301 performs continuous distance measurement until halted by a special command (RS232/RS422: Escape = 0x1B).

The output rate of measured values depends on the number of SA measuring value settings and the preset measuring frequency (MF).

7.2.3 DF – Single Distance Measurement with External Triggering

The SP LAM 301 must be transferred to DF operating mode. It will then perform exactly one measurement cycle on receipt of an external trigger signal and wait in DF mode for the next trigger event to arrive.

This operating mode must be terminated with the help of a special command (RS232/RS422: Escape = 0x1B).

Trigger events must be applied to the external trigger input. (→ 5.1 Main Connector Port)

The interval between two single measurements depends on the number of preset SA measurement values, the setting for measurement frequency (MF) and the setting for trigger delay (TD).

7.2.4 VM – Single Speed Measurement

The SP LAM 301 performs 25 single measurement cycles, on completion of which it will use the 25 single readings to calculate a resulting speed.

The length of time, which measurement requires, depends on the number of preset SA measurement values and the setting for measurement frequency (MF).

7.2.5 VT – Continuous Speed Measurement

The SP LAM 301 performs continuous measurement in packages of 25 single measurement cycles. This measuring mode must be halted with a special command (RS232/RS422: Escape = 0x1B).

The time interval between single measurements depends on the preset number of SA measurement value and the setting for measurement frequency (MF).

7.3 Status

7.3.1 TP – Internal LDM Temperature

The SP LAM 301 outputs its internal temperature via the serial interface and the Profi-bus. Temperature values are output in degrees Celsius (°C).

7.3.2 PA – All-Parameter Display

A complete list of parameters is output via the serial interface.

Example:

```
measure frequency[MF] .....2000(max2000)hz
trigger delay/level[TD] .....0.00msec 0
average value[SA] .....20
scale factor[SF] .....1.000000
measure window[MW] .....-5000.000 5000.000
distance offset[OF] .....1.000
error mode[SE] .....1
digital out[Q1] .....20.000 10.000 1.000 1
digital out[Q2] .....1.000 30.000 0.500 1
analog out[QA] .....1.000 300.000
RS232/422 baud rate[BR].....115200
RS232/422 output format[SD].....dec (0), value (0)
RS232/422 output terminator[TE] .....0Dh 0Ah (0)
SSI output format[SC] .....bin (0)
visier pointer[PL] .....2
autostart command[AS].....ID
```

7.3.3 HW – Hardware Diagnosis

Outputs a specific LDM list of characteristics and measured quantities.

7.4 Parameter Setup

Parameter settings can be made via this serial interface.

0x0D as termination character will cause the command to be transmitted to the SP LAM 301.

For commands with one parameter, the parameter can be defined either directly or separated by space (0x20). For commands including several parameters, each two parameters must be separated by space (0x20).

7.4.1 AS – Autostart Function

This function defines how the SP LAM 301 will behave after a cold start. Once a cold start was triggered, the LDM will automatically perform this command and transmit related data via the serial interface.

Query:	AS
Set:	ASs
Parameter value range s:	ID, ID?, DM, DT, DF, VM, VT, TP, HW, PA, MF, TD, SA, SF, MW, OF, SE, Q1, Q2, QA, BR, SD, TE, BB, AB, SC, PL, AS
Standard:	ID

7.4.2 PL – Pilot Laser

PLx defines parameter settings for pilot laser behavior.

Query:	PL
Set:	PLx
Parameter value range x:	0, 1, 2, 3 (→ Table 4: Values for parameter x)
Standard:	2

x	Behavior
0	Off
1	On
2	Blinking (2 Hz)
3	Blinking (5 Hz)

Tabelle 4: Values for parameter x

7.4.3 PR – Reset to Factory Settings

Resets all parameters to their factory settings, except for the baud rate!

Parameters for firmware version 1.1.16:

```

measure frequency[MF] ..... 2000(max2000)hz
trigger delay/level[TD] ..... 0.00msec 0
average value[SA] ..... 20
scale factor[SF]. ..... 1.000000
measure window[MW] ..... -5000.000 5000.000
distance offset[OF] ..... 0.000
error mode[SE] ..... 1
digital out[Q1] ..... 0.000 0.000 0.000 1
digital out[Q2] ..... 0.000 0.000 0.000 1
analog out[QA] ..... 1.000 300.000
RS232/422 baud rate[BR]..... 115200
RS232/422 output format[SD]..... dec (0), value (0)
RS232/422 output terminator[TE] .. 0Dh 0Ah (0)
SSI output format[SC] ..... bin (0)
visier pointer[PL] ..... 2
autostart command[AS]..... ID

```

7.4.4 DR – Trigger Cold Start

DR performs a cold start of the SP LAM 301, simulating an actual voltage break situation. This command may prove useful after changes in the autostart command.

7.4.5 SF – Scale Factor

SF_x allows a measured output value to be scaled via parameter settings for a scale factor x.

Query:	SF
Set:	SF _x
Parameter value range x:	-10 ... -0.001 und 0.001 ... 10; resolution: 0.000001
Standard:	1.000000

7.4.6 OF – Offset

OF parameterizes a user-adapted offset x which is added to the measured value.

Query:	OF
Set:	OF _x
Parameter value range x:	float32; resolution: 0.001
Standard:	0.000

The SP LAM 301 performs **no** plausibility check on a preset offset value. Accordingly, correct parameterization is the user's responsibility!

7.4.7 SO – Set Offset

SO performs one single distance measurement, then sets it as **-OF** (offset).

Function SO can only be carried out. It does not represent a parameter in the actual sense of the word.

SO can be used for zeroing of applications, systems, processes, etc.

7.4.8 MW – Measurement Window

Parameterizes a metrological range by definition of a starting point x and an end point as limits for output of measured values.

Examples of measurement window application:

- Masking out sources of interference before or behind a selected range for measurement
- Definition of a desired range for measurement

A target which is detected before or behind a preset measurement window will create an invalid measured value output.

Query:	MW
Set:	MW _x y
Parameter value range x:	float32; resolution: 0.001
Parameter value range y:	float32; resolution: 0.001
Standard:	-5000.000 ... 5000.000

The SP LAM 301 performs **no** check for plausibility of a preset measurement window. For this reason, it is the user's responsibility to ensure correct parameterization!

7.4.9 MF – Measurement Frequency [Hz]

MF parameterizes the number x of individual pulses to be emitted per second.

Query:	MF
Set:	MFx
Parameter value range x:	-1 ... 2000; resolution: 1
Standard:	2000

For example, MF1000 means that 1000 individual pulses will be emitted each second. The time to measure and, hence, the transmission of a measured result via the serial interface additionally depend on the setting for parameter SA.

Examples:

MF1000, SA1000: measuring time = 1 s (1 measured value per second at serial interface)

MF2000, SA1000: measuring time = 0.5 s (2 measured values per second at serial interface)

MF2000, SA20000: measuring time = 10 s (1 measured value at serial interface every 10 s)

7.4.10 SA – Average

SA Parameterizes the number of single measured values to be averaged for a result of measurement. SA is directly dependent on MF. (also refer to section 7.4.4)

Query:	SA
Set:	SAX
Parameter value range x:	1 ... 30000; resolution: 1
Standard:	20

7.4.11 TD – External Trigger Delay [ms] & Trigger Level [Flanke]

TD parameterizes LDM behavior in external trigger mode (DF).

x designates the delay in triggering a single measurement, in units of a millisecond.

y designates the edge on arrival of which measurement will be triggered:

0 means that measurement is triggered on a falling edge (high-to-low transition)

1 means that measurement is triggered on a rising edge (low-to-high transition)

Query:	TD
Set:	TDx y
Parameter value range x:	0 ... 300.00 msec; resolution: 0.01 msec
Parameter value range y:	0 oder 1
Standard:	0.00 msec 0

If TD x trigger events must have been received before a measurement is output.

7.4.12 SE – Error Mode

Parameterizes the behavior of the two switching outputs Q1 and Q2 and that of the analog output QA in the event of failure to measure [plus the state on completion of a single distance measurement](#).

Query:	SE
Set:	SEx
Parameter value range x:	0, 1 oder 2 (→ Tabelle 5: Values for parameter x)
Standard:	1

x	Q1, Q2 (z=0)	Q1, Q2 (z=1)	QA
0	Latest value	Latest value	Latest value
1	High	Low	3 mA
2	Low	High	21 mA

Tabelle 5: Values for parameter x

The SP LAM 301 performs [no](#) check for plausibility of a selected error mode. For this reason, correct parameterization is the user's own responsibility!

7.4.13 Q1/Q2 – Switching Output

[Q1/Q2](#) parameterizes the behavior of switching output Q1 or Q2. (refer to section 5.1.2)

Parameterizes a measurement range's starting point w, on reaching of which the output will be triggered, the length x of the measurement range, the hysteresis y and logic behavior z.

Query:	Q1/Q2
Set:	Q1w x y z/Q2w x y z
Parameter value range w:	float32; resolution: 0.001
Parameter value range x:	float32; resolution: 0.001
Parameter value range y:	float32; resolution: 0.001
Parameter value range z:	0 oder 1
Standard:	1.000 300.000

The SP LAM 301 performs [no](#) check for plausibility of QA settings. Accordingly, it is the user's responsibility to ensure correct parameterization!

7.4.14 QA – Analog Output

[QA](#) parameterizes the behavior of the QA analog output. (refer to section 5.1.3)

Available for setting are the lower limit x and the upper limit y of a current range from 4 to 20 mA.

The lower limit may both be smaller and greater than the upper limit. Accordingly, the current range will reverse.

Inputs of identical limits will be ignored and not accepted.

Query:	QA
Set:	QAx y
Parameter value range x:	float32; resolution: 0.001
Parameter value range y:	float32; resolution: 0.001
Standard:	1.000 300.000

The SP LAM 301 performs **no** check for plausibility of QA settings. For this reason, correct parameter settings are the user's own responsibility!

7.4.15 BR – Baud Rate

BR facilitates conversion to other serial baud rate x.

Following a change in the baud rate, a cold start is not necessarily required.

Query:	BR
Set:	BRx
Parameter value range x:	9600, 19200, 38400, 57600, 115200, 230400 oder 460800
Standard:	115200

7.4.16 SD – Serial Interface Termination Character

SD parameterizes the format x and content y of serial interface outputs for distance and speed measurement.

Available settings for format are decimal (ASCII), hexadecimal (ASCII) and binary.

Content means that signal strength and/or temperature are available items for output in addition to actual measured value output.

Query:	SD
Set:	SDx y
Parameter value range x:	0, 1, 2
Parameter value range y:	0, 1, 2, 3 (→ Tabelle 6: Values for parameter y)
Standard:	0 0

	SD0 y	SD1 y	SD2 y
y	Decimal	Hexadecimal	Binary
0	Measured value	Measured value	Measured value
1	Measured value + signal strength	Measured value + signal strength	Measured value + signal strength
2	Measured value + signal strength + temperature	Measured value + signal strength + temperature	Measured value + signal strength + temperature

Tabelle 6: Values for parameter y

7.4.17 TE – Serial Interface Termination Character

TE parameterizes the serial interface termination character for distance and speed measurement.

As a necessary requirement, output format SD0 y must be set.

Query:	TE
Set:	TE _x
Parameter value range x:	0 ... 9; resolution 1 (→ Table 7: Values for parameter x)
Standard:	115200

x	0	1	2	3	4	5	6	7	8	9
Hex code	0x0D0A	0x0D	0x0A	0x02	0x03	0x09	0x20	0x2C	0x3A	0x3B
Description	CR LF	CR	LF	STX	ETX	Tab	Space	Comma	Colon	Semicolon

Tabelle 7: Values for parameter x

7.4.18 SC – Format SSI

SC parameterizes format x of SSI code. (refer to section 5.2)

Query:	SC
Set:	SC _x
Parameter value range x:	0 or 1
Standard:	0

7.4.19 BB – Field Bus Baud Rate

Parameterizes the baud rate for field bus operation. (currently unsupported)

Query:	BB
Set:	BB _x
Parameter value range x:	0
Standard:	0

7.4.20 AB – Bus Address

Parameterizes bus address x of the field bus. (currently unsupported)

Query:	AB
Set:	AB _x
Parameter value range x:	255
Standard:	255

8 Preventive Maintenance & Care

8.1 User Maintenance Actions

Please note:

- Dust on optical glass surfaces (transmitter optics, receiver optics) may be removed using a pneumatic brush. However, do not use cleaners containing organic solvents to wipe surfaces of this kind clean. You are advised to contact the Manufacturer in the event of stubborn contamination or soiling.
- Isopropanol is suitable for SP LAM 301 cleaning. Remember not to use solvents for cleaning.
- You are prohibited from opening the SP LAM 301. Failure to comply will void any claims for warranty.
- Do not loosen or remove any screw on the SP LAM 301.

8.2 Software Update

- Firmware updates may not be performed by anyone other than Manufacturer personnel.
- For user-performed Profibus firmware updates, the SL4.EXE program is available.

8.3 Preventive Maintenance by Sensor Partners BV

In the event of necessary repair work, you should carefully pack, enclose a note stating actual operating conditions, and ship the SP LAM 301 to your competent dealer or to us at this address:

Sensor Partners BV
James Wattlaan 7
5151 DP Drunen
Holland

Phone: +31 (0) 416-378239
Fax: +31 (0) 416-377439
Web: www.sensor.nl
E-Mail: info@sensor.nl

9 Malfunction & Error Messages

9.1 Malfunction

Error	Cause	Action for removal
No data via RS232 or RS422	Faulty interface configuration	Check interface configuration
Device error (external diagnosis)	Hardware problems	Reship SP LAM 301 for repair, contact technical support

9.2 Operating Advice

Code	Cause	Action for removal
E02	No target	Check for measuring distance
E04	Laser defect	Reship SP LAM 301 for repair, contact technical support

9.3 Error Messages

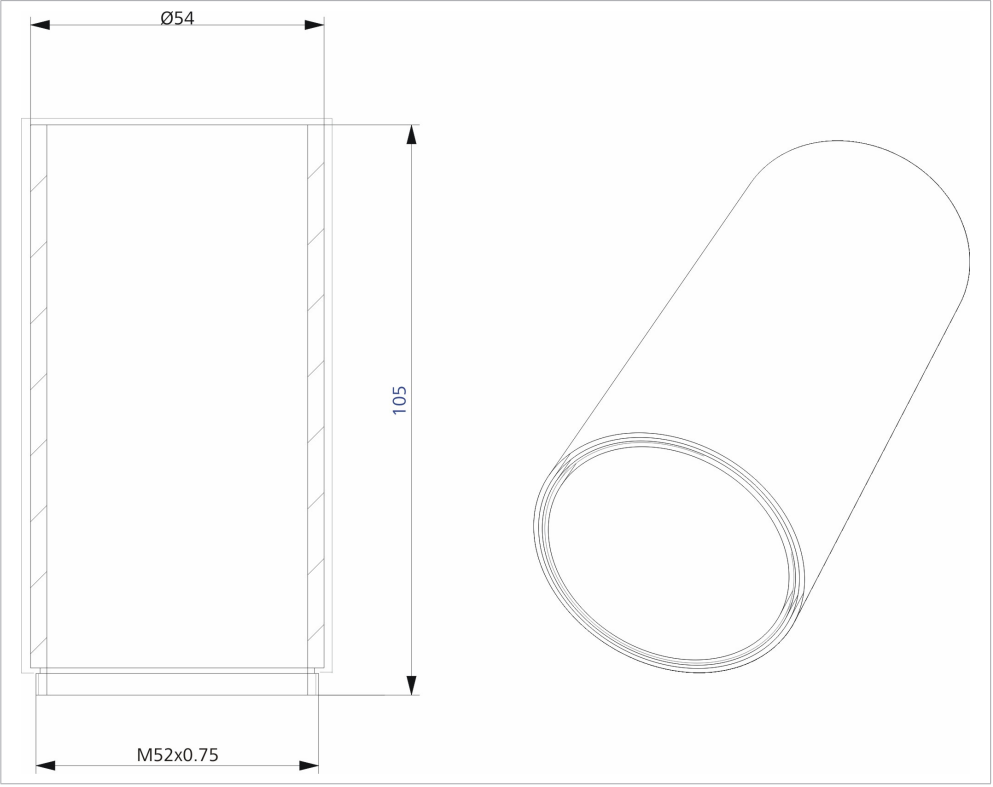
Error	Cause	Action for removal
Red status LED of status display lights	Read error message via RS232 or RS422 interface	Reship SP LAM 301 for repair, contact technical support

10 EC Declaration of Conformity

11 List of Abbreviations & Glossary

DF	Single distance measurement with external triggering
DM	Single distance measurement
DT	Distance tracking
VM	Single Speed Measurement
VT	Continuous Speed Measurement
GSD-Datei	SP LAM 301 master file
ID number	SP LAM 301 registration number with Profibus Nutzerorganisation e.V.
LSB	Least Significant Bit
MSB	Most Significant Bit
SSI	Synchronous Serial Interface

Exhibit 2: Anti-Dust Tube



Sensor ***Partners***

www.sensor.nl
www.sensors.be