User Manual

LDM 41/42 P

Firmware Version 7.02 and 8.03

Version 3.0

CE

Dear User,

You are advised to carefully read this User Manual before turning on the LDM 41/42 P laser distance measuring module for the first time.

This is necessary to ensure that you will be able to utilize all the capabilities and features which your new acquisition provides.

This technology is subject to continuously ongoing development.

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Manual version:	V 3.0
Firmware version:	≥ 7.02 and 8.03

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.

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1. General

The LDM 41/42 P is a Laser sensor to measure distances from 0.1 m to more than 100 m with pinpoint accuracy.

A given target can be clearly identified with the help of a red Laser sighting point. In terms of operating reach, the LDM 41/42 P performs depending on the reflectance, morphology and qualities of the target to be measured.

The sensor works based on comparative phase measurement. It emits modulated Laser light which is diffusely reflected back from the target with a certain shift in phase to be compared with a reference signal. From the amount of phase shift, a required distance can then be determined with millimetre accuracy.

LDM   Laser beam (meas beam)   Target
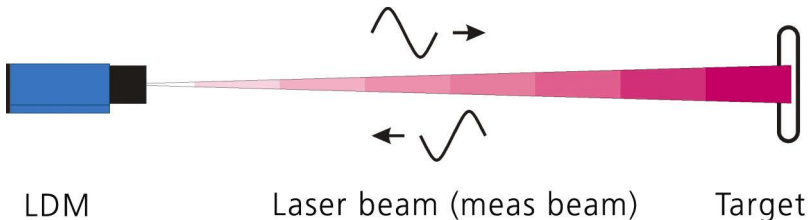
Figure 1: Measurement principle

A distance measuring cycle can be triggered in three different ways:
- By continuous measurement,
- By carrying out single measurements via Profibus DP,
- By external triggering (in remote-trigger mode).

For a more detailed description of these three trigger options, you should consult section chapter 8 of this User Manual.

Special performance features include:

- Provides pinpoint accuracy and great reach in extreme outdoor conditions.

- Works across a wide range of operating voltages from 10 V= to 30 V= from an on-board vehicle supply point, an industrial direct voltage supply net or a DC power pack.

- Features a consistently low power consumption of <3.5 W.

- Up to 30 m reach for distance measurement, with potential for more than 100 m reach if additional reflectors[1] are mounted onto the target (depending on reflectance and environmental conditions).Visible laser beam for easier sighting.

- Output and control via Profibus DP.

- Input of measuring functions and commands from, and output of measured values to, a PC or a laptop.

- Option for remote triggering of measurements from an external trigger device.

- Measured values can be displayed in metres, decimetres, centimetres, feet, inches, etc., due to free scaling.

- Large range of accessories available.

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[1] e.g. 3M, self adhesive foil white non glossy

2.   Safety Instructions

2.1.   General

These safety and operating instructions should be read carefully and observed when using the LDM 41/42 P.

There is danger of laser radiation or electrical shock.
In the event of any repair works, the LDM 41/42 P should only be opened by qualified staff, who are specifically authorized by the manufacturer to carry out such repairs, since dangerous high voltage and laser radiation are generated in the inner parts of the device. Unauthorized intervention into the inner product space will void any warranty claims.

Compliance with all specified operating conditions is necessary.
Failure to observe advisory notes or information contained in this User Manual or nonconforming product usage may cause physical injury to the user or material damage to the LDM 41/42 P.
As long as voltage is supplied, cable connectors must not be plugged or unplugged. Remember to turn all voltage supply off before commencing any work on cable connections.

2.2.   Intended and Conforming Use

- Measurement of distances
- Special measuring functions
- Compliance with prescribed temperatures for operation and storage
- Operation at correct voltage level
- Application of specified signal levels to the appropriate data lines.

2.3.   Nonconforming Use

- Do not operate the LDM 41/42 P in any other way than described under "Intended & Conforming Use" above and only in a proper working condition.
- Safety devices must not be defeated or otherwise rendered ineffective.
- Information and warning signs must not be removed.
- Repair work on the LDM 41/42 P must not be carried out by anyone other than authorized personnel.

- Refrain from using the LDM 41/42 P without certified protection in an explosive environment.
- Measurement with the LDM 41/42 P pointed at the sun or other strong light sources may produce faulty results.
- Measurement of targets with poor surface reflectance in a strongly reflecting environment may also result faulty measurements.
- Measurement of strongly reflecting surfaces may deliver faulty results.
- Measurement performed through transparent optical media, for example, glass, optical filters, Plexiglas, etc. may equally produce incorrect results.
- Measurement on translucent objects (materials allow light to pass through, but are not transparency, e.g. polystyrene, wax, different plastics etc.) can give a too large measured value, since also light is reflected by deeper layers.
- Rapidly changing measuring conditions are likely to falsify the result of measurement.

2.4.   Laser Classification

The LDM 41/42 P is a Class 2 laser product ≤1 mW as stipulated in IEC825-1/DIN EN 60825-1:2001-11 and a Class II product under FDA21 CFR.

Caution:
          There is Class 2 Laser radiation. Do not stare into beam!

Figure 2 Laser Class 2

The Laser power is limited to 1 mW. In the event of accidental, short-time Laser exposure (up to 0.25 s), the human eye is sufficiently

protected by its own eyelid winking reflex. This natural reflex may be impaired by medication, alcohol and drugs.
Although the product can be operated without taking special safety precautions, one should refrain from directly looking into the Laser beam. Do not direct the Laser beam onto persons.

The sensor can use without any additional safety protection.

2.5. Electrical Supply

Use only 10 V to 30 V DC (direct voltage) for LDM 41/42 P operation.
Use only the specially designated connector terminal for voltage supply.
Specified signal levels must not be exceeded, in order to guarantee correct data communication.

2.6. Import Operating Advice

To make full use of the system's inherent performance capabilities and ensure a long service life, you should always follow the operating rules set out below:

- Do not turn on the LDM 41/42 P if there is any fog or dirt on its optical components.

- Do not touch any of the device's optical parts with bare hands.

- Proceed with care when removing dust or dirt from optical components.

- Prevent shock impacts during use and transport of the LDM 41/42 P.

- Prevent overheating of the LDM 41/42 P. Prevent exposure of the device to direct sunlight when storing it in motor vehicles.

- Prevent major temperature variances during operation of the LDM 41/42 P.

- In accordance with IP65 internal protection standards, the LDM 41/42 P is designed to be splash proof and dustproof.

3. Technical Data

Measurement range[2]:	0.1 m up to 30 m with natural surfaces, depending on target reflectance or reflectors more than 100 m achievable[3]
Measuring accuracy[4]:	$\pm$ 2 mm under defined measuring conditions[5]
	$\pm$ 3 mm (+15 °C up to +30 °C)
	$\pm$ 4 mm in DS mode <0.5 m (+15 °C … 30 °C)
	$\pm$ 5 mm (-10 °C up to +50 °C)
Resolution:	0.1 mm, user scalable, standard 1 mm
Reproducibility[6]:	$\pm$ 0.5 mm
Measuring time:	0.24 up to 6 s setup or auto mode DT
	0.1 s (10 Hz) mode DW at white surface
	20 ms (50 Hz) mode DX at white surface (only LDM 42 P)
Target motion speed:	≤ 4 m/s in DX mode (only LDM 42 P)
Acceleration:	≤ 2.5 m/s² in DX mode (only LDM 42 P)
Operating temperature:	- 10 °C up to + 50 °C
Storage temperature:	- 20 °C up to + 70 °C
Supply voltage:	10 V up to 30 V DC (protected against polarity reversal)
Power consumption:	depending on operating mode < 3.5 W for distance tracking, < 3 W for standby
Profibus interface:	**Profibus DP norm slave**, auto detect up to 12 MBit, ID Number **0x2079** (8313), **13 Byte IN, 1 Byte OUT**

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[2] dependent on target reflectance, stray light influences and atmospheric conditions
[3] e.g. 3M, self adhesive foil white non glossy
[4] Statistic spread 95%.
[5] for measurement at a planar white target surface in continues movement or still standing, +15 up to +30 °C
[6] Dependent on target reflectance, stray light influences and atmospheric conditions

Data interface:	RS 232 baud rate 9600, ASCII, format 8N1 (fixed), receive path is deactivated after connecting to the Profibus master!
Trigger input:	external trigger in DF mode, trigger pulse 3 up to 24 V, length ≥ 1 ms, start of measurement 5 ms + programmable trigger slope and trigger delay, trigger delay can be set 0 ms ... 9999 ms
EMC:	EN 61326-1
Shock resistance:	10 g / 6 ms persistence shock in compliance with DIN ISO 9022-3-31-01-1
Laser Class:	Laser Class 2, under IEC825-1 / EN60825, Class II (FDA21 CFR)
Average service life:	100,000 h at 60 °C Laser temperature (internal)
Wave length:	650 nm (red visible)
Laser divergence[7]:	0.6 mrad
Laser angle tolerance:	better than ± 1 ° to the ground plane
Connection:	4 circular plug-in connectors
Dimensions (LxWxH):	218 x 96 x 50 (mm)
Mounting:	100 x 85 (mm), 4 x M6 holes
Weight:	approx. 850 g
Protection class:	IP 65 (water splash and dust proof)

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[7] at 10 m distance the beam diameter is 6 mm, at a distance of 50 m it is 3 cm and at a distance of 100 m it is 6 cm

4. Mounting

The casing consists of a rugged, corrosion-resistant extruded aluminium profile with front-side and rear-side covers also of corrosion-resistant design. Four mounting holes are provided in the base plate for mounting the LDM 41/42 P.
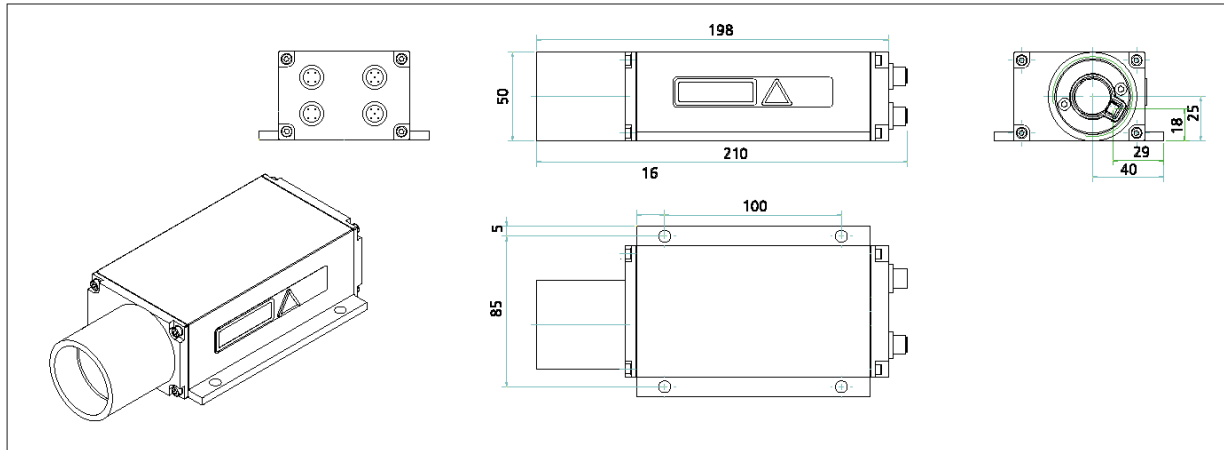
Figure 3 Mounting drawing

To protect the range finder's optical surfaces from dust, physical contact and impacts, etc., a protection tube has been attached to the casing. Please note that measurement cannot be guaranteed to function correctly if the protection tube is removed incorrectly or by unqualified personnel!

Interface connectors are located on the rear-side cover. Plugs and cables are available in various lengths.
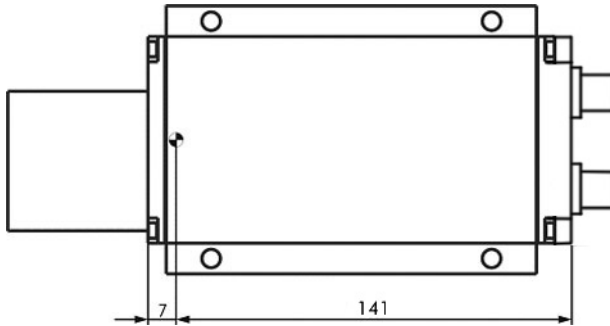
Figure 4 Offset against zero-edge

The LDM 41/42 P's zero-point is located 7 mm behind the outer surface of the front-side cover or alternatively 141 mm before the outside surface of the rear-side cover on the inside of the device. This zero-point has been introduced for construction design reasons. It can be adjusted with the help of the "OF" parameter.

5. Electrical Connection

5.1. LDM 41/42 P Rear-Side Cover Terminals

Connector terminals are located on the rear-side cover of the device. The terminals consist of 4 buses for metal circular plug-in connectors (from Binder), or compatible connectors, sealed against the casing in compliance with IP 65 requirements. This connector type guarantees optimised screening and a high IP level.

The following connection plugs should be used:

Quantity	Connector Type	Use
1	4-pin male cable connector (series 715 B from Binder)	Profibus DP Output
1	4-pin female cable connector *) (series 715 B from Binder)	Profibus DP Input
1	5-pin male cable connector (series 713 from Binder)	RS 232
1	5-pin female cable connector (series 713 from Binder)	Power supply and trigger input

*) until Dec. 2006 4-pin male cable connector

Note: Various connectors and cables are available. Please ensure that **only shielded connectors and shielded cables** are used.
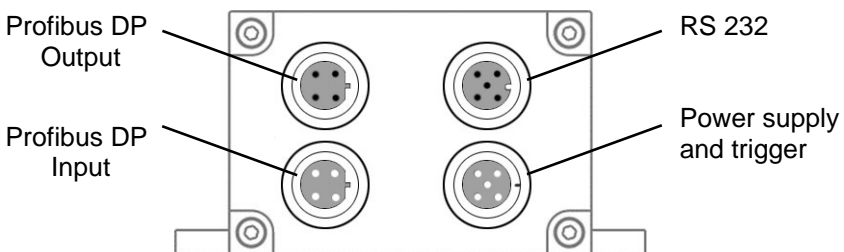
Figure 5 LDM 41/42 P terminals

5.2. Assignment of Terminals

5.2.1. Power Supply

The required power supply is 10 to 30 V DC.
The trigger input allows for a distance measurement via an external
signal in the form of a voltage impulse from 3 to 24 V (only DF mode,
please see Chapter 8).

Pin	Description	Colour	Comment
1	VCC	brown	Power supply 10 to 30 V
3	GND	blue	Power supply 0 V
5	Trigger	gray	Trigger input 3 to 24 V (ground potential GND)

5.2.2. Profibus DP

The LDM 41/42 P has two terminals (input and output) for circular plug-
in connectors (series 715 B for Profibus DP from Binder) conforming to
the relevant standards.

Pin	Description	Comment
1	+UB	Power supply for active terminal resistance
2	A	Profibus signal line A (green)
3	0 V	Power supply for active terminal resistance
4	B	Profibus signal line B (red)

Note: Only use connection plugs and Profibus cables that
conform to the relevant standards. If the LDM 41/42 P is to be
connected at the end of the bus, then a terminal resistance must
be connected to the output terminal for the Profibus DP.

5.2.3. RS 232 Serial Interface

The RS232 interface was originally designed as a PC interface only. It has now become the standard for serial data transfer for short distances. It is subject to interference when used for longer distances, in particular, in environments with interfering high-frequency electromagnetic radiance. As a result, this interface should only be used for configuring the LDM 41/42 P. Please configure using the programming cable and the LDMTool programme.
Following successful configuration, remove the programming cable and protect the terminal with a sealing plug.

⚠️ **Note:** Please configure the LDM 41/42 P prior to connecting the Profibus. **The receiving line of the RS232 serial interface is deactivated after connecting to the Profibus master.**

Please observe the RS 232 standard. The maximum extension of the RS 232 lines is 15 m.

Pin	Description	Colour	Comment
1	RxD	brown	Receiving line
2	TxD	white	Transmit line
3	GND	blue	Ground potential

⚠️ **Note:** Following successful programming, remove the RS 232 cable and protect the RS 232 cable connector with the enclosed sealing plug against entry of dirt. If the cable is to remain connected to the device, then a terminal resistance must be attached.

Sealing of interface cables when not in use or with open terminal points:
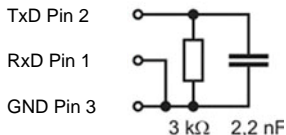
Ensure that no data line ends are left open, since they may be subject to interference (EMC).
A terminator circuit should be installed when the RS 232 is unconnected.
This circuit must be provided by the customer (see diagram on the left).

Figure 6   Recommended termination wiring for work with open RS 232

Programming Cable

Connection to a PC requires the following cable with SUB-D 9 F
connectors. The TxD and RxD signals of the LDM 41/42 P and the PC
connection are crossed. The colours apply to the optional programming
cable.

Pin LDM 4xP	Description	Colour	Pin SUB-D 9 F	Description
1	RxD	brown	3	TxD
2	TxD	white	2	RxD
3	GND	blue	5	GND

5.2.4.   Shields and Grounding

Cable shields must be grounded with low resistance. Only high quality
shielded cables should be used.
Carrier bases and control boxes should have equal potential. Potential
differences could lead to electrical currents and may cause EMC
problems (no correct measurement function or switching the gauge off
or on is necessary).

If no potential equalization is possible, then mount the LDM 41/42 P
isolated from the carrier base (use nylon screws and washers). Connect
the screen with mass to the cable end. This way of assembly should
also be used when installing the LDM 41/42 P inside vehicles.

6. Limiting Values for Voltages

GND lines of the power supply and RS 232 terminals are connected internally and form the ground potential for all of the limiting values indicated below.

Input voltages:

Terminal point	Voltage	Comment
VCC	+10 up to +30 V	pole-reversal-protected
TxD	± 13.2 V	short-circuit-proof
RxD	± 25 V	short-circuit-proof
TRIG	± 25 V	short-circuit-proof

Output voltages:

Terminal point	Voltage	Comment
TxD	± 5.4 V	± 5 V at 3 kΩ load

Limiting values of voltages, loads and logical levels comply with relevant RS 232 and Profibus standards. All outputs are sustained-short-circuit-proof.

7. Start Up

Ensure that all cable ends are protected against short circuit prior to turning on the power supply!
Connect cable terminals as required for the particular operating mode. A pole-reversal protection is included so as to prevent the destruction of electronic components.
Connection to the Profibus master should only take place following start up!

⚠️ **Note:** Please turn on the LDM 41/42 P prior to connecting the Profibus. **The receiving line of the RS232 serial interface is deactivated after connecting to the Profibus master.**

Turning on the LDM 41/42 P requires a **PC with a corresponding COM1 data interface**, an **optional programming cable** and a terminal programme. We recommend the use of the following programme: **LDMTOOL (Version 4.5 or higher)**.

When turning on the LDM 41/42 P, it must be properly installed at the designated operation site, aimed at the target, and kept in a stable position. Targets to be measured (e.g. machine or system components) should preferably have a light and homogeneous surface. Several optional reflex foils are available.

⚠️ **Caution: Do no use any retro reflectors!**

Alignment of the LDM 41/42 P is facilitated by a visible laser beam[8] that can easily be turned on from a PC.
Operating voltage supply occurs via the power supply terminal (see Chapter 5).

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[8] Depending on ambient light and target conditions

8. Parameters and Control via RS232

8.1. General

It is easy to configure the LDM 41/42 P by using a PC, as it provides a wide range of operating functions. Configuration should take place prior to connecting to the Profibus.

⚠️ **Caution: If the LDM 41/42 P has been configured via the Profibus DP Master, then the PC interface (RS 232) can no longer be used to enter commands.** However, the LDMTool programme can be used for display distance values.

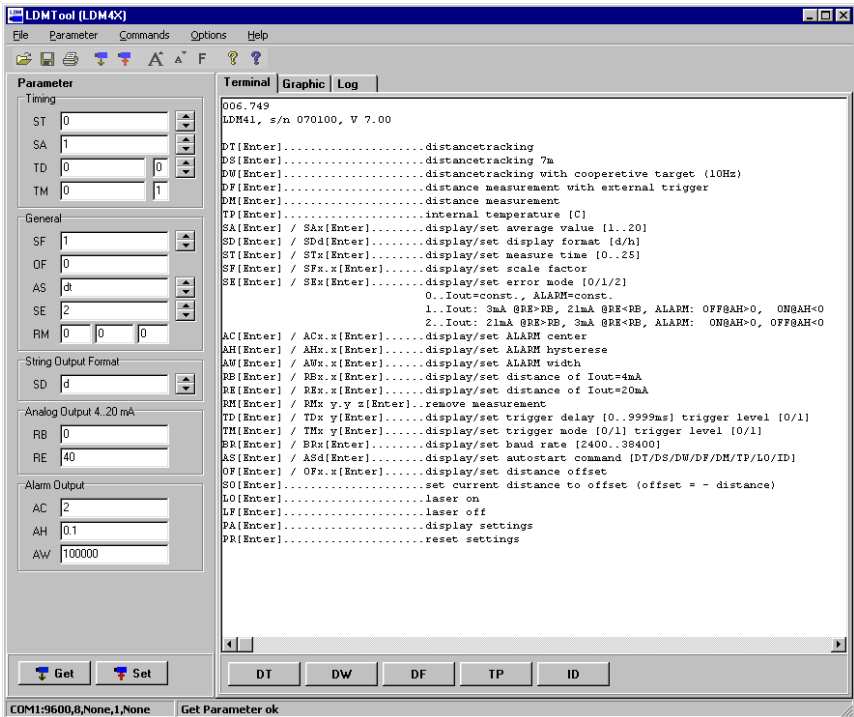By selecting the ID[Enter] command, you may call up the menu with the available set-up commands.

Figure 7 LDMTool with Help text

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Note: Configuration commands for the analogue output and digital alarm output cannot be used for the LDM 41/42 P. However, they do ensure compatibility with the LDM 41/42 A (without Profibus DP).

Prior to commencing measurements, desired parameter settings can be entered via a smart selection procedure, so as to adapt the LDM 41/42 P in an optimal manner to specific environments and measuring tasks.

Such settings will be stored when turning off the LDM 41/42 P. They can only be changed by entering new values or by reinstalling the standard parameter settings.

Command entries are not case-sensitive. This means that both small and capital lettering can be used for commands. Any commands to be sent to the LDM 41/42 P should end with [Enter] or alternatively a hexadecimal 0Dh (CR, carriage return) character. Any decimal digits to be entered must be separated by a full stop (2Eh). When entering command parameters, a distinction must be made between parameter settings and parameter queries. Querying takes place via simple format commands, e.g. (for scale factor parameters):

SF[Enter]

When setting parameters, a new value must be added after the command without using a delimitation sign in-between, e.g.:

SF39.3701[Enter]

In this example the scale factor was set to 39.3701.

The LDM 41/42 P supports the following commands:

Command	Description
DT	Starts distance tracking
DS	Starts distance tracking (< 7 m)
DW	Starts distance tracking on white target at 10 Hz
DX	Starts distance tracking on white target at 50 Hz (only LDM 42 P)
DF	Starts remote-triggered single distance measurement (single shot)
DM	Starts single distance measurement (single shot)
TP	Queries internal temperature
SA	Queries / sets floating average value (1...20)
SD	Queries / sets output format (**d**ec/**h**ex)
ST	Queries / sets time to measure (0...25)
SF	Queries / sets scale factor
TD	Queries / sets trigger delay
BR	Queries / sets baud rate
AS	Queries / sets autostart
OF	Queries / sets offset
SO	Sets current distance as offset
LO	Turns on laser
LF	Turns off laser
PA	Displays all parameter values
PR	Resets all parameters to standard values (don't use)

8.2.   DT......distance tracking

Input parameter SA, SD, SE, SF, ST, OF
Output   Profibus, RS232

The DT mode is suitable for distance measurement for different kinds of surfaces (varying reflectance). With this type of distance tracking mode, the LDM 41/42 P uses internal algorithms to continuously evaluate the quality of the returned laser radiation signal. This may lead to longer measuring times in the case of poor reflectance or sudden jumps in distance.
The minimum measuring time is 240 ms and the maximum time is 6 s. If the measuring signal fails to reach a specified quality within six seconds, then an error message will be displayed.
The measuring time may also be limited by setting the ST parameter to a desired value.
ESC stops the measurement.

8.3.   DS......distance tracking (< 7 m)

Input parameter   SA, SD, SE, SF, ST, OF
Output   Profibus, RS232

Operation in DS mode makes sense where different types of surfaces have to be measured at close range up to 7 m. Compared to DT measuring mode, it allows a higher measurement rate. Within the range from 0.1 m to 0.5 m, measuring accuracy is restricted ($\pm$ 4 mm).
Measuring time (time to measure) can be limited via ST parameter settings.
ESC stops the measurement.

8.4.   DW......distance tracking with cooperative target (10Hz)

Input parameter SA, SD, SE, SF, OF
Output   Profibus, RS232

The DW mode performs at a steady measuring rate of 10 Hz.
The selected object must have a white target board for measured values to be stable.
ESC stops the measurement.

8.5.   DX......distance tracking with cooperative target (50Hz)

Input parameter SA, SD, SE, SF, OF
Output   Profibus, RS232

The DX mode performs at a steady measuring rate of 50 Hz **(only LDM 42 P)**. The selected object must have a white target board for measured values to be stable. ESC stops the measurement.

8.6.   DF......distance measurement with external trigger

Input parameter SA, SD, SE, SF, ST, OF
Output   Profibus, RS232

The DF mode is used for a measurement that is triggered by an external trigger pulse.
Initially, after selecting this mode, the operator does not receive any response. However, as soon as the trigger pulse has been detected, the LDM 41/42 P will provide the distance value.
Settings for trigger delay (delay) and trigger slope can be defined via the TD parameter (see Chapter TD).

8.7.   DM......distance measurement

Input parameter SA, SD, SE, SF, ST, OF
Output   Profibus, RS232

DM mode triggers a single measurement (single shot).

8.8.   TP......internal temperature [°C]

TP queries the value of the LDM 41/42 P's internal temperature.
Note: In tracking mode, the internal temperature may exceed the surrounding temperature level by as much as 10 K.

8.9.   SA......display/set average value [1..20]

SA allows you to calculate a floating average value on the basis of the following formula:

$$\text{Average value} \quad x = \frac{x_1 + x_2 + x_3 + ... + x_{n\ (20)}}{n}$$

The standard setting is 1 (no averaging).

8.10. SD......display/set display format [d/h]

SD switches between the decimal (d) and hexadecimal (h) output format for measured values. SD affects all commands that provide a distance value as output.
A hexadecimal output value is calculated on the basis of a given measured distance value (in mm), multiplied by the scale factor SF. Hex format: <SPACE>xxxxxx<CR><LF>, x=0...F.
Negative distance values provided as output in the form of two's complement notation.

Examples:
Distance = 4,996 m, SF1
  dec: 004,996<CR><LF>
  hex: _001384<CR><LF> (= 4996 mm ✕ SF1)
Distance = 4,996 m, SF10
  dec: 049,960<CR><LF>
  hex: _00C328<CR><LF> (= 49960 = 4996 mm ✕ SF10)

> **Note:** The standard setting is **SD h** (hexadecimal). Hexadecimal output is a **compulsory requirement** for using the Profibus interface. Please use the graphic display in program LDMTool.

8.11. ST......display/set measure time [0..25]

Measuring time is a parameter that is directly connected to the selected measuring mode. As a general rule, it can be said that the poorer the reflectance of a particular target surface, the more time the LDM 41/42 P will require to determine the distance with the specified level of accuracy. For example, if error message E15 is output because of poor reflectance and insufficient measuring time, this latter setting must be increased.
The available value range for measuring time is 0 to 25. The higher the time setting, the more time will be available for measurement and the lower the resulting measuring rate.
An exception to this is the zero-value. In this case, the LDM 41/42 P automatically picks the smallest possible time value for measurement.
The LDM 41/42 P comes with a factory setting of ST = 0.
ST works in the DT, DF and DM operation modes.
The measuring time setting option can also be used to modify the measuring rate, e.g. in order to restrict the data volume or for

synchronization purposes. The following sample time setting should only be regarded as an approximate value:

Measuring time $\approx$ ST$\cdot$240 ms (except ST=0)

Example:
The target distance is 25 m, but the target's reflectance is not ideal. With a measuring time setting of ST 2, E15 will be the output following measurement. In this case, the user will have to increase the measuring time.

8.12. SF......display/set scale factor

SF multiplies a calculated distance value with a user-selectable factor for changes in resolution or outputs using a different measuring unit. The scale factor may also be negative. The standard setting is 1.

The scale factor influences the output of measurement results, Offset (OF), Alarm Centre (AC), Alarm Hysteresis (AH), Range Begin (RB) and Range End (RE).

Scale factor	Resolution	Output	Output Unit
SF1	1 mm	12.345	m
SF10	0.1 mm	123.45	dm
SF1.0936	0.01 yard	13.500	yard
SF3.28084	0.01 feet	40.501	feet
SF0.3937	1 inch	4,860	100 inch
SF-1	1 mm	-12.345	m

Note:
Following a change in the scale factor, the settings for digital and/or analogue output and offset must be adjusted accordingly!

8.13. TD......display/set trigger delay [0..9999ms] trigger level [0/1]

TD is only intended for the configuration of the remote trigger input (see Chapter 8.5 DF mode).

TD consists of two sub parameters: the actual delay value, i.e. the delay time, and the trigger level.

Trigger delay corresponds to the time from arrival of the trigger signal to the starting point of a measurement. It may be set to any value between 0 and 9999 ms. The trigger level can be used to define whether a measurement is to begin on a rising (0), or a falling (1), pulse slope. Trigger delay and trigger level must be separated by a space (20h) in the entry line. The standard setting is 0 0.

Example:

TD1000_0[Enter]

In the above example, the delay has been set to 1000 ms and the trigger slope to "rising" (LOW-to-HIGH transition).

8.14.   BR......display/set baud rate [2400..38400]

Available baud rate settings are: 2400, 4800, **9600**, 19200, 38400. Faulty entries will be rounded to the nearest baud rate.
A fixed data format of eight data bits with no parity and one stop bit is used.

⚠ **Caution:** The standard setting is 9600 baud. A **9600 baud rate** is a **compulsory requirement** for using the Profibus interface.

8.15.   AS....display/set autostart command

AS (autostart) defines which function will be carried out when power is supplied to the LDM 41/42 P (DT/DW/DX/DF/DM/ID/TP/LO). Possible entries are those delivering a measured value on the output side, an ID command or the command for turning on the laser (LO).
For example, if ASDT parameters have been set, then the LDM 41/42 P will begin with distance tracking when it is turning on. The command is important for operation via RS 232. If the mLDM 41/42 P is connected to a Profibus master, then the latter will control the output. The standard setting is DT (distance tracking).

8.16. OF......display/set distance offset

With the help of OF (offset), users can define a zero-point for their application.
For details on the position of the module's zero-point, please refer to Chapter 4.
OF must be selected so as to properly match it to the currently valid scale factor setting (SF).
OF may also take on negative values. The standard setting is 0.

8.17. SO......set current distance to offset (offset = - distance)

SO performs a distance measurement and saves the measured reading as an offset value with an inverted mathematical sign (OF)

8.18. LO......laser on

LO turns on the laser. This function can be used for orientation or functional testing of the LDM 41/42 P.

8.19. LF......laser off

LO turns off the laser.

8.20. PA......display settings

PA lists all parameters in a table.

8.21. PR......reset settings

PR resets all parameters (except for baud rate).

Note:
Please do not use this command, because all settings will be erased. This will then require a complete reprogramming of all parameters.

9. Profibus DP

9.1. General

The LDM 41/42 P is operated as a standard Profibus slave. It becomes operational with master 13 byte entry data: 2x 8 bit error information, 16 bit measurement value counter, 32 bit time stamp, 32 bit distance and 8 bit internal temperature are available.

One byte of output data is used for control. It is possible to switch between various measurement modes. In addition, the internal equipment temperature can be measured and the laser can be turned off.

Bus rates of up to 12 Mbaud (autodetect) are supported. The slave address is provided via the bus. Connection takes place via circular plug-in connectors that are in compliance with relevant standards. If only one Profibus is used, then a terminal resistance should be attached to the other Profibus.
Configuration of measuring time, scaling, etc., takes place via the serial interface (see Chapter 8).

9.2. Parameter Setting

The LDM 41/42 P is configured as a standard Profibus slave. The standard mode transfers binary data from the Profibus. In the ASCII mode, the ASCII values are transferred in the way they are transferred from the LDM 4x P (only for special applications).

Note: Please ensure that the parameter setting of the LDM 4x P is correct. The parameter baud rate (BR9600) and output format (SDh) must be set via the serial RS 232 interface of the LDM 4x P by using a PC and the LDMTool programme, or alternatively a terminal program, prior to connection to the Profibus Master!

Modes	Profibus IN (Gateway Output)	Profibus Configuration	Profibus Configuration Bytes
Standard	**8 bit Error Counter** **8 bit Error Code** **16 bit Counter** **32 bit Time Stamp** **32 bit Distance[9]** **8 bit Temperature[10]**	13 byte IN 1 byte OUT	156 32 0 (0x9C 0x20 0)
ASCII	16 bit Counter 32 bit Time Stamp 8 bit Number of Character n n byte ASCII Character	32 byte IN 0 byte OUT	223 0 0 (0xDF 0 0)

9.3. Profibus IN, Explanation of Error Codes

Code	Description
0 (0x00)	<u>Received valid measurement value</u>; Error Counter and Code are set to zero
15 (0x0F)	Reflexes too weak, use target board[11] or distance from LDM (front edge) is out of range
16 (0x10)	Reflexes too strong, use target board
17 (0x11)	Too much constant light (e.g. sun)
23 (0x17)	Temperature below - 10 °C
24 (0x18)	Temperature above + 50 °C
61 (0x3D)	Faulty command
255 (0xFF)	Invalid string from LDM 4x P (e.g. hexadecimal output has not been set)

9.4. Profibus IN, Explanation of Additional Binary Values

Error Counter   Number of errors after last valid measurement value
Counter   Increased for each new valid measurement value
Time Stamp   Set for each new valid measurement value (ms)

---

[9] Scaling depends on LDM 4xP parameter settings (see 8.12 SF......display/set scale factor)
[10] Displays the internal temperature in °C, if the control byte has been set on the TP mode, activation HI/LO slope bit 6
[11] E.g. 3M, self-adhesive, white non-glossy foil

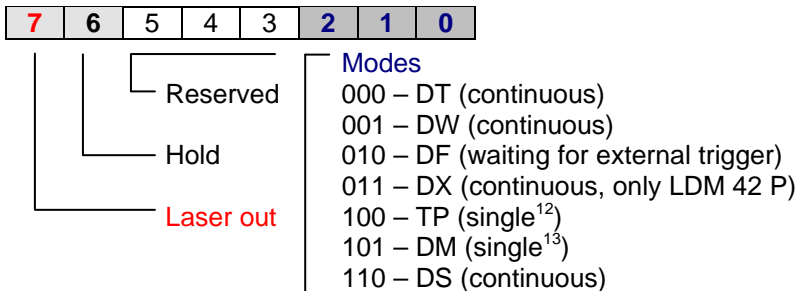## 9.5.   Profibus OUT, Explanation of Control Byte

The control byte sets the **Measuring Mode** via **Bit 0 to 2**. For a description of the various **Modes**, please see Chapter 8.

Bit 3 to 5 are reserved and can be set to 0.

If **Bit 6** has been set to 1, then the actual measuring value is kept. If Bit 6 is set from 0 to 1, the 1/0 slope is also activated. This slope will provide a new measurement for the DM single measurement mode and TP temperature measurement. For all other modes, Bit 6 generally remains set at 0.

To turn off the **laser** and switch the LDM 41/42P to **standby operation**, **Bit 7** should be set at 1. The remaining bits have no meaning.

If all bits are set at 0, then the LDM 41/42 P will operate in the DT mode (Distance Tracking, continuous measurement).

7	6	5	4	3	2	1	0

Reserved

Hold

Laser out

Modes
000 – DT (continuous)
001 – DW (continuous)
010 – DF (waiting for external trigger)
011 – DX (continuous, only LDM 42 P)
100 – TP (single[12])
101 – DM (single[13])
110 – DS (continuous)

---

[12] New temperature measurement (second and subsequent) at Bit 6 Hold (1/0 slope)
[13] New distance measurement (second and subsequent) at Bit 6 Hold (1/0 slope)

10. List of Commands

Command	Description
DT	Starts distance tracking
DS	Starts distance tracking (< 7 m)
DW	Starts distance tracking on white target at 10 Hz
DX	Starts distance tracking on white target at 50 Hz (only LDM 42 P)
DF	Starts remote-triggered single distance measurement (single shot)
DM	Starts single distance measurement (single shot)
TP	Queries internal temperature
SA	Queries / sets floating average value (1...20)
SD	Queries / sets output format (**d**ec/**h**ex)
ST	Queries / sets time to measure (0...25)
SF	Queries / sets scale factor
TD	Queries / sets trigger delay
BR	Queries / sets baud rate
AS	Queries / sets autostart
OF	Queries / sets offset
SO	Sets current distance as offset
LO	Turns on laser
LF	Turns off laser
PA	Displays all parameter values
PR	Resets all parameters to standard values

11. Error Codes RS 232 and Profibus

Code	Description	Action
E15	Reflexes are too weak, **or** distance from LDM (front edge) to target is less than 0.1m or in DS mode the distance is greater than 7m	Use white target[14] board **or** change distance to target
E16	Reflexes are too strong	Use white target board **or** filter
E17	Too much constant light (e.g. sun) or reflexes are too strong	Use aperture or filter and/or white target board
E18	DX mode (**only LDM 42**): reflexes too weak, **or** distance from LDM (front edge) to target is less than 0.1 m	Use white target board **or** increase distance to target
E23	Internal temperature below – 10°C	Heating necessary
E24	Internal temperature above + 60°C	Cooling necessary
E31	EEPROM error checksum	Necessary to repair
E51	Failed to set avalanche voltage	Necessary to repair
E52	Excessively high laser current/laser defect	Necessary to repair
E53	Division by 0	SF must be unequal of zero or necessary to repair
E54	PLL range	Necessary to repair
E55	Unknown error	Necessary to repair
E61	Faulty command	Correct PC input
E62	Illegal parameter, invalid command	Correct PC input
E63	SIO parity error	Check PC data transfer
E64	SIO framing error	Check PC data transfer

---

[14] E.g. 3M, self-adhesive, white non-glossy foil

12. GSD Data

```
;============================================================
; Profibus Device ASTECH Unigate for LDM4xA and LDM4xP
; Model : LDM 4x Series
; Description : LDM 4x Series with Profibus-DP
; Language : English
; Date : 6 September 2005
; Author : ASTECH GmbH
;============================================================

#Profibus_DP

GSD_Revision        = 1

; Device identification
Vendor_Name         = "ASTECH"
Model_Name          = "LDM4xP"
Revision            = "V2.0"
Ident_Number        = 0x2079
Protocol_Ident      = 0
Station_Type        = 0
FMS_supp            = 0
Hardware_Release    = "Revision D"
Software_Release    = "V2.0"

; Supported baudrates
9.6_supp            = 1
19.2_supp           = 1
93.75_supp          = 1
187.5_supp          = 1
500_supp            = 1
1.5M_supp           = 1
3M_supp             = 1
6M_supp             = 1
12M_supp            = 1

; Maximum responder time for supported baudrates
MaxTsdr_9.6         = 60
MaxTsdr_19.2        = 60
MaxTsdr_93.75       = 60
MaxTsdr_187.5       = 60
MaxTsdr_500         = 100
MaxTsdr_1.5M        = 150
MaxTsdr_3M          = 250
MaxTsdr_6M          = 450
MaxTsdr_12M         = 800

; Supported hardware features
Redundancy          = 0          ; not supported
```

```
Repeater_Ctrl_Sig    = 0         ; not supported
24V_Pins             = 0         ; not connected
Implementation_Type  = "SPC3"
Bitmap_Device        = "LDM4xP_"

; Supported DP features
Freeze_Mode_supp     = 1
Sync_Mode_supp       = 1
Auto_Baud_supp       = 1
Set_Slave_Add_supp   = 1

; Maximum polling frequency
Min_Slave_Intervall  = 1         ; 100 us

; Maximum supported sizes
Modular_Station      = 1         ; modular
Max_Module           = 1
Max_Input_Len        = 244
Max_Output_Len       = 244
Max_Data_Len         = 432
Modul_Offset         = 0

Fail_Safe            = 0         ; state CLEAR not accepted
Slave_Family         = 9
Max_Diag_Data_Len    = 8

; Definition of modules
Module = "Standard: 1/1/2/4/4/1 Byte" 0x9C,0x20
EndModule
Module = "------------------------------" 0x00,0x00
EndModule
Module = "ASCII: 2/4/1/25 Byte" 0xDF,0x00,0x00
EndModule

;===========================================================

Bitmap LDM4xP_N.bmp
```
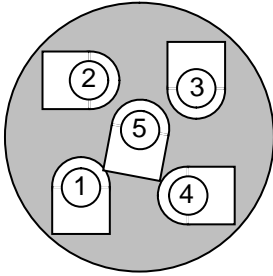

Figure 8 GSD data and bitmap

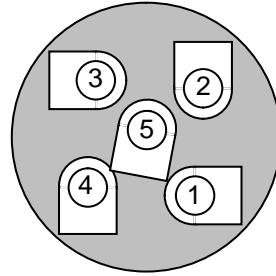To obtain the latest GSD data and bitmap, please visit www.astech.de.

13. Contact Assignment for Cable Connectors

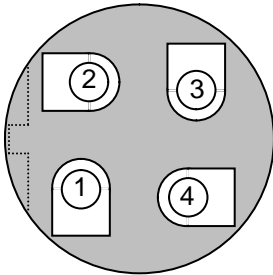Numbers are displayed **when looking at the terminal side**.

RS 232
5-pin male cable connector

Power supply and Trigger
5-pin female cable connector

Profibus Output
4-pin mal cable connector
(B code)

Profibus Input
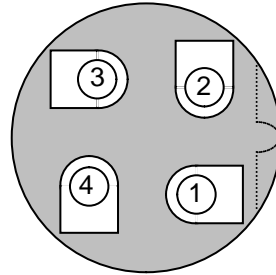4-pin female cable connector
(B code)

Figure 9   Contact assignment

14. EC Declaration of Conformity

$$C\hspace{-2pt}E$$

In according with the

Directive of Electromagnetic Compatibility 89 / 336 / ECC, annex I

The company ASTECH Angewandte Sensortechnik GmbH in Schonenfahrerstr. 5, 18057 Rostock / Germany herewith declare, represented by the signatory, that the following designated product

Laser Distance Measurement Sensor

LDM 41 P / LDM 42 P

agree with the following harmonized standard:

IEC 61326-1

Electromagnetic interference and electromagnetic compatibility (EMC) *including radio interference

Rostock, 2010-12-01
ASTECH Angewandte Sensortechnik GmbH

Volker Ahrendt
General Manager

15. Part Numbers

Part-No.	Name
12-2002-00	LDM41P
12-2003-00	LDM42P
15-0000-00	Terminator for Profibus
15-0014-00	Male cable connector Profibus OUT, 4-pin, B-coded
15-0015-00	Female cable connector Profibus IN, 4-pin, B-coded
15-0019-00	Programming cable RS232 5m
15-2002-00	Connection cable LDM41/42P, 5m
15-2002-01	Connection cable LDM41/42P, 10m
11-0001-00	USB-RS232 Interface converter, 0.2m
12-2006-00	Protection window Standard for LDM4x-Serie
12-2006-01	Protection window Quartz glass for LDM4x-Serie
12-2006-02	Protection window Sapphire glass for LDM4x-Serie
12-2007-00	Gray filter 2-fach for LDM4x-Serie
12-2007-01	Gray filter 4-fach for LDM4x-Serie
12-2010-00	Reflection foil matte/white, A4
12-2011-00	Highly reflective foil silver, A4
12-2015-00	Protection tube for pressure air for LDM4x-Serie
16-0000-00	ASTECH CD (LDM, VLM)
16-2001-01	Printed Manual LDM41/42P, A5, DE
16-2001-02	Printed Manual LDM41/42P, A5, EN
17-2000-00	License number for PC-Software LDMTOOL for LDM3x und LDM4x

Note: Several single sensors are also available as packages including sensor and cable, manual and CD (sets). Additionally are other protection enclosures with and without a thermostat available.