
Manual

LDM51A

Firmware Version from 5.14

Version 1.4



Dear User,

You are advised to carefully read this User Manual before turning on the Laser Distance Sensor LDM51A for the first time.

This is necessary to ensure that you will be able to use all the capabilities and features provided by your new purchase.

This product is subject to ongoing technological developments.

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Note:

Proper care has been used in compiling this document. No liability will be accepted in the event of damage resulting from the failure to comply with the information contained herein.

Revision history

Manual Version	Date	Changes
1.4	12.03.2015	Device types added
1.3	30.07.2014	New design

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Used Symbols



Sign warns against emitting visible and invisible laser radiation.



Sign warns against danger of electrical power and of electric shock.



Sign warns against danger.



Sign shows information for use in hazardous environments.



Sign indicates important information regarding device use of the device.



The sign shows protection class 3 (protective extra-low voltage).



Sign indicates degree of protection (IP) of the device.



Sign informs that special guidelines had to be applied for device disposal.

1 General Information

The measurement gauge LDM51A measures contactless the distance between itself and nearly every surface and material.

The LDM51A operates with a modulated visible laser with low beam divergence. Newly developed algorithms and most modern technologies of the opto-electronic signal processing allow a save, highly precise and fast distance measurements that can be applied in almost all areas of machinery and plant engineering.

While developing the LDM51A there was paid particular attention to the operation in outdoor areas with high influence of constant light by solar radiation and high temperatures. By its robust aluminum housing and the optional heating the LDM51A is prepared for safe use in harsh surrounding conditions.

Applications:

- Plant automation and process technology
- Positioning applications in transportation and logistic
- Machine-observation and -positioning in metal industry e.g. rolling-mills, de-coiler
- Position and height detection in crane applications
- Level measurement in silos and heaps on materials like sand, earth, feed, cereals, cement
- Thickness, length and width detection
- Diameter of steel coils
- Distance measurement on hot glowing steel with temperatures over 1300 °C

2 Safety advice

2.1 Basic safety advice

Please read the safety and operating advice carefully, and observe the advice when operating the device.



Danger of Laser radiation

Do not open the LDM51A, otherwise Laser radiation can be emitted that can cause eye injuries. Please observe all information and guidelines for operating the Laser.

The LDM51A corresponds to Laser Class 2 based on the standard IEC 60825-1:2007.

When looking into the laser beam accidentally and for a short moment, the eye will be protected by the eyelid closing reflex.



Danger, electric shock

The LDM51A may only be opened for repair purposes by the manufacturer. If the device is opened arbitrarily without authorization, all warranty claims will expire.



The **operating and storage conditions** have to be observed (see chapter 3). The inobservance of this advice and the adverse use of the device can lead to injuries of the user or to damage of the device.



Connectors may not be plugged or unplugged when voltage is applied. All installation work may only be carried out when no voltage is applied.



The device may only be **operated as intended** and in faultless condition.

Safety installations must not be rendered ineffective.

Safety and warning signs must not be removed.

**Protection Class 3, low voltage**

The device LDM51A operates with low voltage of DC 10 to 30 volts.



Protection degree: In accordance with the **Protection Degree IP 67**, the LDM51A is protected against jet water and dust, and against short submersion into water.

When operating the device under extreme outdoor environmental conditions, the use of additional weather protection is recommended (e.g. a cover plate with a short distance to the LDM51A). Rapid temperature changes can lead to humidity entering the device.



The device is **not shatter-proof**. Do not let the device fall onto the ground, and avoid any shock.

The device is delivered in a solid cardboard box, which is suited for the transport of the device.



The device may **not be used in explosive environments**; otherwise there is the danger of damage to the LDM51A and the surrounding equipment, and of injuries of the user.

2.2 Safety advice for Laser Class 2



Based on the standard EN 60825-1:2007 the LDM51A is in correspondence with laser class 2.

When looking into the laser beam accidentally and for a short moment, the eye will be protected by the eyelid closing reflex. The eyelid closing reflex can be affected by pharmaceuticals, alcohol and other substances.

2.3 Advice for operating device



The LDM51A should not be put into operation when optical parts are fogged or dirty. The optical components of the equipment should not be touched with bare hands!

Dust and dirt are removed from the optical components with

extreme caution! Cleaning with solvents or mechanical means is not allowed



The device must be protected against overheating. The device will not be switched off automatically when the operating temperatures are exceeded. The persisting overheating of the device will lead to a reduced lifetime of the laser diode.



The device must be protected from impact.

The device must be protected from extreme temperature fluctuations. When extreme temperature fluctuations are occurring use additional protection housing.



It is not allowed to operate the device in explosive environments.



The device corresponds to the protection degree IP 67, and is protected against jet water and short submersion. Please observe the conditions for the protection degree IP 67, and observe especially the following advice:

- The device must not be exposed to persisting driving rain or high temperature variations.
- If the device is exposed to humidity, the temperature difference between the device and the environment may be $\pm 5\text{K}$ maximum.



It is necessary to observe the operating and storage conditions.

For the LDM51A use only a supply voltage of 10 V ... 30 V DC (direct current voltage).

The limit values for the input voltage have to be observed. Do not wire inputs as outputs. All outputs are resistant to short circuits. The housing is galvanically separated from the sensor electronics assembly. The interference resistance at electrostatic discharge (ESD) is 4 kV according to IEC 61326-1.

2.4 Norms

The device conforms to the following norms:

- IEC 61326-1:2006 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2006); German version EN 61326-1:2007
- IEC 60825-1:2007 Safety of Laser products – Part 1: equipment classification and requirements
(IEC 60825-1:2007), Laser Class 1
- IEC 61010-1:2001 Safety requirements for electrical equipment for measurement, control and laboratory use - General requirements (IEC 61010-1:2001);
German version EN 61010-1:2001

2.5 Disposal



For the disposal of the device, special environmental protection guidelines apply. Do not dispose the device with the usual domestic refuse. The manufacturer offers to take back the device after the end of the product life cycle, and to dispose of the product in accordance with the effective environmental protection guidelines. Please note that this service is subject to a charge.

3 Operating conditions

3.1 Electrical installation conditions

For the operation of LDM51A use only a DC voltage of 10 V ... 30 V.



The limit values for the input voltage have to be observed. Do not wire inputs as outputs.

All outputs are short circuit proof.

The housing is galvanically separated from the sensor electronics assembly.

The interference resistance at electrostatic discharge (ESD) is 4 kV according to EN 61326-1.

Table 1 : Electrical installation conditions

Electrical installation conditions of LDM51A	
Supply voltage	10 V ... 30 V DC (direct current voltage)
Power consumption	< 10 W (without heating)

3.2 Operating and storage conditions

Operating temperature -10 °C ... +60 °C (special-type -40 °C ... + 60°C)

Storage temperature -40 °C ... +70 °C

Air humidity 15 % ... 90 % not condensing



The mentioned **operating and storage conditions** have to be observed. When the operating temperatures exceed the permitted values, the device will not be switched off automatically. The continuous overheating of the device will reduce the lifetime of the laser diode.

3.3 Appropriate use

The device is intended for the following applications:

Distance measurement and output of measured data via RS-232 or RS-422 interface, analogue output and digital outputs.

It should be noted:

- Operation with correct supply voltage,
- Compliance with environmental conditions, the operating and storage temperature,
- Protection of windows against fogging and soiling,
- Using data lines with specified signal levels,
- Observing of guidelines in this manual.



Measurement through optically transparent material

Measurement through optically transparent materials such as glass, optical filters, acrylic glass etc. can lead to erroneous measurement results. When measuring through optically transparent material, use the function "measurement window". By using this function due to setting a fixed measurement range, a wrong measurement - caused by an optical medium in front of the laser - may be avoided. Please take care that the surface of the medium is clean and clear.

3.4 Improperly use – error sources

The device may only be used when the safety advice described in chapter 2 is observed. The non-observance of the safety advice can lead to damages of the device or to injuries of the eyes.

To achieve correct measurement results, avoid the following error sources:

- Measurement against the sun or other intense light sources
- Measurement onto low reflective target surfaces in highly reflective environments
- Measurements onto highly reflective surfaces (mirror)
- Measurements through glass, optical filter, Plexiglas or other transparent materials can lead to measurement errors
- Two or more LDM51A may not be aligned in "frontal view" because the devices interact each other
- Operation and storage of the device under conditions that do not conform with the specifications



The operating temperatures have to be observed. The overheating of the device has to be avoided in any case. When the operating temperatures are exceeded, the device is not switched off automatically. Persisting overheating of the device leads to a reduced lifetime of the laser diode.

4 Device description

4.1 General device description

The LDM51A distance meter is available in different versions. Types can be selected based on the required interface and on the temperature conditions at the place of application.

LDM51A versions designed for an operating temperature of as low as $-40\text{ }^{\circ}\text{C}$ can be used for applications outdoors or in refrigerated warehouses. The heating element ensures the operating temperature of the components and free optics (no condensation) of the LDM51A.

The required connecting cables are available with straight and angular plug-in connectors. In order to prevent the direct incidence of extraneous light into the device optics, a light protector is available as well that can be screwed onto the device.

Serial interfaces

The LDM51A is equipped with a switchable serial interface. It can operate as RS-232, RS-422 and RS-485. See chapter 5, Interface description.

Outputs

The LDM51A has three switching outputs, an analogue output (4 ... 20 mA). All outputs are parameterizable.

Optional interfaces

The LDM51A can be equipped with an additional Profibus- and/or SSI-Interface

4.2 Device Types

The LDM51 is available in different designs and with different interfaces. The following devices are available:

Table 2 : Device types

Type	Analog output	Profibus	SSI	Heating
LDM51A	Yes	-	-	-
LDM51A-h	Yes	-	-	Yes
LDM51P	-	Yes	-	-
LDM51P-h	-	Yes	-	Yes
LDM51S	-	-	yes	-
LDM51S-h	-	-	Yes	Yes
LDM51SP	-	Yes	Yes	-
LDM51SP-h	-	yes	Yes	yes

4.3 Technical Data

Table 3 : Technical data

Measurement properties	
Measurement principle	Pulse reflection mixing method
Measured parameter	Distances
Measuring range ¹	
total	0,15 m ... 500 m
Onto Oralite 5200 target	50 m ... 500 m
3M 3279 special target	0,15 m ... 100 m
Onto natural surfaces	0,15 m ... 100 m
Measurement accuracy ²	
Up to 20 Hz measuring frequency	± 1 mm
All measuring frequencies	≤ 2,5 mm
Resolution of measured values	± 0,1 mm
Measuring period, minimum	10 ms

¹ Range for natural, diffusely reflective surfaces; dependent on target reflectivity, stray light, measuring frequency and environmental conditions

² For single measurement, 1 Sigma

Electrical connection conditions

Supply voltage	10 V ... 30 V DC
Power consumption	< 10 W (without heating) < 42 W (with heating, 24 V)

Laser

Laser classification	Laser class 2, EN 60825-1:2007
Laser Wavelength	635 nm
Laser Divergence	< 0,2 mrad (50% laser power)
Laser spot in 10 m	4 mm × 5 mm

Environmental and application conditions

Operating temperature	-40 °C ... +60 °C, with integrated heating -10 °C ... +60 °C, without heating
Storage temperature	-40°C ... +70°C
Humidity	15% ... 90%, non-condensing
Housing protection class	IP 67
Shock resistance	
Persistence shock	30 g / 6 ms, DIN ISO 9022-3-30-03-2
Continuous shock	10 g / 6 ms, DIN ISO 9022-3-31-01-1(2)
Swing (sine shaped)	1g / 10 Hz ... 2000 Hz, DIN ISO 9022-3-36-02-1(2)
EMV	EN 61326-1
Dimensions	120 mm x 76,5 mm x 40 mm
LxBxH incl. connections	
Weight	Ca. 700 g

Interface	
Connections	1x 12-pole, M16 2x 5-pole, M12 B-encoded 1x 5-pole, M12 A-encoded
Serial interfaces	RS-232, RS-422, RS-485
Switching output	3x "High side", belastbar bis zu 0,2 A
Analogue output	4 mA ... 20 mA Error handling at 3 mA / 21 mA Total output error at 20 mA: 0,15 % at a temperature of 25 °C
Trigger, in- and output	1x
Profibus	
Profibus	DP-V0 Slave IEC 61158 / IEC 61784
Transmission rate	9,6 kBaud ... 12 MBaud
Identity number	0E36 HEX
Baud rate recognition	Automatic
Terminator	external
Slave address	Can be set via display or SSA command
GSD-File	LDM50E36.GSD, PNO-Profile Encoder Class 1/2
	Configuration of measurement parameters, switching outputs, trigger connection and starting behavior
	Output of measured distance values or error messages, monitoring of internal device temperature
	Storage of all parameters and PB address in NVRAM
SSI	
Transmission rate	200 kHz, 25µs Pause
Signal input/output	Difference signal(RS-422)
	24 bit, binary or Gray-encoded, adjustable

Interface

	1 validity bit
Potential separation	500 V for signal input
LSB	Bit 0
MSB	Bit 23 (optional Bit 24)

4.4 Laser beam image

The laser beam of the LDM51A has a divergence of 0.13 mrad x 0.17 mrad (width x height).

The diameter of the laser spot in the exit lens measures 4 mm.

The table below shows the size of the laser spot in dependence on the distance. The laser spot has an elliptical shape.

Table 4 : Laser beam image

Distance	Laser spot width	Laser spot height
1 m	5 mm	5 mm
5 m	3 mm	3 mm
10 m	4 mm	5 mm
50 m	5 mm	7 mm
100 m	26 mm	34 mm
200 m	52 mm	68 mm
400 m	104 mm	136 mm
500 m	130 mm	170 mm

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

4.5 Mechanical integration requirements

The LDM51A can be screwed on using 3 (underside) or 2 M6 fastening screws respectively (length to be chosen depending on the counter piece). 3 M6 fastening screws plus washers and washer springs are included in the scope of delivery.



The zero point for measurement is identical with the housing front face.

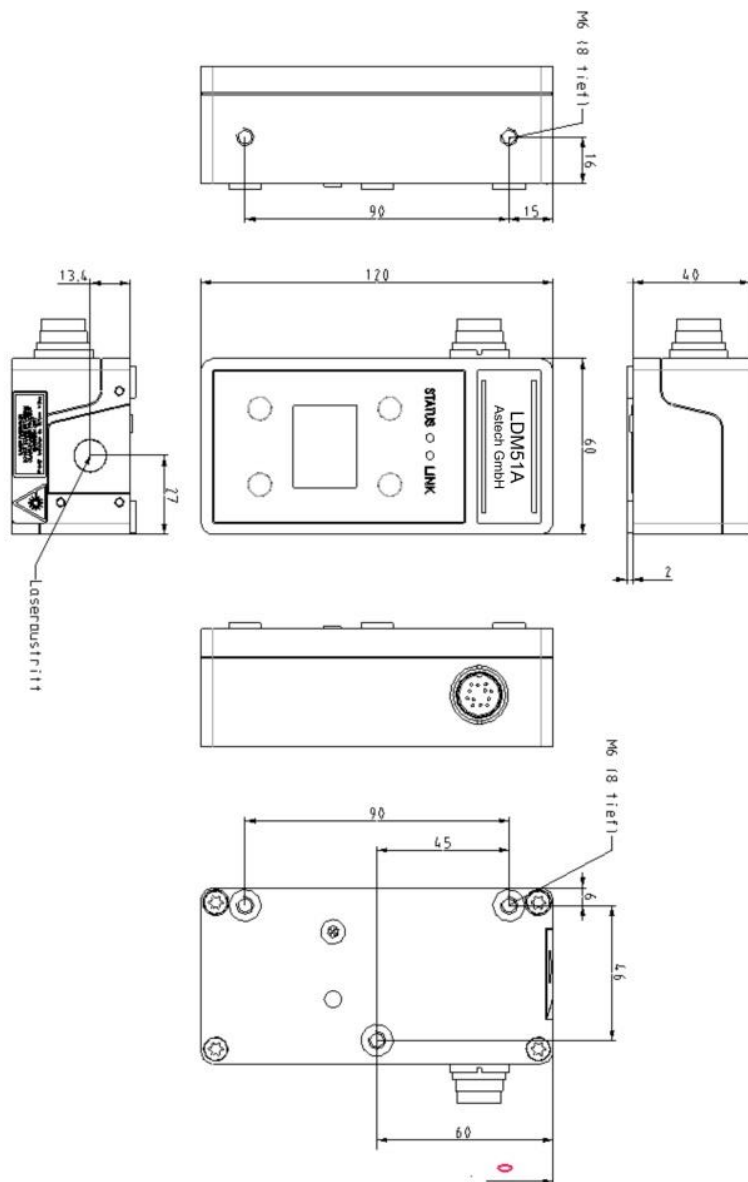


Figure 1 : Installation and mounting (in mm)

4.6 Connector pin assignments

The device is connected via interface cable. Various cable lengths are available.

Table 5 : Connector pin assignments

Pin	Color code	Signal	Meaning
A	white	RxD/Rx+	RS-232 Receiver data RS-422 Receiver data +
B	brown	Rx-	RS-422 Receiver data -
C	green	TRIG	Trigger input/output
D	yellow	QA	Analog output (3 mA ... 21 mA)
E	gey	TX-	RS-422 Transmitter data -
F	pink	TxD/Tx+	RS-232 Transmitter data RS-422 Transmitter data +
G	blue	Q3	Switching output Q3
H	red	VCC	Power supply 10...30 VDC
J	black	GND _{power}	GND supply voltage
K	violet	Q2	Switching output Q2
L	grey/pink	GND _{Signal}	GND output signal, analog
M	red/blue	Q1	Switching output Q1



The shield of the device cable is to be connected to the shield connector of the equipment, e.g. PLC.

Open and unused cable leads must be insulated. For cable extension only high quality shielded cables has to be used.

There is a reverse polarity protection and an overvoltage protection is guaranteed up to 30 VDC.

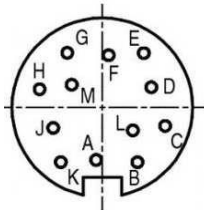


Figure 2 : Interface cable socket top view

5 Interface description

5.1 Interface overview

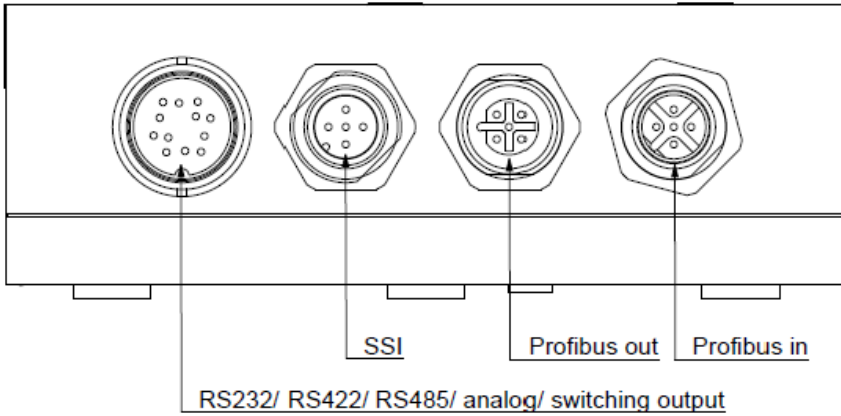


Figure 3 : LDM51A, all connectors

If the LDM51A types with Profibus interface should be used via serial interface only, the Profibus parameter PB must be disabled with command:

PB 0

5.2 Serial interface RS-232

The serial interface RS-232 can be used for the transmission of measured data or the parameterization of the LDM51A.

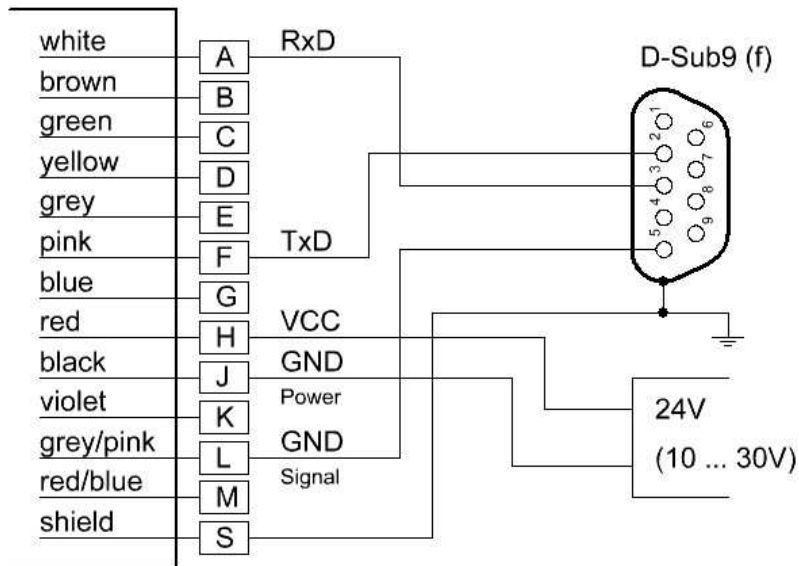


Figure 4 : Wiring of serial interface RS-232

5.3 Serial interface RS-422

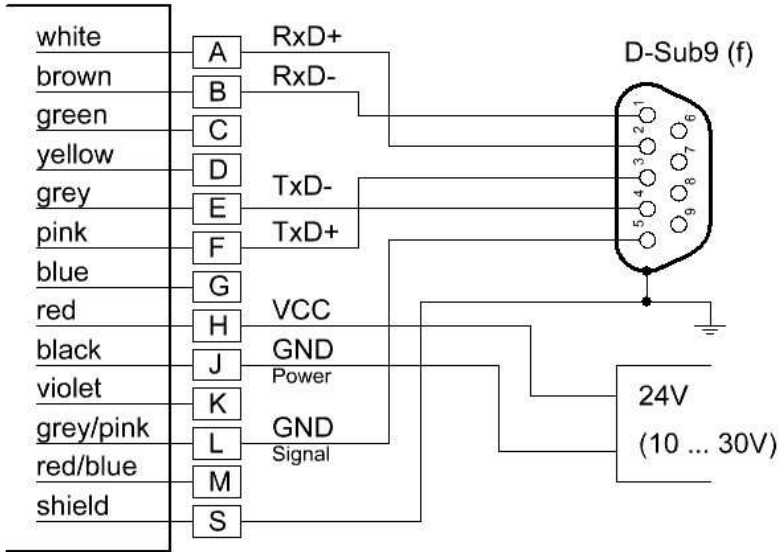


Figure 5 : Wiring of serial interface RS-422



Wiring of D-Sub9 is not standardized for RS-422; please check your system

5.4 Serial interface RS-485

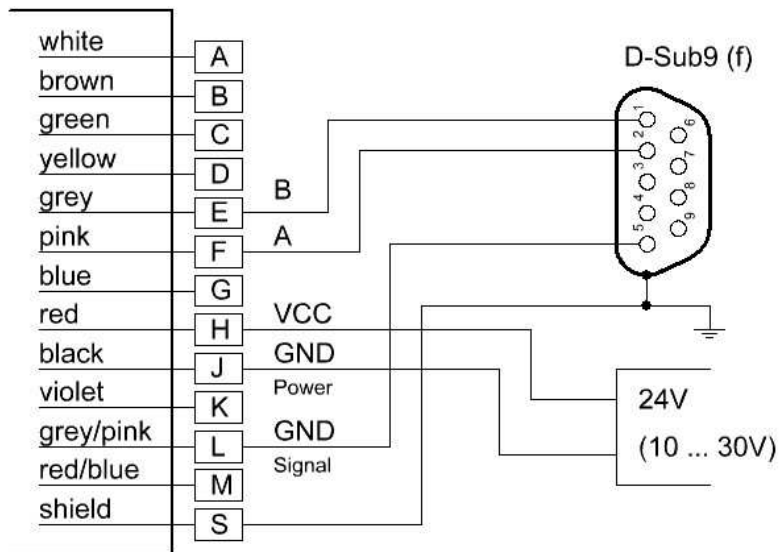


Figure 6 : Wiring of serial interface RS-485



Wiring of D-Sub9 is not standardized for RS-422; please check your system

5.5 SSI – Synchronous serial interface



SSI will be parameterized via serial interface or the internal display of the LDM51A

SSI data interface is optional for LDM51A (SSI = Synchronous serial interface).

At the request of a SSI clock LDM51A starts the output of measuring values and sends the data bit by bit from the shift register of LDM51A(Slave) to a external controller (Master).

It could be used all measuring modes of LDM51A. The active measurement mode will be set via serial interface or profibus or internal display.

Setup via serial interface See page 65, SSI – Setting the SSI parameters

Setup via internal display Parameters / BUS / SSI / SSI mode

SSI work independent of Profibus interface.

Transmission rate 200 kHz

Break duration Minimum 25 μ s (between 2 bit sequences)

Data length 24 bit or 25 bit (programmable)

Format Binär oder gray kodiert

Bit string:

- 1) Data length 24 bits \rightarrow bit 23 – 0 = Data string

Bit	23	22-1	0
	MSB		LSB

2) Data length 25 bits → bit 24 = error bit, bit 23 – 0 = Data string

Bit	24	23-1	0
	MSB		LSB

The inputs (CLOCK) are galvanic isolated, the potential separation is realized up to 500V.

To ensure undisturbed data transfer paired twisted wires are required.

Clock rate	Cable length
< 250 kHz	< 150 m
< 200 kHz	< 200 m
< 125 kHz	< 300 m

Please not that by using of parameter measurement window MW (page 55) and / or Offset OF (page 57) the distance output value has to be in the positive range (distance value > 0).

Otherwise the SSI output will be 000000.

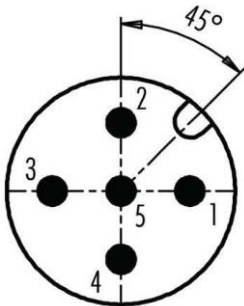


Figure 7 : SSI cable jack pin

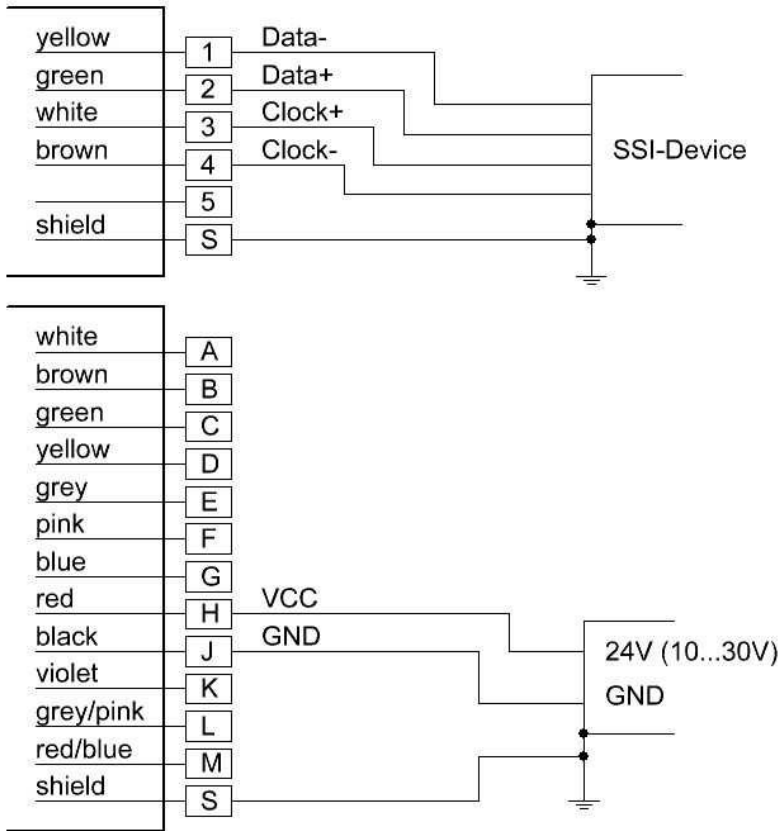


Figure 8 : Wiring of SSI

5.6 Profibus interface

Please see detailed Profibus information in chapter 8, Profibus.

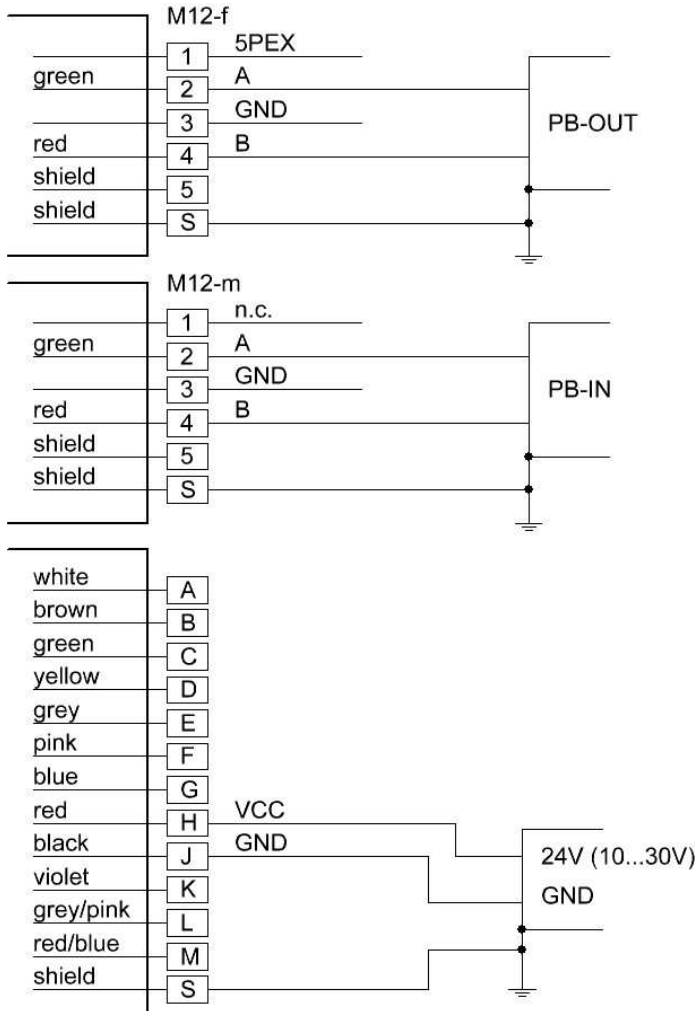


Figure 9 : Wiring of Profibus interface

5.7 Q1/Q2/Q3 – Digital switching output

The switching outputs Q1, Q2 and Q3 show distance information as logic switching information. They signalize when values are above or below a preset switching range subject to hysteresis.

Hence, they are perfectly suitable for the direct further processing of monitoring variables such as filling level or object detection. Parameterization is done via the serial interface

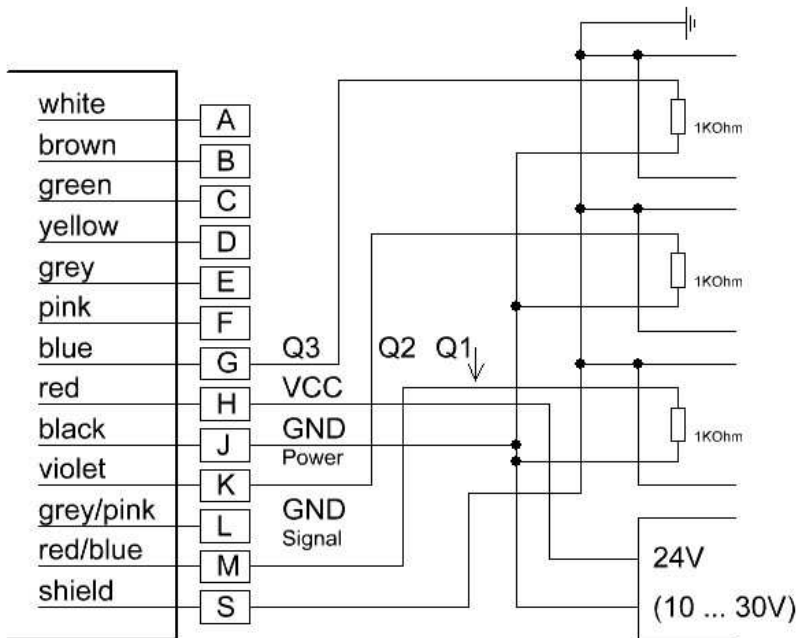


Figure 10 : Wiring of switching outputs Q1, Q2, Q3



A load resistance of $> 150 \text{ Ohm}$ (30 V max. operating voltage: 0.2 A max. load current) must be switched against $\text{GND}_{\text{Power}}$ at the switching output. It is essential that the load current of 0.2 A is not exceeded.

Q1/Q2/Q3 parameterizes the behavior of the switching outputs.

Parameterization covers the beginning w of the measurement range, i.e. the point where the output will switch, the length x of the measurement range, the hysteresis y and the logic behavior z

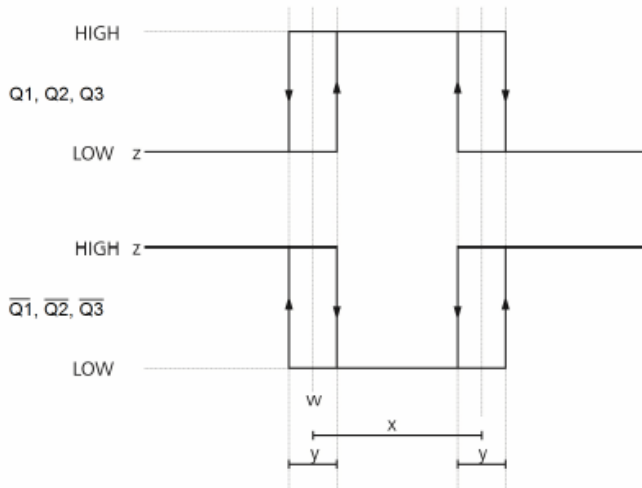


Figure 11 : Behavior and parameters of the switching outputs

LOW = 0

$U < 1 \text{ V}$

HIGH = 1

$U = \text{operating voltage} - 1 \text{ V}$

Variable	Description	Specification
w	Switching threshold	32 bits integer
x	Switching range	32 bits integer
y	Switching hysteresis	32 bits integer $y \geq 0$
z	Switching status	$z = 0 \text{ or } 1$



The LDM51A does not check the settings of Q1, Q2 and/or Q3 for plausibility

5.8 QA – Analog output

The analog output enables the normed, analog transmission of distance data across large distances using a two-wire line. The current of 4 to 20 mA impressed in the line is proportional to the measured distance within an adjustable distance interval. Parameterization is done via the serial interface.

Properties of the analog output:

- 4 mA ... 20 mA
- Indication in case of an error: 3 mA or 21 mA (selectable via the parameter SE)
- Resolution: 12 bit DA-converter
- Load: 100 Ohm ≤ R ≤ 500 Ohm/0,5W

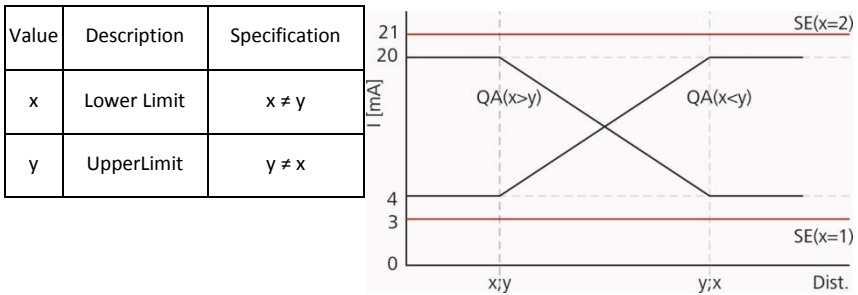


Figure 12 : Signal diagram of LDM51A analog output

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

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

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

Figure 13 : Behavior of analog output



The LDM51A does not check the QA settings for plausibility. The user is responsible for correct parameterization.

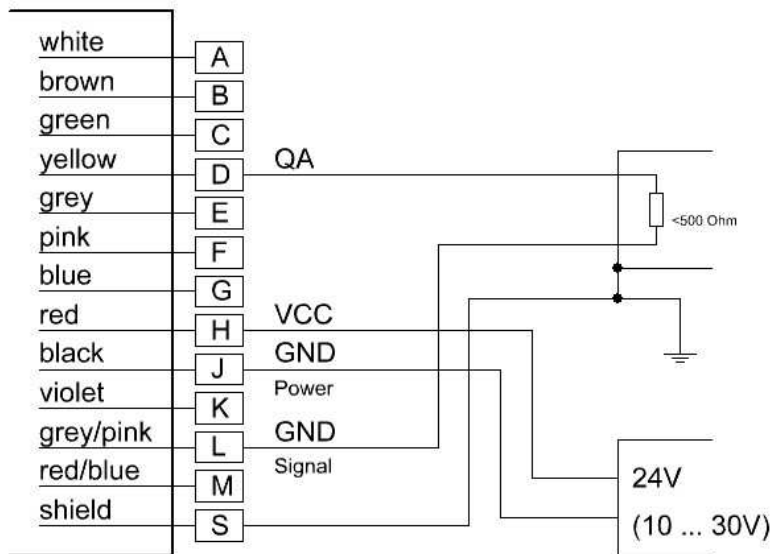


Figure 14 : Wiring analog output QA of LDM51A



Where current/ voltage is to be converted, a load resistance of $100 \text{ ohms} < R < 500 \text{ ohms} / 0.5 \text{ W}$ is to be switched between current output QA and GND.

5.9 TRI + TRO Trigger

Trigger function

The LDM52 Trigger could be used as input or output

Trigger input / external trigger function:

1. External trigger signal will be sent → start of measurement DM in accordance with parameter TRI
2. Trigger output/ e.g. connection between 2 LDM51A

The output trigger signal of the 1. LDM51A (parameterized with TRO) start a single measurement DM of the second LDM51A (parameterized with TRO)

Differences between trigger input and trigger output

Important is the parameter x of TRI and TRO.

TRI x > 0 / TRO x = 0	Trigger input The measurement starts after an external trigger impulse
TRI x = 0 / TRO x > 0	Trigger output The LDM51A sends a trigger impulse to the second device

The parameterization of the trigger connection is carried out via the serial interface or the internal display.



For the trigger function may only activated TRI or TRO. A concurrent use of TRI and TRO is not possible.

→ Output of warning information

Voltage level fort he trigger signals

Low-Pegel	0 V to 1,5 V
High-Pegel	3 V to 30 V
Threshold	2.25 V
Hysteresis	0.1 V

TRI – Trigger input

The parameterization of trigger input will be set with command TRI.

x	edge	Parameterized the edge of trigger signal
		0 Rising edge
		1 Falling edge
		2 Every edge
Y	delay	Parameterized the time up to the measurement in ms

Query: TRI
 Set: TRI x y
 Value range parameter x: 0, 1, 2
 Value range parameter y: 0 ms to 60000 ms
 Standard: 0 0

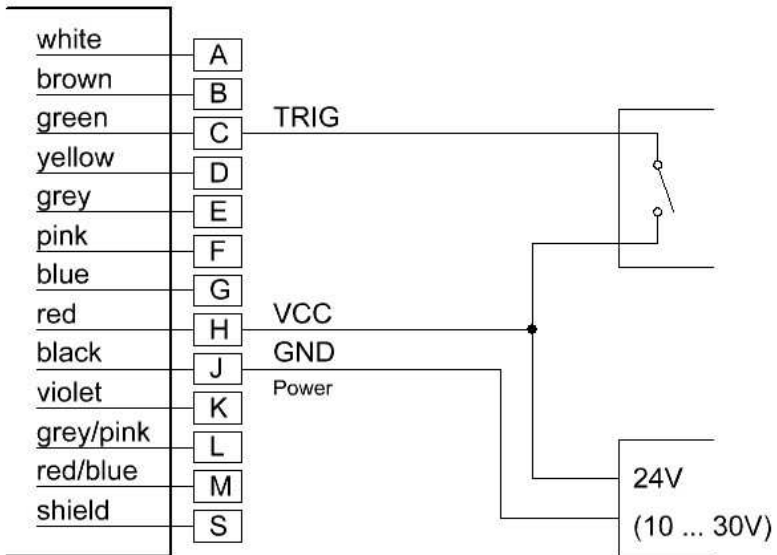


Figure 15 : Wiring of trigger input

TRO – Trigger output

The parameterization of trigger output will be set with command TRO.

x	edge	Parameterized the edge of trigger signal
		0 Rising edge
		1 Falling edge
		2 Every edge
y	delay	Parameterized the time (delay) up to the measurement in ms

Query: TRO
 Set: TRO x y
 Value range parameter x: 0, 1, 2
 Value range parameter y: 0 ms to 60000 ms, disabled at 0 ms
 Standard: 0 0

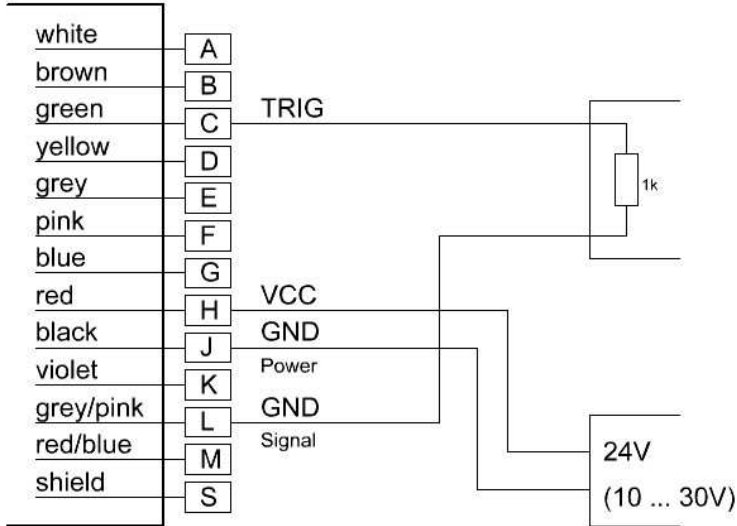


Figure 16: Wiring of trigger output

6 Start-up LDM51A

6.1 Preparation of start-up

- Remove the packaging of the LDM51A
- Check scope of delivery for completeness
- Check device and accessories for damages
- Check connections and cables for damages

6.2 Start-up checklist

The following table shows an example procedure for commissioning the LDM51A. The table raises no claim of being complete. The application-specific wiring is required. The user is responsible for the installation of the application-specific wiring.

Table 6 : Start-up LDM51A

Nr.	Work step
1	Unpack the LDM51A and check for damages
2	Mount the LDM51A at the target location (with 2 screws through the side face or 3 screws through the bottom (4.4) Roughly direct it at the target surface
3	Plug and firmly screw on the interface cable in the de-energized condition.
4	Connect and firmly screw on the Profibus and SSI connections(optional)
5	Wire the open cable end. Energize. Green status LED must light up
6	As soon as STATUS LED is green, the red laser beam will be visible. Precondition: AS DT (default value). Mechanical fine adjustment can be executed.
7	Parameterize the LDM51A via the menu navigation on the display. Alternatively parameterize the device using a terminal program.
8	Activate the distance measurement mode (e.g. DT)

Nr. Work step

- 9 Start the distance measurement (laser is switched on).
Measurement output and Status- LED must be checked. Stop the distance measurement mode.
Alternative: Start measurement via Profibus.
The SSI measurement mode is to be defined in the AUTOSTART AS command
- 10 Final visual check

Before switching on the power supply make sure that all cable ends are protected against short circuits!

Connect cable terminals as required for the particular operating mode. To prevent short circuits, seal unused cable ends!

For starting-up, a PC with RS-232 or RS-422 data interface and a terminal program are required. We recommend the Windows program LDMTool Version 4.8 or higher (see Figure 17 Program LDMTool).

RS-232 to USB converter are available optionally.

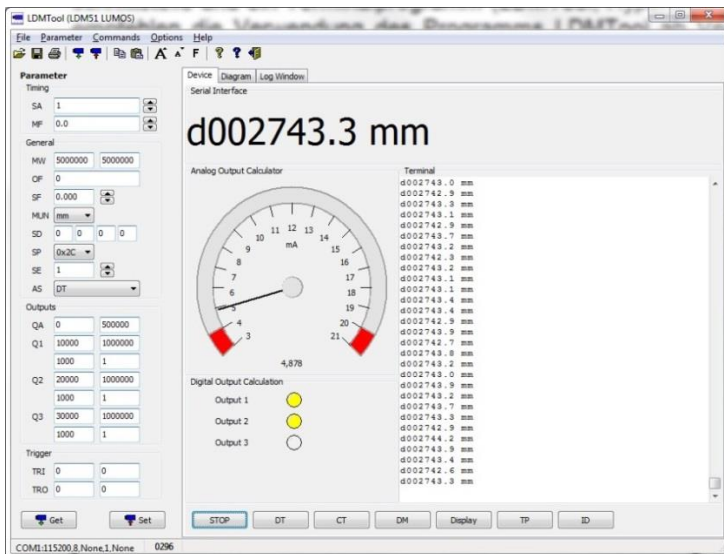


Figure 17 : Program LDMTool

6.3 Ranges and accuracies

The tables below show the ranges and accuracies in relation to the target surface for outdoor applications. For indoor applications the measuring range could be larger. The measuring range depends on target reflectivity, stray light, measuring frequency and environmental conditions.

Table 7 : Ranges and accuracies

Target	Measuring frequency	Measuring range	Maximum accuracy
white, matt, reflectivity approx. 80 %	Variable	15 cm ... 100 m	± 1 mm
	20 Hz	15 cm ... 40 m	± 1 mm
	50 Hz	50 cm ... 35 m	± 2,5 mm
	100 Hz	50 cm ... 30 m	± 2,5 mm
grey, matt, reflectivity approx. 13 %	Variable	15 cm ... 50 m	± 1 mm
	20 Hz	15 cm ... 25 m	± 1 mm
	50 Hz	50 cm ... 18 m	± 2,5 mm
	100 Hz	50 cm ... 10 m	± 2,5 mm
black, matt, reflectivity approx. 6 %	Variable	15 cm ... 20 m	± 1 mm
	20 Hz	15 cm ... 10 m	± 1 mm
	50 Hz	50 cm ... 10 m	± 2,5 mm
	100 Hz	50 cm ... 10 m	± 2,5 mm
Reflective tape 3M 3279 special	Variable	50 cm ... 100 m	± 1 mm
	20 Hz	50 cm ... 100 m	± 1 mm
	50 Hz	50 cm ... 100 m	± 2,5 mm
	100 Hz	50 cm ... 100 m	± 2,5 mm
Reflective tape Oralite 5200	Variabele	50 m ... 500 m	± 1 mm
	20 Hz	50 m ... 450 m	± 1 mm
	50 Hz	50 m ... 300 m	± 2,5 mm
	100 Hz	50 m ... 250 m	± 2,5 mm

6.4 Measurement involving moving targets

Where measurements involve a moving object or the LDM51A is moved during measuring, this will have an impact on the accuracy of the measured value.

This must be observed particularly when calculating average values (parameter SA – Average value).

The speed of the moving object may be 20 m/s at the highest.

Measurement jumps of > 30cm and/or considerable changes in the reflectivity of the target surface can prolong the measurement period.

In case of a fixed measuring frequency (parameter MF – Measuring frequency [Hz]), this may result in no measured value being generated within the predefined time. A warning or error message will be displayed instead.

7 Description of commands

7.1 Overview of commands

Table 8 : Overview of commands

Command-Class	Command	Description	Standard(s)	Range(s)
Operation Mode	DM	Individual distance measurement	-	-
	DT	Distance tracking	-	-
	CT	Continuous tracking	-	-
Status	TP	Internal temperature in °C	-	-
	PA	Output of a parameter list	-	-
Identification	ID	Identification	-	-
	ID?	Online help	-	-
Setup Parameter	PR	Resetting parameters to factory settings	-	Not included: BR, RS, SB, SSI, PB
	SAX	Average value	1	1 ... 50
	MFx	Measuring frequency in Hz	0	0.0 ... 100.0
	MWx y	Measurement window	x = -5000000 y = 5000000	± float 32 ± float 32
	MUNx	Unit of the measured value	mm	mm, cm, dm, m, in/8, in/16, in, ft, yd

Command-Class	Command	Description	Standard(s)	Range(s)
	SFx	Scale factor	0	-10.000 ... 10.000
	OFx	Distance offset	0	-5000000 ... 5000000
	SDw x y z	Data format of the serial interface output	0, 0, 0, 0	Parameter w: 0 ... 5 x,y,z: 0 oder 1
	BRx	Baud rate	115200	600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 56000, 57600, 115200, 128000, 230400, 256000
	SBx	Stop bit of the serial output	1.0	0.5 / 1.0 / 1.5 / 2.0
	RSx	Selection of the serial interface	232	232 / 422 / 485
	ASx	Autostart	5	1 ... 24
	TEnn	Terminator for the output of measured values	1	1 ... 10
	SEx	Behavior of outputs in case of faulty measurements	1	0, 1 oder 2
	SPx	Seperator for parameters	1	1 ... 5
	HEx y	Switching threshold for switching the heating on and off	4 10	-40 ... 40 (integer) (Fehler! Verweisquelle konnte nicht gefunden werden.)
	Q1w x y z	Q1 switch output with switching threshold, switching range, Swiching hysteresis and State level	0 100000 2500 1	32-Bit-Interger 32-Bit-Interger 32-Bit-Interger $y \geq 0$ 0 or 1

Command-Class	Command	Description	Standard(s)	Range(s)
	Q2w x y z	Analogous to Q1w x y z	-	-
	Q3w x y z	Analogous to Q1w x y z	-	-
	QAx y	Analog output with lower and upper limit	1 100000	-5000000 ... 5000000 -5000000 ... 5000000
	PB	Setting the Profibus parameter	-	-
	TRI x y	Parameters of trigger input	0 0	0, 1, 2 (edge) 0 ... 60000 (delay in ms)
	TRO x y	Parameters of trigger output	0 0	0, 1, 2
Additional Commands	DF	Turns off the OLED display	-	-
	DN	Turns on the OLED display	-	-
	LF	Deactivates laser diode	-	-
	LN	Activates laser diode	-	-
	SDT	Deactivates tracking modes	-	-
	SH	Switches off heating unit restart	-	-
	DR	Executes restart (no reset of parameters)	-	-

7.2 General information

The LDM51A is parameterized using the serial interface or the display. Precondition for programming via serial interface connection provided by a terminal program (e.g. LDMTTool (REF) or Hyperterm).

The set parameters are stored in an EEPROM. The last entered data will be available upon restarting.

Retrieval of parameters:

Input PARAMETER <ENTER>

Setting of Parameters:

Input PARAMETER VARIABLE <ENTER>

The variables are described with the individual parameters.

Starting a measurement (operating modes)

Input COMMAND <ENTER>

Stopping a measurement <ESC>

<ESC> = (0x1B)

Entering distances

Always in 0,1 mm(100 µm)

Whenever an incorrect or incomplete command is entered, the following responses are shown:

?	The input does not contain any parameter or command
Parameter with current value	Entry of a parameter with incorrect figure/parameterization

7.3 Transmission protocol

- Interface settings: asynchronous, 8 data bits, no parity, 1 stop bit
- Transmission protocol format/syntax: 7-bit-ASCII
- Commands are case-insensitive (NO differentiation between lower and upper case)
- Decimal separator in the output of figures is dot „.“ (0x2E)
- The terminator of a command (sending command) is the enter key (0x0D, 0x0A) or Carriage Return (0x0D) or Line Feed (0x0A)
- Where parameters have several values, they are separated by a space (0x20)
- The response to commands with parameters is the respective command including the parameters
- The response to commands without parameters is the respective command including the current parameter
- The response to commands with parameters outside of the valid value range is the respective command including the current parameters
- The response to unknown commands and faulty parameter formats is a „?“ (0x3F)

7.4 Operating modes

DM – Individual distance measurement

The LDM51A will perform exactly one measurement and then wait for new instructions.

The duration of the measurement depends on the number of preset measuring values SA and the preset measuring frequency MF.

Typical parameter settings:

MF0, SA1, DM

Execute single measurement, allowing for a sufficient period of time as needed to reliably (accuracy < 1mm) determine the distance to a static (during the measurement) target object.

MFx, SA1, DM

Execute single measurement, allowing for a period of time of maximally 1 / x seconds to reliably (accuracy < 1 mm) determine the distance to a static (during the measurement) target object.

DT – Continuous distance measurement (distance tracking)

The LDM51A performs a continuous measurement.

The measurement can be interrupted by a command:

Display	STOP
RS-232/422/485	Escape = 0x1B

The output frequency of the measured values depends on the selected parameters MF and SA.

The DT mode works with high measuring stability in the collection of the measured values, even in case of beam interruptions and discontinuous motion sequences of the target.

Example response (setting SD 0):

D 0002.935 21.1 57.8

Output format = decimal (D)

Distance = 2,935 m

Signal quality = 21.1

Temperature = 57.8 °C

CT – Continuous tracking

The LDM51A performs an uninterrupted continuous measurement, adjusting the laser parameters (unambiguous ranges) in relation to the target only every 6 seconds or when an obvious distance measurement error has occurred.

The measuring accuracy for frequencies > 20 Hz is higher in the mode CT as in the operation mode DT.

Areas of application:

- Quick measurements on hot surfaces.
- Tracking of continuously quickly moving targets (z.B. crab [crane], vehicle)
- Scanning of static targets



Distance jumps or laser beam interruptions can result in faulty measurements. The warning w1912 is issued.

7.5 Identification commands

ID – recognition

When entering the command ID, the LDM51A will respond by displaying the manufacturer's data in the following order: Device type, serial number, manufacturer's part number, firmware version, time stamp.

Example:

LDM51A 130007 012890-001-22 V5.13.1021 13-10-23.10:10

ID? – Online help

By entering the command ID? the user will obtain an overview of all available operations and parameters described in the following sections.

```

Command List: Commands must start with correct beginning, e.g.: "DM2" = "DM 2".
(*) declares the option of adding a positive integer to change the parameter.
(+) declares the option of adding an integer to change the parameter.
(+) declares the option of adding a floating-point number to change the parameter.
(*) declares the option of adding a string (e.g. "cm" in case of MM) to change the parameter.
(%) declares the option of adding a boolean value (0 = false, or 1 = true) to change the parameter.

**Identifications**
ID?          - Prints this help.
ID           - Prints the firmware ID.

**Status/Parameters**
TP           - Prints the temperature of the device.
PA           - Prints all parameters.
PR           - Resets the parameters to firmware defaults.
SA (tu)     - Prints/Changes number of to be fused measurements. Co-domain: [0, 50], (0 == auto).
HF (t)      - Prints/Changes measurement frequency. Co-domain: [0.0, 100.0].
MM (tu tu)  - Prints/Changes the expected range for measurements in decimillimeters.
MM (t)      - Prints/Changes the unit of the measurements. Co-domain: [mm, cm, m, in/8, in/16, in, ft, yd].
MM (t)      - Prints/Changes the offset in decimillimeters. Co-domain: [-5000000, 5000000].
SD (tu tu kb kb) - Prints/Changes the output format.
Q1 (t tu td kb) - Prints/Changes the parameterization of switching output Q1.
Q2 (t tu td kb) - Prints/Changes the parameterization of switching output Q2.
Q3 (t tu td kb) - Prints/Changes the parameterization of switching output Q3.
QA (tu tu)  - Prints/Changes the parameterization of the analog switching output QA.
TA (tu tu)  - Prints/Changes the parameterization of the input trigger TA.
TBO (tu tu) - Prints/Changes the parameterization of the output trigger TBO.
BR (tu)     - Prints/Changes the baudrate of the serial port. Co-domain: [600,1200,2400,4800,9600,14400,19200,28800,38400,56000,67600,115200,128000,230400,256000].
SB (t)      - Prints/Changes the stopbits of the serial port. Co-domain: [0.5, 1.0, 1.5, 2.0].
RE (tu)     - Prints/Changes the mode of the serial port. Co-domain: [232, 485, 422].
AS (tu)     - Prints/Changes the autostart commands. Co-domain: [1 .. 10].
TE (tu)     - Prints/Changes the terminator. Co-domain: [1 .. 10].
SE (tu)     - Prints/Changes the behaviour on errors. Co-domain: [0 .. 2].
SF (tu)     - Prints/Changes the character that separates the values (e.g. distance and temperature). Co-domain: [1 .. 5].
SF (t)      - Prints/Changes the scaling factor. To use [MM] set "SF 0". Co-domain: [(+/-)10.001, (+/-)10.000].
MCT (kb)    - Prints/Changes the tracking mode, started from the menu. Co-domain: [0 = standard, 1 = cautious].
DF          - Turns off the OLED-Display.
DM          - Turns on the OLED-Display.

**Operation Mode**
DR          - Restarts the device (does not reset parameters).
LD         - Prints status of laser diode.
LP         - Deactivates Laser diode.
DM (tu)    - Starts precise measurement, uses tu as average parameter if available.
ST        - Deactivates tracking mode.
CT        - Activates/Deactivates continuous tracking mode.
DT        - Activates/Deactivates tracking mode.
LM        - Activates laser diode.

```

Figure 18 : Output of the ID? command

7.6 Status commands

TP – internal temperature

The LDM51A outputs its internal device temperature in °C.

The internal temperature is about 10 kelvins higher than the ambient temperature.

When the specified temperature range is exceeded or fallen short of, the warning w1904 or w1905 will be generated cyclically. Measurements will not be possible until the temperature has returned to a point within the specified range.

Example: 26°C



The LDM51A user must make sure that the specified ambient temperature (operating temperature) is adhered to. The LDM51A will not be switched off automatically when the temperature is above or below the defined temperature range.

PA – Parameter setting

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

```

Baudrate of serial port [BR]:          115200
Stopbits of serial port [SB]:         1
Serial port mode (RS232/422/485) [RS]: 232
Average [SA]:                          1
Measurement frequency [MF]:           0.0
Minimum distance from target in 'mm / 10' [MW]: -5000000
Maximum distance from target in 'mm / 10' [MW]: 5000000
Offset in 'mm / 10' [OF]:             0
Parametrization of switching output Q1 [Q1]: 0, 1000000, 2500, 0
Parametrization of switching output Q2 [Q2]: 0, 1000000, 2500, 0
Parametrization of switching output Q3 [Q3]: 0, 1000000, 2500, 0
Parametrization of the analog switching output QA [QA]: 0, 1000000
Unit for the distances [MUN]:          mm
Trigger (input) [TRI]:                 0, 0
Trigger (output) [TRO]:                0, 0
Autostart commands [AS]:              DT
Output format [SD]:                    0 0 0 0
Terminator [TE]:                       0x0D0A
Scale factor [SF]:                     0.000
Error mode [SE]:                       0
Separator [SP]:                        0x2C
Standard tracking mode from menu [MCT]: 0

```

Figure 19 : Output of the PA command

7.7 Command for parameter setup

Parameters are set via serial interface. The command will be transferred to the LDM51A with the final character (0x0D) or Carriage Return (0x0D) or Line Feed (0x0A). If commands have only one parameter, the parameter will be inserted directly or separated by a blank space (0x20). If commands have several parameters, these parameters will be separated by a blank space (0x20).

AS – Auto start function

The autostart function defines the behavior of the LDM51A after a cold boot. After the connection to the supply voltage and the internal start-up routine the LDM51A will automatically execute the command and send the data to the available outputs. A figure from the table below must be entered (see Table 9 : Auto start parameters).

Query: AS
 Set: ASx
 Value range 1 ... 24 (see table below)
 parameter x:
 Standard: 5

Table 9 : Auto start parameters

Value x	Command	Meaning
1	ID	Output of device identification
2	ID?	Output of command list
3	TP	Output of internal device temperature
4	DM	Start of individual measurement
5	DT	Start of continuous measurement
6	CT	Start of quick continuous measurement
7	DF	Display is deactivated
8	DF ID	Display is deactivated + Output of device identification
9	DF TP	Display is deactivated + output of internal device temperature
10	DF DM	Display is deactivated + start of individual

Value x	Command	Meaning
		measurement
11	DF DT	Display is deactivated + start of continuous measurement
12	DF CT	Display is deactivated + start of uninterrupted continuous measurement
Only for gauge-types with heating(temperature range -40 °C ... +60 °C)		
13	SH	Heating is deactivated
14	SH ID	Heating is deactivated + output of device identification
15	SH TP	Heating is deactivated + output of internal device temperature
16	SH DM	Heating is deactivated + start of individual measurement
17	SH DT	Heating is deactivated + start of continuous measurement
18	SH CT	Heating is deactivated + start of uninterrupted continuous measurement
19	SH DF	Heating is deactivated + Display is deactivated
20	SH DF ID	Heating is deactivated + Display is deactivated +output of device identification
21	SH DF TP	Heating is deactivated + Display is deactivated + output of the internal device temperature
22	SH DF DM	Heating is deactivated + Display is deactivated + start of individual measurement
23	SH DF DT	Heating is deactivated + Display is deactivated + start of continuous measurement
24	SH DF CT	Heating is deactivated + Display is deactivated + Start of uninterrupted continuous measurement

Depending on the measurement mode used, it takes max. 6 s from applying the supply voltage to the point where the first measured value is put out.

BR – Baud rate

BR enables the adjustment of the serial baud rate x.

As soon as a new baud rate is set, the device will start communicating with the new baud rate.

BR will not be modified upon a parameter reset via (PR)

Query:	BR
Set:	BRx
Range of parameter x:	1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 56000, 57600, 115200, 128000, 230400, 256000
Standard:	115200

SB – Stop bit of the serial output

Set the parameter of the stop bit for serial data transmission

Query:	SB
Set:	SBx
Range of parameter x:	0.5 / 1.0 / 1.5 / 2.0
Standard:	1.0

RS – Serial port

Selection of the serial interface to be used for communication.

Query:	RS
Set:	RSx
Range for parameter x:	232 / 422 / 485
Standard:	232

PR – Parameter reset

All parameters are reset to factory settings, except the baud rate BR, the serial port RS, the stop bits SB, the SSI interface parameters SSI and the Profibus interface parameters PB! We do not recommend using this command. Afterwards the device must be programmed new (auto start, scaling analogue and output etc.).

Example:

```

Parameters set to firmware defaults.
Baudrate of serial port [BR]:                115200
Stopbits of serial port [SB]:                1
Serial port mode (RS232/422/485) [RS]:       232
Average [SA]:                                1
Measurement frequency [MF]:                  0.0
Minimum distance from target in 'mm / 10' [MW]: -5000000
Maximum distance from target in 'mm / 10' [MW]: 5000000
Offset in 'mm / 10' [OF]:                    0
Parametrization of switching output Q1 [Q1]: 0, 1000000, 2500, 0
Parametrization of switching output Q2 [Q2]: 0, 1000000, 2500, 0
Parametrization of switching output Q3 [Q3]: 0, 1000000, 2500, 0
Parametrization of the analog switching output QA [QA]: 0, 1000000
Unit for the distances [MUN]:                mm
Trigger (input) [TRI]:                       0, 0
Trigger (output) [TRO]:                      0, 0
Autostart commands [AS]:                     DT
Output format [SD]:                           0 0 0 0
Terminator [TE]:                             0x0D0A
Scale factor [SF]:                           0.000
Error mode [SE]:                             0
Separator [SP]:                              0x2C
Standard tracking mode from menu [MCT]:       0

```

Figure 20 : Parameter reset with PR command

DR – Release of cold start

DR carries out a cold start of the LDM51A and actually simulates an interruption of the supply voltage. This command is useful for a test if “Autostart”-command was changed for example.

MW – Measurement window

Parameterizes the scope of a measurement window by start x and end y. Only measured values within the measurement window will be put out.

For example, the measurement window can be used to:

- Eliminate interfering objects before or behind a measurement range
- Define a measurement range

If there is no target object within the defined measurement window, an error message will be generated cyclically:

E1203 Target with unsuitable reflectivity

E1207 A target before or behind the measurement window is recognized

Query:	MW
Set:	MWx y
Range of parameter x:	Resolution: 0.1 mm
Range of parameter y:	Resolution: 0.1 mm

The LDM51A does not check the set measurement window for plausibility. The user is responsible for correct parameterization!

MUN – Unit of the measured value

MUNx enables the definition of a unit for the output value. It is shown together with the measured value. In order to use MUN, SF 0 must be set.

Query:	MUN
Set:	MUNx
Range of parameter x:	mm, cm, dm, m, in/8, in/16, in ft, yd
Standard:	mm

MF – Measuring frequency [Hz]

MF parameterizes the number x of the measured value outputs per second.

When a value x outside of the measurement range is entered, the lowest or highest permissible MF value will automatically be set.

Entered value < x → MF 0.0

Entered value > x → MF 100.0

Query:	MF
--------	----

Set:	MFx
Range of parameter x:	0.0 ... 100.0 (Hz); Resolution: 0.1
Standard:	0

MF 0

Automatic measurement. The output frequency ranges between 0.3 Hz and 10 Hz in most cases. Essential factors concerning the measurement period are, among others, the reflectivity of the target surface and the environmental conditions (e.g. light, fog, rain).

OF – Offset

OF parameterizes a user specific offset x that is added to the measured value. It s entered in 0.1 mm.

Query:	OF
Set:	OFx
Range of parameter x:	-5000000 ... 5000000
Standard:	0

The LDM51A does not check the set offset for plausibility. The user is responsible for correct parameterization!

SF – Scale factor

SFx defines a factor by which the output value is multiplied.

Query:	SF
Set:	SFx
Range of parameter x:	-10000 ... 10000
Standard:	0



At SF ≠ 0 the parameter MUN is ineffective.

At SF = 0 the unit defined by MUN becomes effective.

SA – Average value

SA parameterizes the number x of the individual measured values to be averaged for measured value output. SA directly correlates with the measuring frequency MF (see page 56):

Output time in seconds = SA / MF

or

Output frequency in Hz = MF / SA

Query: SA

Set: Sax

Range of Parameter
x: 1 ... 50; resolution: 1

Standard: 1

The spread of the measured values can be reduced by determining average values.

$$\sigma_{SA} = \frac{\sigma_1}{\sqrt{SA}}$$

The following applies:

σ_{SA} Dispersion after mean value calculation

σ_1 Dispersion of single measured value (approx. 5 cm)

SA Number of averaged single measurements

Table 10 : Scattering of distance measurement

f [Hz] = MF	SA	Output frequency [Hz]	σ_{SA} [mm]
20	1	20	± 1,0
20	10	2	± 0,3

SE – Error Mode

SE sets the behavior *x* of switching outputs Q1 and Q2 and of analogue output QA in case of faulty measurements as well as the state after carrying out a single distance measurement. The switching behavior of Q1 and Q2 depends on parameter *z*.

Query:	SE
Set:	SE x
Range of parameter <i>x</i> :	0, 1, 2 (Table 11 : Error Mode SE x , meaning of parameter <i>x</i>)
Standard:	1

Table 11 : Error Mode SE x , meaning of parameter *x*

<i>x</i>	Q1, Q2, Q3 (<i>z</i> =0)	Q1, Q2, Q3 (<i>z</i> =1)	QA
0	Last value	Last value	Last value
1	High	Low	3 mA
2	Low	High	21 mA

There is no plausibility check of the preset error mode. The user itself is responsible for correct parameter setting!

SP – Separator for parameters

Output values are separated by the character SP.

Query:	SP
Set:	SP x
Range of parameter <i>x</i> :	0 ... 5
Standard:	1

<i>x</i>	1	2	3	4	5
Hexcode	0x2C	0x3B	0x20	0x2F	0x09
Symbol	Komma	Semicolon	Space	Slash	Tabulator

HE – Heating adjustment

The parameter HE defines the switching thresholds for switching the heating element on and off. The command is enabled only where the device is actually equipped with a heating element.

Query:	HE
Set:	HEx y
Range of parameter x:	-40 ... 40 (integer)
Range of parameter y:	-40 ... 40 (integer)
Standard:	HE4 10

For switching the heating on or off, the internal measured temperature is compared to the set parameters.

Internal temperature < x (HeatON) Heating is switched on.

Internal temperature > y (HeatOFF) Heating is switched off.

Please observe the following $x \text{ (HeatON)} \leq y \text{ (HeatOFF)}$
when setting the parameterization

MCT – Output/modification of the operating mode when starting a measurement using the display

When starting a continuous measurement using the integrated display, you need to define if the LDM51A should measure based on the operating mode DT or CT.

The operating mode is selected via the command MCT.

When starting a measurement using the display, the predefined operating mode will be applied as a rule.

When a measurement is started using a communication program or PLC, the command DT or CT will determine the type of measurement.

Q1/Q2/Q3 – Switching output

Q1/Q2/Q3 parameterizes the behavior of the switching outputs:

- w begin of measurement range within the output switches
- x length of measurement range within the output switches
- y hysteresis and
- z logical behavior

Query: Q1 or Q2 or Q3
 Set: Q1w x y z / Q2w x y z / Q3w x y z
 Switching threshold w: 32-Bit-Integer
 Switching range x: 32-Bit-Integer
 Switching hysteresis y: 32-Bit-Integer ; $y \geq 0$
 Switching state z: 0 or 1
 Standard: 0 100000 2500 1



The LDM51A does not check the settings of Q1, Q2 and/or Q3 for plausibility

QA – Analog output

QA sets the behavior of the analog output QA (see chapter 5.8).

The lower limit x and the upper limit y of the 4 to 20 mA current range are controlled by QA. The lower limit may be smaller or may be larger than the upper limit. Accordingly the current range is reserved.

Settings of equal limits will be ignored and not stored.

Query: QA
 Set: QAx y
 Range of parameter x: -5000000 ... 5000000
 Range of parameter y: -5000000 ... 5000000
 Standard: 0 1000 (0 m ... 10 m)

The measurement window MW also applies to the analog output.



The LDM51A does not check the QA settings for plausibility. The user is responsible for correct parameterization.

SD – Data format of the serial interface output

SD parameterizes the output format and the possible output values. Possible output values are the distance, the signal quality, the temperature and the switching outputs (active / inactive).

Query: SD
 Set: SDw x y z
 Range of parameter w: 0 ... 5
 Range of parameters x,y,z: 0 or 1 (see Table 13 : Output format of parameters x y z)
 Standard: 0 0 0 0

Table 12 : Output format of parameter w

Parameter w	Output format	Separators between the values	Unit of measure SF 0 + MUNx
0	Decimal	1 separator	Unit
1	Decimal	None	None
2	Hexadecimal floating point IEEE-754	None	None
3	Hexadecimal	None	None
4	Binary	None	None
5	SSI and switching outputs only	None	None

Table 13 : Output format of parameters x y z

Parameter	Value	Signal quality	Temperature	Switching outputs
x	0	Off		
x	1	On		
y	0		Off	
y	1		On	
z	0			Off
z	1			On

Explanation binary output format**Distance value:**

- 4 Byte, MSB = Bit 31
- MSB of Byte 3 always **1**
- MSB of Byte 2, 1 and 0 always **0**
- Measurement data of each Byte = **Bit 6 ... Bit 0**
- Coding: Two's complement

Signal:

- 2 Byte
- MSB = Bit 15
- MSB of Byte 1 always **0**
- Daten = **Bit 6 ... Bit 0**
- No sign bit
- Maximum value: 16383 (14 Bit Data)

Temperature:

- 2 Byte
- MSB = Bit 15
- Sign bit= Bit 14
- MSB of Byte 1 and 0 always **0**
- Data = **Bit 6 ... Bit 0**

Binary format of switching outputs Q1, Q2, Q3:

- 1 Byte
- MSB = Bit 7 (always 0)

Q1 = Bit 2

Q2 = Bit 1

Q3 = Bit 0

1 = switching output on (active)

0 = switching output off

Bit	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	1
	MSB = 0					Q1 on	Q2 off	Q3 on

TE – Terminator of the serial interface

TE is used to set the terminator for the output of measured values in the ASCII format (also see command SD).

Query: TE
 Set: TEnn
 Range of parameter x: 1 ... 10; (Table 14)
 Standard: 1

Table 14 : Termination character(s) TEx, meaning of parameter x

x	1	2	3	4	5	6	7	8	9	10
Hexcode	0x0D 0x0A	0x0D	0x0A	0x02	0x03	0x09	0x20	0x2C	0x3A	0x3B
Description	CR LF	CR	LF	STX	ETX	Tabu- lator	Space	Komma	Colon	Semi- colon

When an invalid character is entered, it will not be set. The current separator will be kept instead.

PB – Setting the Profibus parameters

PB parameterizes the availability of Profibus interface.

Query: PB
 Set: PBx
 Range of parameter x: 0 (disabled), 1 (enabled)
 Standard: 0

For LDM51A types with Profibus interface the default value is PB1 (Profibus enabled).

If LDM51A types with Profibus interface should be used via serial interface only, the Profibus parameter PB must be disabled with command:

PB 0

SSA – Profibus slave address

With parameter SSA the Profibus slave address can be set.

It could be set via LDM51A keys or via service program.

Query: SSA
 Set: SSAx
 Range of parameter x: 0 ... 126
 Standard: 4

SSI – Setting the SSI parameters

SSI defines the Synchronous Serial Interface (see chapter REF)

Query: SSI
 Set: SSIx
 Range of parameter x: 0 ... 4 (see table below)
 Standard: 0

Wert x	Beschreibung
0	SSI aus (deaktiviert)

1	SSI aktiv / 24 bit / binär
2	SSI aktiv / 24 bit / gray
3	SSI aktiv / 25 bit / binär / MSB = Errorbit
4	SSI aktiv / 25 bit / gray / MSB = Errorbit

7.8 Direct controlling of the LDM51A

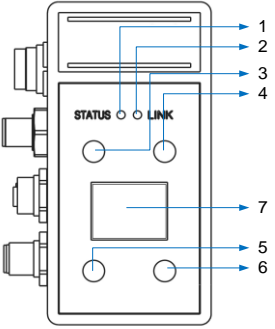

The LDM51A can directly be parameterized and set for measurements without an additional PC. Precondition is that it is supplied with voltage through the interface cable.

The LDM51A is ready for operation when the green STATUS LED is lit.

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

The display can be deactivated during the measurement.

It can be switched on again by pressing key T3 or T4.

	<table border="0"> <tr> <td>1 Status LED</td> <td>off</td> <td>Power supply off</td> </tr> <tr> <td></td> <td>red</td> <td>Power supply on, not ready for operation</td> </tr> <tr> <td></td> <td>green</td> <td>LDM51A ready for operation</td> </tr> <tr> <td>2 LINK LED</td> <td>off</td> <td>no data transfer</td> </tr> <tr> <td></td> <td>Green, flashing</td> <td>Data transfer active (Profibus/serial)</td> </tr> <tr> <td>3 Key T1</td> <td colspan="2">Function see display indication</td> </tr> <tr> <td>4 Key T2</td> <td colspan="2">Function see display indication</td> </tr> <tr> <td>5 Key T3</td> <td colspan="2">Function see display indication</td> </tr> <tr> <td>6 Key T4</td> <td colspan="2">Function see display indication</td> </tr> <tr> <td>7 Display</td> <td colspan="2"></td> </tr> </table>	1 Status LED	off	Power supply off		red	Power supply on, not ready for operation		green	LDM51A ready for operation	2 LINK LED	off	no data transfer		Green, flashing	Data transfer active (Profibus/serial)	3 Key T1	Function see display indication		4 Key T2	Function see display indication		5 Key T3	Function see display indication		6 Key T4	Function see display indication		7 Display		
1 Status LED	off	Power supply off																													
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5 Key T3	Function see display indication																														
6 Key T4	Function see display indication																														
7 Display																															
	<table border="0"> <tr> <td>STOP</td> <td>Measurement will be stopped</td> </tr> <tr> <td>Disp.</td> <td>Display will be disabled</td> </tr> <tr> <td colspan="2">The display can be enabled with key T4 or T3</td> </tr> </table>	STOP	Measurement will be stopped	Disp.	Display will be disabled	The display can be enabled with key T4 or T3																									
STOP	Measurement will be stopped																														
Disp.	Display will be disabled																														
The display can be enabled with key T4 or T3																															



	<p>Parameter setting</p> <p>After STOP (measurement) parameters can be set</p> <p>Menu ↑ move cursor / selection bar up</p> <p>Menu ↓ move cursor / selection bar down</p> <p>Select select parameter</p> <p>Meas.on start measurement</p>
	<p>Execute command</p> <p>Example "Identification":</p> <p>→ stop measurement</p> <p>→ Status → Select</p> <p>→ Identification → Select</p> <p>Again repeat command</p> <p>Return return to upper menu</p>

Figure 21 : LDM51A Display

8 Profibus

8.1 ID Number

LDM51P is registered under ID number 0E36 (HEX) by PROFIBUS Nutzerorganisation e.V.

8.2 Connection conditions

LDM51P can be connected to any Profibus-DP structure. The connected Profibus-DP master has to be able to send a parameterization.

The master configuration tool (usually configuration software) must support the parameters of the GSD file.

8.3 GSD-File

The GSD-File is named ASTECH_LDM51P.GSD.

It is part of the ASTECH CD.

The current GSD is for downloading available under the following address:

<http://astech.de/en/download.html>

The inclusion of the GSD file into the master configuration tool should be carried out to the documentation of the configuration tool.

8.4 Slave address

The Profibus slave address can be set under consideration of the other Profibus slaves in the range of 0...126.

The address can be set with command SSAX via the serial interface or via the LDM51P keys and the GUI (graphical user interface).

The documentation of the master configuration tool will inform how the slave address has to be changed via the master configuration tool. The default address is 4. The slave address will be stored permanently in the EEPROM and will be available even after power failure.

If several slaves are operated on a Profibus master they must have different addresses and have to connect one by one.

8.5 Bus termination

The Profibus termination is to realize externally.

The supply voltage of 5 VDC will be supplied via Profibus OUT. The 5 VDC are isolated galvanically from the power supply (VCC). The maximum load is 100 mA.

8.6 Baud rate

The LDM51A has an automatic baud rate for the following baud rates: 9.6 / 19.2/ 93.75/ 187.5/ 500 kBaud und 1.5/ 3/ 6/ 12 MBaud.

8.7 Length of segment

The maximum segment length between two Profibus participants depends on the selected baud rate. The following segment length must be observed.

Baud rate	Length of segment
9,6 kBaud ... 93,75 kBaud	1200 m
187,5 kBaud	1000 m
500 kBaud	400 m
1,5 Mbaud	200 m
3 MBaud ... 12 MBaud	100 m

Cable type A is strongly recommended for connection to different Profibus units. Cable type A has the following properties:

Characteristic wave impedance	135 Ω ... 165 Ω
Capacity of the cable	≤ 30 pf/m
Loop resistance	≤ 110 Ω /km
Wire diameter	> 0.64 mm
Wire cross-section	> 0.34 mm ²

8.8 Profibus interface

The Profibus interface of LDM51P is a standard Profibus-DP V0 interface (local peripherals).

V0 is the version number. The telegrams are byte-oriented. Bytes are also referred to as Octets in Profibus standard terminology. From the user's angle, the description can be restricted to a few telegram types:

- Cyclical data exchange telegrams (DataEx)
- Diagnostic telegrams
- Parameter setting telegrams.

The different Profibus-slaves of the same or similar function are described in profiles. The profiles make it easier for the user to use PB slaves having the same function but coming from different suppliers.

For using LDM51P at the Profibus, the encoder profile of the Profibus (order No. 3062 of PNO) is supported.

For this LDM51P serves as linear encoder. Under the encoder profile, LDM51P can work as Class1 or Class2 (recommended) encoder.

All versions are implemented via GSD file. In addition to profile-specific data, the LDM51P provides specific settings which refer to the control of the laser and to diagnostics.

Profile	Class	Functions
Encoder	Class 1	Input only Simple diagnostics Minimum parameter setting
	Class 2	Input and output (Preset) Extended diagnostics Extended parameter setting
LDM51A	Class 1	See Encoder profile
	Class 2	Additional manufacturer-specific diagnostics and parameter setting

8.9 Configuration data

The configuration of the input and output data can be selected as follows:

Table 15 : Configuration data

Mandatory		
Class 1	D1 hex	2 words inputs, consistency
Class 2	F1 hex	2 words of input data, 2 words of output data for preset value, consistency
Class 2	D3 hex	4 words inputs, consistency
Class 2	D3 E1 hex	4 words of input data 2 words of output data for preset value, consistency
Class 2	98 A4 hex	9 bytes of input data 5 bytes of output data, consistency
optional		
Class 1	D0 hex	Not realized
Class 2	F0 hex	Not realized

8.10 Cyclical data exchange – input (slave to master)

Position data supplied by LDM51P is signed. The sign can be inverted in the parameter SF (scale factor). The resolution is also defined by SF.

The arrangement of octets in the telegrams conforms to the Profibus (big endian), i.e., the MSB comes first, the LSB comes last.

Octet	Bit	Type	Output
1 ... 4		Signed 32	Position data from encoder in 0,1 mm
Configuration with 8 byte input and SS mode:			
5 ... 8		Signed 32	Signal level
Configuration with 9 byte input:			
9		Signed 8	Temperature in °C

8.11 Cyclical data exchange – Output (master to slave)

The most significant bit in the present value (bit 32) defines the validity of the preset.

Octet	Bit	Type	Output
1 ... 4		Signed 32	Preset Value Normal Mode: MSB = 0 (bit 31) Preset Mode: MSB = 1 (bit 31)
Configuration with 5 byte output:			
5	0	Bit	0:laser off, 1:laser on
	1	Bit	0:normal –1:ext. diagnostics with Exxxx
	2	Bit	0:no diagnostic, 1:Diag. as needed
	3	Bit	0:no OLED-Control,1:OLED-Ctrl active
	4	Bit	0:OLED off, 1:OLED on

The internal offset can be set to a required value by the present.

The offset can be changed by setting bit 31. The following applies:

M_{DataEx} Value transported on the Profibus in cyclical data exchange

M_{Laser} Value measured by the laser

M_{Offset} Offset calculated internally

Cyclical calculation of: $M_{DataEx} = M_{Laser} + M_{Offset}$

The M_{Offset} value can be written in the LDM51A directly as parameter Octet 32..35 (see 8.6) and can be changed by cyclical data while the system is operating (and the configuration is as required, see 8.3).

If bit 31 of M_{Preset} is set in the cyclical output data, M_{Offset} is updated.

If bit 31 is zero, M_{Offset} is not changed.

The new offset can be read as octets 30..33 in the diagnostic data.

Bit 31 has no particular release function for parameter data; the offset is always adopted.

8.12 Parameter data

At least the following parameters apply to class 1 devices

Table 16 : Parameter data class 1 devices

Octet	Bit	Type	Output
1		byte	Station status (profibus default)
2		byte	wd_fact_1 (watch dog)(profibus default)
3		byte	wd_fact_2 (profibus default)
4		byte	min_tsdr (profibus default)
5 ... 6		word	Ident number (profibus default)
7		byte	group ident (profibus default)
8		byte	spc3 spec (profibus default)
5	0	bool	unused
	1	bool	class 2 functionality on/off
	2	bool	commissioning diagnostic on/off
	3	bool	unused
	4	bool	reserved for future use
	5	bool	unused

Octet	Bit	Type	Output
	6	bool	unused
	7	bool	unused

The following additional parameters apply to class 2 devices:

Table 17 : Parameter data class 2 devices

Octet	Bit	Type	Output
10...13		unsigned 32	Unused – Linear Encoder (Measuring units per revolution)
14...17		unsigned 32	Unused – linear Encoder (Measuring range in ...)
18...25		Byte(s)	Unused – (reserved for future used)
26	0	bool	Unused
	1	bool	Unused
	2...3	2 bit number	Error reaction 0...2 [SEnn] (0:last valid value, 1:min value, 2:max value)
	4	bool	Unused
	5...7	3 bit number	Measure mode [0:DT, 1:CT, 2:TDM]
27	0...1	2 bit number	TRI x 0 ... 2
	2...3	2 bit number	TRO x 0 ... 2
	4	bool	Q1 z
	5	bool	Q2 z
	6	bool	Q3 z
	7	bool	unused
28...29		signed 16	TRI y: 0 ... 32767
30...31		signed 16	TRO y: 0 ... 32767

Octet	Bit	Type	Output
32...33		unsigned 16	SA x: 0,1 ... 1000
34...37		unsigned 32	MF x: 0,0000...200,0000 in 0,0001 steps
38...41		unsigned 32	OF -2147483648...2147483647
42...45		signed 32	SF -1000,000...1000,000 in 0,001 steps
46...49		signed 32	MW min -2147483648 .. 2147483647
50...53		signed 32	MW max -2147483648 .. 2147483647
54...55		unsigned 16	diag time (in 100 ms steps)
56...59		signed 32	Q1w -2147483648 .. 2147483647
60...63		signed 32	Q1x -2147483648 .. 2147483647
64...67		signed 32	Q1y -2147483648 .. 2147483647
68...71		signed 32	Q2w -2147483648 .. 2147483647
72...75		signed 32	Q2x -2147483648 .. 2147483647
76...79		signed 32	Q2y -2147483648 .. 2147483647
80...83		signed 32	Q3w -2147483648 .. 2147483647
84...87		signed 32	Q3x -2147483648 .. 2147483647
88...91		signed 32	Q3y -2147483648 .. 2147483647
92...95		signed 32	QAx -2147483648 .. 2147483647
96...99		signed 32	QAy -2147483648 .. 2147483647

As LDM51A is a linear encoder and measures absolute distances, the parameters

- “code sequence”,
- „scaling function control“,
- „Measuring units per revolution“ and

- „Measuring range in measuring units“ of the encoder profile are ignored.

8.13 Diagnostic data

Table 18 : Profibus diagnostic data

Class 2 functionality	Commissioning diagnostic	Diagnostic Information
-	0	6 byte Normal diagnostic
0	1	16 byte Class 1 diagnostic
1	1	61 byte Class 2 diagnostic

Octet	Bit	Type	Output
Profibus default diagnostic			
1		Byte	Diag state 1
2		Byte	Diag state 2
3		Byte	Diag state 3
4		Byte	Master address
5...6		Word	Slave ident
Class 1 diagnostic			
7		Byte	Extended diag. header, length (class 1:0A, class 2:37)
8		Byte	Alarms – unused
9	0	Bool	Unused
	1	Bool	Class 2 functionality on/off
	2	Bool	Commissioning diagnostic on/off
	3	Bool	Unused
	4	Bool	Reserved for future use
	5	Bool	Unused
	6	Bool	Unused

Octet	Bit	Type	Output
	7	Bool	Unused
10		Byte	Encoder type (=7 absolute linear encoder)
11...14		Unsigned 32	Single turn resolution 100000nm = 0,1 mm
15...16		Unsigned 32	No of distinguishable revolutions - unused (=0)
			Class 2 diagnostic
17	0	Bool	E1001 "unexpected error"
	1	Bool	E1002 "mail-box error"
	2	Bool	E1003 "mutex error"
	3...7	Bool	-
18...19	0	Bool	E1101 "pc usart error"
	1	Bool	E1102 "pc usart error"
	2	Bool	E1103 "laser usart error"
	3	Bool	E1104 "laser usart error"
	4	Bool	E1105 "laser usart error"
	5	Bool	E1106 "spi error"
	6	Bool	E1107 "spi error"
	7	Bool	E1108 "i2c error"
	8	Bool	E1109 "i2c error"
	9	Bool	E1110 "ssi error"
	10	Bool	E1111 "ssi error"
	11	Bool	E1112 "profibus error"
	12	Bool	E1113 "profibus error"
	13	Bool	E1201 "no destination found"
14	Bool	E1202 "calibration error"	

Octet	Bit	Type	Output
	15	Bool	E1203 "bad surface"
20...21	0	Bool	E1204 "measure aborted"
	1	Bool	E1205 "measure running"
	2	Bool	E1206 "dest. too bright"
	3	Bool	E1207 "destination not in window"
	4	Bool	E1208 "parameter error"
	5	Bool	E1209 "no answer from laser"
	6	Bool	W1901 "reboot"
	7	Bool	W1902 "supply outer limit"
	8	Bool	W1903 "supply outer limit"
	9	Bool	W1904 "temp outer limit"
	10	Bool	W1905 "temp outer limit"
	11	Bool	W1906 "heating active"
	12	Bool	E1910 "measure time out"
	13	Bool	W1911 "measure freq. too high"
	14	Bool	E1912 "."
	15	Bool	-
22...23		Word	Warnings – unused (=0)
24...25		Word	Profile version (z.B. 1.1 = 0110 hex)
26...27		Word	Software version (z.B. 1.1 = 0110 hex)
28...31		Unsigned 32	Operating time (of laser), in 0,1 hours
32...35		Signed 32	Offset value (siehe auch output daten)
36...39		Signed 32	Manufacture offset – unused (=0)
40...43		Unsigned 32	Measuring units per revolution – unused (=0)
44...47		Unsigned 32	Measuring range – unused (=0)

Octet	Bit	Type	Output
48...57		10 byte	Serial number
58...59		Signed 16	Laser temperature in °C
60		Byte	Reserved – unused
61		Byte	Reserved – unused

8.14 Monitoring

Set to a trigger time of 500 ms, a watchdog internal to the PU monitors the functioning of the module. The following functions are monitored

- The main loop with Profibus requested processing
- The laser control
- The update function

In case of transient errors (ESD, program error, ...) the module can be started again after a watchdog reset. Each reset increments the watchdog counter by one.

Other reset causes are also counted:

- Spike detection reset
- SW reset
- Programming and debug reset
- Brownout reset (monitoring of the operating voltage)
- External reset
- Power-On reset

9 Maintenance

9.1 Maintenance by the user

Please note:

- Dust on optical glass surfaces (transmitter and receiver optics) can be removed with a blower brush. Don't clean glass surfaces using cleaning agents containing organic solvents. In case of heavy pollution, please contact the manufacturer.
- Isopropyl alcohol is suitable for cleaning the device. Do not use any solvents.
- Do not open the device, otherwise the warranty obligations shall cease to apply.
- Do not loose any screws of the device.

9.2 Firmware update

Firmware updates of the sensor electronics of the LDM51A may only be done by the manufacturer.

9.3 Repair

In case of necessary repair, send the device to your dealer or to the manufacturer. Ensure the safe packaging and provide information about the conditions of use (application, installation, environment, etc.)

10 Error processing

Table 19 : Error codes

Fehler	Meaning	Action
e1001	Error operating system / Firmware	Restart system
e1002	Error operating system / Firmware	
e1003	Error operating system / Firmware	
e1101	Error in communication with PC	Check connection to external system / contact service for repair
e1102	Error in communication with PC	
e1103	Laser module error	Contact service / send LDM51A to supplier
e1104	Laser module error	
e1105	Laser module error	
e1106	Hardware error (internal data transfer)	
e1107	Hardware error (internal data transfer)	
e1108	Hardware error (controller)	
e1109	Hardware error (controller)	
e1110	Hardware error (SSI)	
e1111	Hardware error (SSI)	
e1112	Hardware error (Profibus)	
e1113	Hardware error (Profibus)	
e1201	Measurement impossible /no target	Adjust device / check target

Fehler	Meaning	Action
e1202	Error measuring module (calibration)	Contact service / send LDM51A to supplier
e1203	Target with unsuitable reflectivity	Check target and distance
e1204	Measurement interrupted (measuring module)	Restart system
e1205	Measurement still running (measuring module)	Restart system
e1206	Target too bright / too much back light	Check / limit ambient light
e1207	Target outside of the measurement window (MW)	No action or change MW setup
e1208	Incorrect measurement parameterization	Check setup
e1209	Hardware error (measuring module)	Contact service / send LDM51A to supplier

Table 20 : Warnings

Warnings	Meaning	Action
w1901	Restart being executed	No action
w1902	Input voltage outside of the specification (too low)	Check power supply: 10...30 VDC
w1903	Input voltage outside of the specification (too high)	
w1904	Temperature outside of the specification (too low)	
w1905	Heating active, min temperature not reached, no measurement possible	Check ambient temperature
w1906	Temperature outside of the specification (too high)	No action / wait until LDM51A is ready
W1907	Trigger input and trigger output active at the same time	Check ambient temperature

Warnings	Meaning	Action
w1910	Measurement not completed within predefined period of time	Activate TRI or TRO, not both for the same time
w1911	Measuring frequency too high	Use variable measuring time (MF0) / check target
W1912	Distance jump	Change MF

11 Accessories (Options)

11.1 RS-232 cable for LDM51A

For parameter setting an optional programming cable is available to link the LDM51A with a PC (COM port, RS-232). The use of the PC software LDMTool is recommended.

Table 21 : Pin assignment of programming cable PC sided

Pin SUB-D 9 F	Color code	Meaning SUB-D 9 F (RS-232, PC COM)
Shield	-	Cable shield
3	brown	TxD
2	white	RxD
5	blue	GND

Table 22 : Pin assignment of programming cable LDM51A sided

Pin LDM51A	Color code	Meaning LDM51A
Shield	-	Cable shield
3	white	TxD
10	violet	RxD
2	blue	GND
9	red	VCC (+10 V ... +30 V DC)
L	grey/pink	GND



Please use only high quality shielded cable.

RS-232 cable: **TxD and RxD have to be crossed.**

11.2 Connection box TCB30xA

A junction box with built-in terminal block and accessories is available optionally.

11.3 Adjustment bracket JW51x

The adjustment bracket enables the alignment of the device to the target. It allows a rotation of $\pm 5^\circ$ in two axes.

11.4 Software LDMTTool from version 4.8

A demo version of the software LDMTTool is included in the delivery. By purchasing a license number, the software becomes a full-version. Parameter setting and numerical display of measured values are available also with the demo version (see Figure 17 : Program LDMTTool).

12 Part numbers

Table 23 : Part numbers

Part-No.	Name
10-2070-00	LDM51A
10-2070-01	LDM51A-h with heating
10-2071-00	LDM51S with SSI interface
10-2071-01	LDM51S-h with SSI interface and heating
10-2072-00	LDM51P with Profibus interface
10-2072-01	LDM51P-h with Profibus interface and heating
10-2073-00	LDM51SP with SSI and Profibus interface
10-2073-01	LDM51SP-h with SSI-, Profibus interface and heating
11-2000-00	Power supply 24V, 1A, Euro 1m
11-0001-00	USB-RS-232 Interface converter; 0,2m; max 460800 Baud
12-2000-01	Junction box LDM51A
12-2018-00	Adjustment mounting bracket LDM51A
15-2001-00	RS-232-cable D-SUB9F/Terminal, 2m
15-2003-00	Interface cable LDM51A, 2 m
15-2003-01	Interface cable LDM51A, 5 m
15-2006-02	Interface cable LDM51A, 10 m
15-2006-03	Interface cable LDM51A, 15 m
15-2006-04	Interface cable LDM51A, 20 m
15-2006-05	Interface cable LDM51A, 50 m
15-2006-06	Interface cable LDM51A, 30 m
15-2006-08	Interface cable LDM51A, 30 m, 90°
12-2010-00	Reflective foil matt white, A4
11-0006-00	ASTECH USB Stick (Documentation and Software)
17-2000-00	License number for PC Software LDMTTool

Note: Several sensors are available as packages including sensor, cable, manual and CD (Set).

13 EG Declaration of conformity



We herewith declare, represented by the signatories, that the following designated product

**Laser distance sensor
LDM51A**

agrees with the Directive of Electromagnetic Compatibility 2004/108/EG.

The following harmonized standards were considered:

IEC 61326-1:2005	Electrical equipment for measurement, control and laboratory use, EMC requirements Part1: General requirement (IEC 61326-1:2005); German Version EN 61326-1:2006
IEC 60825-1:2007	Safety of Laser products - Part 1: Equipment classification and requirements (IEC 60825-1:2007); German Version EN 60825-1:2007; Laser Class 2
IEC 60068-2-1:2007 Ab	Environmental testing – Part 2: Tests – Testgroup Low Temperature Test Ab, test item passive, temperature -40°C (Storage)
IEC 60068-2-1:2007 Ad	Environmental testing – Part 2: Tests – Testgroup Low Temperature Test Ad, test item active, temperature -15°C (in function, without internal heating)
IEC 60068-2-1:2007 Ad	Environmental testing – Part 2: Tests – Testgroup Low Temperature Test Ad, test item active, temperature -40°C (in function, with internal heating)
IEC 60068-2-2:2007 Bb	Environmental testing – Part 2: Tests – Testgroup High Temperature Test Bb, test item passive, temperature +70°C (Storage)
IEC 60068-2-2:2007 Bd	Environmental testing – Part 2: Tests – Testgroup High Temperature Test Bd, test item active, temperature +60°C (in function)

Rostock, December 12, 2014

ASTECH Angewandte Sensortechnik GmbH

A handwritten signature in blue ink, appearing to read 'J. Mirow', is written over a faint circular stamp.

Jens Mirow
Managing Director

