DeviceNet™

User Manual

Laser Measuring Device LE-200 with CAN DeviceNet - interface

- Safety notes
- Assembly
- Installation / Commissioning
- Parameter setting
- Causes of Faults and Remedies

- Software/Support CD: 490-01001
  - Soft-No.: 490-00407

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Italic or **bold** font styles are used for the title of a document or are used for highlighting.

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″ < > ″ indicates keys on your computer keyboard (such as <RETURN>).

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Revision History

Note

The cover of this document shows the current revision status and the corresponding date. Since each individual page has its own revision status and date in the footer, there may be different revision statuses within the document.

Documents that are in the appendix have their own revision history.

Document created: 22.07.2003

Revision	Date
Expansion of the function for the error output, service 00C • Speed-check, configurable via TRWinProg	18.09.2003
New parameter, service 00F • "Intensity in %"	09.10.2003
- Revision of the warning label in chapter "Intended purpose"	18.12.2003
• Revision of the shielding concept • General technical modifications • Layout modifications	01.06.2007
• Max. measuring range 240 m	18.12.2007
• Implementation of new reflectors • Physical resolution = 0,1mm	05.02.2009
• Shield connection via cable screw glands removed	12.01.2010

Table of Contents

1 Safety

1.1 General risk potential

The Laser Measuring Device LE-200 CAN DeviceNet cannot be operated independently, but is installed as part of an overall system usually consisting of several interacting components. For this reason, the laser measuring device is not equipped directly with a protective device.

Warning
The corresponding measures must be taken in order to avoid person and property damages!

However, in the event of an error via an error status (CAN bus) or via an error output (hardware) different error messages are output
(see 6.3.12 page 28 and 6.3.10 page 27).
It is therefore essential to **integrate the error messages into your own safety system** via the evaluation software (e.g. a PLC).

All persons responsible for the assembly, start-up and operation of the device must

- be suitably qualified
- adhere strictly to this operating manual.

Your safety and the safety of your equipment depends on this!

1.2 Safety information

This operating manual contains information which must be observed in the interests of your own personal safety and that of your equipment. The safety hints are emphasized by a warning triangle and classified according to the degree of danger as follows:

Warning
means that failure to take the relevant safety precautions can lead to serious damage to property or injuries.

Note
refers to important information and features of the product, plus tips on its application.

1.2.1 Hints on installation

Since the Laser Measuring Device is normally used as part of a larger system, these hints are merely intended as a guide for integrating the device safely into its environment.

Warning

- During the operation of the Laser Measuring Device it isn't allowed to interrupt the laser beam. If it comes nevertheless to an interruption, at the restart of the automatic operation mode first the validity (plausibility) of the measured value has to be checked.

- Precautionary measures must be taken to allow an interrupted program to be properly resumed following a voltage drop or failure. Dangerous operating conditions must not be permitted to arise even for short periods. If necessary, an ***"EMERGENCY STOP"*** must be forced.

- EMERGENCY STOP devices according to EN 60204/IEC 204 (VDE 0113) must remain operational in all operating modes of the programmable controller. The release of the EMERGENCY STOP devices must not trigger an uncontrolled or undefined reactivation of the equipment.

- The safety and accident prevention regulations applicable to the specific application must be observed.

- In the case of permanently installed plants or systems without an all-pole mains switch and/or fuses, one of these devices must be installed accordingly and the equipment connected to a PE conductor.

- In the case of 24 V supplies, make sure the extra-low voltage is reliably disconnected. Only use power supply units manufactured to the standards IEC 364 - 4 - 41 / HD 384.04.41 (VDE 0100 Part 410).

- Fluctuations or deviations of the supply voltage from the nominal value must not exceed the tolerance limits stated in the specifications, otherwise operational failures and dangerous states in the electrical assemblies cannot be ruled out.

- Connecting and signal wires must be installed in such a way as to prevent the automation functions from being hampered by inductive and capacitive interference.

- The units of the automation system and their operating elements must be installed in such a way as to ensure adequate protection against accidental actuation.

- In order to prevent a wire or strand breakage on the signal side from causing undefined states in the programmable controller, suitable hardware and software safety precautions must be taken with regard to the I/O interface.

1.2.1.1 General interference suppression measures

- Lay the (shielded) connecting cable to the device at a sufficient distance or in a separate room from any power cables which are subject to interference. Otherwise the data transmission of the measured value can be interfered.
- To ensure reliable data transmission, use fully shielded cables and make sure they are well earthed. For differential data transfer (RS422, RS485 etc.), twisted-pair wires must be used in addition.
- Use a minimum cable cross-section of 0.22 mm^2 for data transfer purposes**.**
- Use a minimum earthing cable (machine base) cross-section of 10 mm^2 in order to avoid equipotential currents across the shield. Make sure the resistance of the earthing cable is much lower than that of the shield.
- Avoid crossing cables where possible. If unavoidable, only cross them at right-angles.
- The line shielding of the CAN cable must be connected on screw-clamp 16, see chapter 5.1.2 on page 17 and chapter 5.1.5 on page 20. In order to correspond to the CAN DeviceNet installation technology, the cable screw glands and internal screen clamps may not be used in this case for the shielding connection. The CAN connection signal GNDI is galvanically separated from the device voltage supply and may not be connected therefore with 0V.
- The line shielding for the RS485 connection with parameter setting possibility over "TRWinProg" is to be connected on the internalscreen clamp **(A)**, see chapter 5.1.5 on page 20.

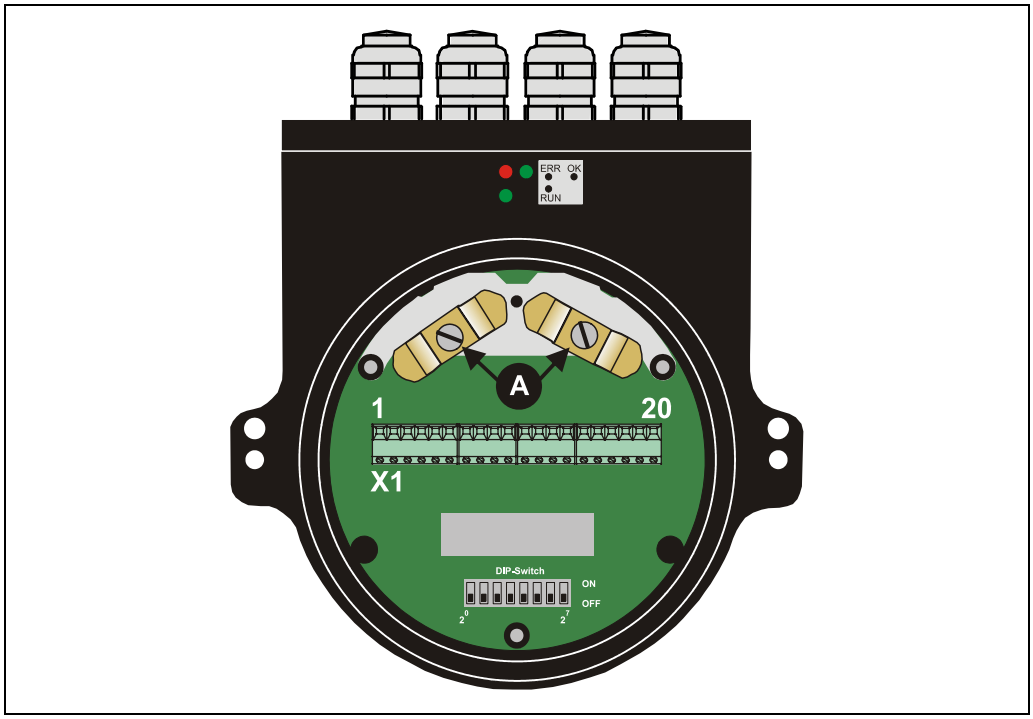


Figure 1: Connection cap with shield clampings

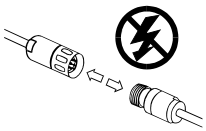
1.3 Intended purpose

The measuring system is used for recording linear movements and processing the measured data for a downstream control system with a CAN DeviceNet Field Bus interface according to ISO/DIS 11898.

Particularly the measuring system is designed for the use of distance measurements for the detection of the position and positioning of:

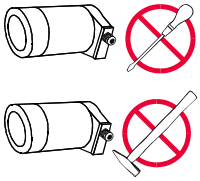
- High-bay storage devices and lifting gears
- Crane systems
- Side-tracking skates and truck storage vehicles
- Transfer machines

Warning



Switch off the voltage supply before carrying out wiring work or opening and closing electrical connections!
Short-circuits, voltage peaks, etc. can cause operating failures and uncontrolled operating states, as well as serious personal injuries and damage to property.

Check all electrical connections before switching on the system!
Incorrectly wired connections can cause operating failures, while wrong connections can lead to serious personal injuries and damage to property.



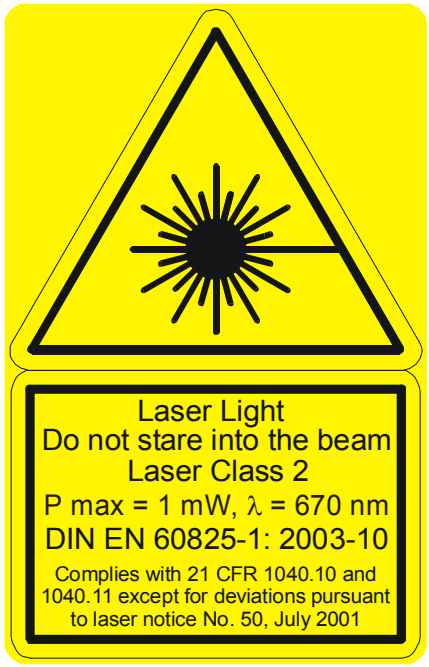
Mechanical or electrical modifications to the measuring systems ***are prohibited for safety reasons!***

In particular the following uses are forbidden

- operation in areas where interruption of the laser beam, e.g. by covering the laser lens opening, can lead to equipment damage or injury to personnel
- in environments, in which strong rain, snow, fog, steams or direct insolations etc. can influence the laser beam intensity negatively
- operation in rooms with explosive atmospheres
- operation for medical purposes

With use-purposes larger 125m measuring length, a special reflector must to be used! (see chapter "Accessories", page 32)

Warning



- In the case of Class 2 laser devices, the eye is not endangered if the exposure of the laser radiation is very short (up to 0.25 s) and accidental. For this reason, devices of this class can be used without additional protective measures, provided for the application it is not necessary to look into the laser beam deliberately for longer periods, i.e. 0.25 s, or to look repeatedly into the laser beam itself or the specular reflected beam.

  The existence of the blinking reflex for the protection of the eyes may not be assumed. Therefore the eyes should be closed consciously, or the head should be turned away immediately!

- The device must be installed in such a way that the exposure of persons to the laser beam can only happen accidentally.
- The laser beam may only extend as far as is necessary for the range measurement. The beam must be limited at the end of the useful range by a diffusely reflecting target area in such a way as to minimize the danger from direct or diffuse reflection. For this purpose, you should use the TR-Electronic reflecting foil supplied with the device.
- The area outside the operating range where the unshielded laser beam falls should be limited as far as possible and should remain out of bounds, particularly in the area above and below eye level.
- Observe the legal and local regulations applicable to the operation of laser units.

Note

The start-up, operating and programming instructions contained in this manual are mandatory.

1.4 Authorized operators

The start-up and operation of this device may only be performed by qualified personnel. For the purposes of this manual, the term "qualified personnel" refers to persons who are authorized to operate, earth and label equipment, systems and power circuits according to recognized safety standards.

1.5 Safety measures at the installation site

Warning

Do not perform any welding work once the device is connected and switched on!
Variations in potential can destroy the device or restrict its operation.

Do not touch plug contacts with your hands!
Static charges may destroy electronic components of the device.

Do not connect unused inputs (see pin assignment)!

Observe the voltage supply range:

Standard device:	18-27 V DC (± 5 %)
Device with heating:	24 V DC (± 5 %)

Clean lens opening of the laser and the reflecting foil regularly!
(see chapter "Maintenance", page 30)

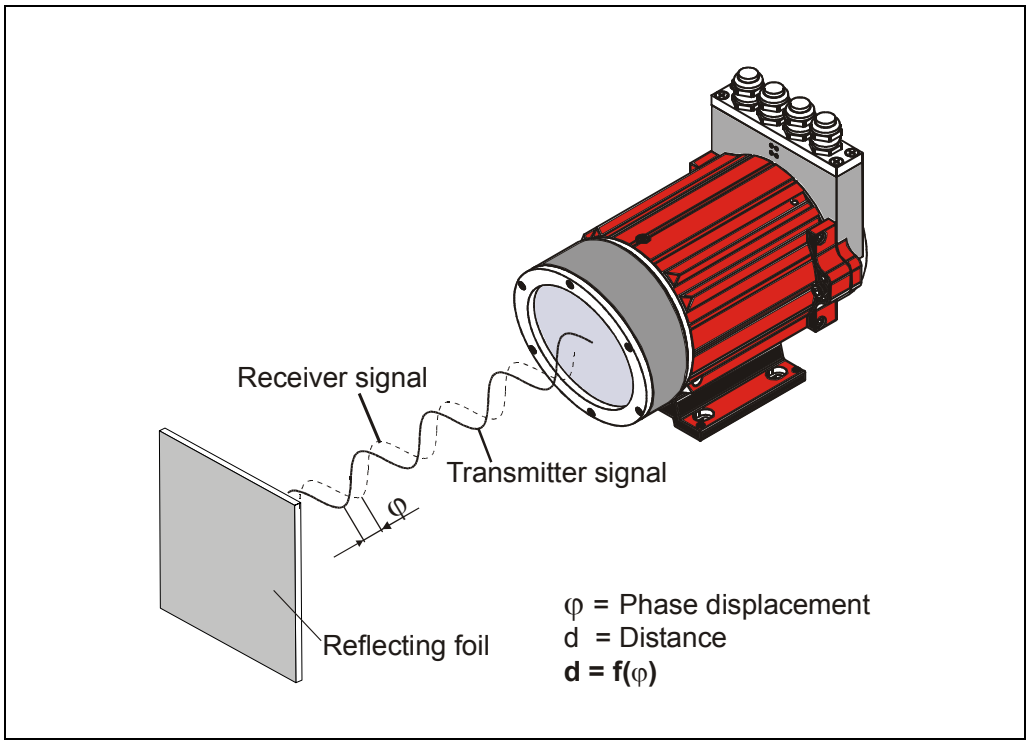
i ***Note***
Make sure that the environment of the installation site is protected against corrosive media (acids, etc.)

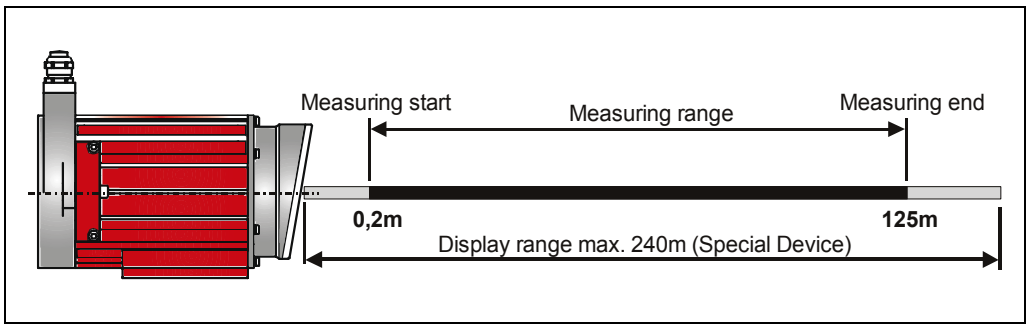
2 General Description

The laser measuring devices of the series LE are optical sensors, with which larger distances can be measured without contact and serviceable for controller. The measuring system consists of the real measuring device with laser light source, receiving optics, electronic evaluation and data interface as well as a reflector. The device sends out a modulated light beam which is reflected by the reflector. From the phase difference of the sent and received light beam the distance is measured 1000 times per second. Thus the LE is suitable also directly for the position feedback in controller loops.

According to the requirements the laser distance measuring devices of the series LE-200 CAN DeviceNet are configured either directly over the CAN-bus or with the PC-programming software "TRWinProg".

Principle





3 Transportation / Storage

Transport instructions

Do not drop the device or expose it to shocks or vibrations!
Device contains an optical system with glass elements.

Only use the original packaging!
The wrong packaging material can cause damage to the device during transportation.

Storage

Storage temperature : -20 to +75°C

Store in dry conditions.

4 Assembly instructions

The adjustment of the laser measuring device in the vertical plain is carried out via four studs (A) in the mounting plate. The adjustment in the horizontal plane can be made by four hexagon bolts (B). It has to be taken into account that the screw diameter is approx. 1-2 mm smaller than the through bore of the mounting plate. Exact dimensional properties are on the dimensional drawing in the rear part of the document.

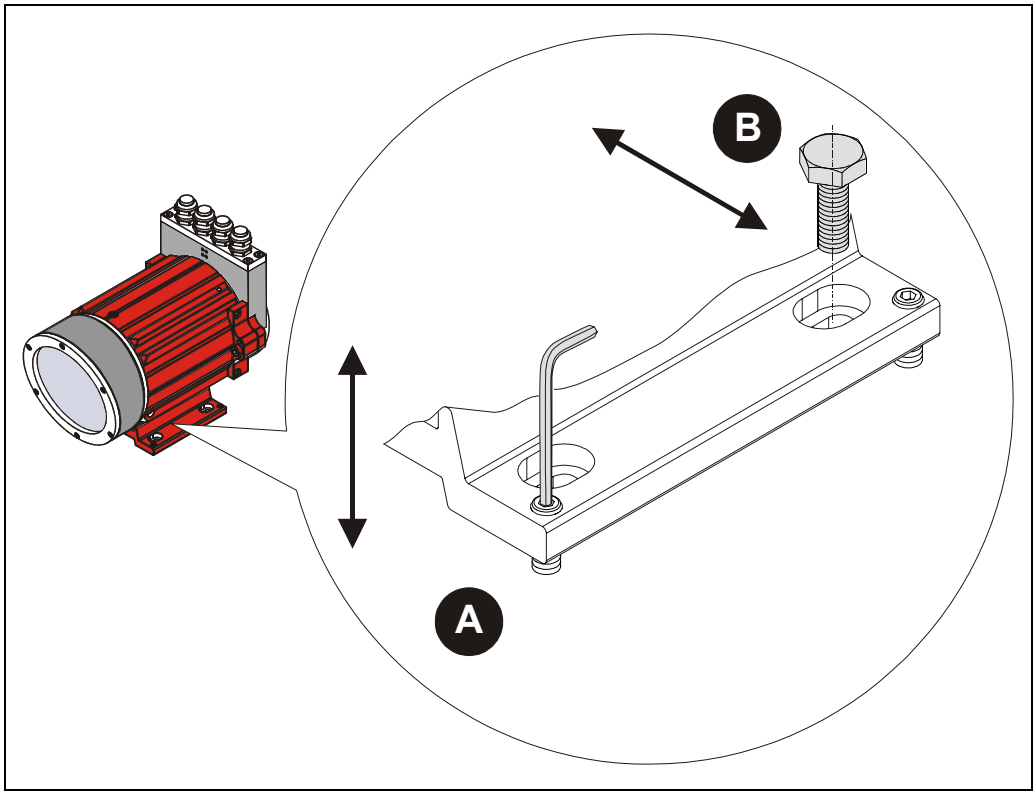


Figure 2: Mechanical adjustment possibilities

4.1 Aligning of the laser light spot to the reflector / foil inclination

The measuring device or reflector is attached to the moving object and the reflector/sensor to the fixed remote station in such a way that the reflector always remains within the visual field of the sensor. This can be done using the light spot of the laser diode, which is still clearly visible on the reflecting foil even at long distance. When aligning the laser measuring device, the user may need to take measures to ensure that it can be mechanically adjusted.
The size of the reflecting foil must be such that the light spot cannot be displaced from the reflector by vibrations. Since with an increasing distance the light spot gets larger and larger, the edge areas of the foil also have to be avoided.
The device comes with a reflecting foil measuring 20 x 20 [cm], but other sizes can be ordered on request.

i

Note
Reflecting foils by other manufacturers should not be used under any circumstances, as all the information in the "Specifications" chapter refers to the foil already supplied with the device.

Procedure:

- **Figure 3: Detection of the surface reflectivity:**
  - At first attaching the reflector foil flatly and drive plant on minimal distance Laser – Foil.
  - Centering paper (C) in front of the laser optics so, that the laser beam can unhinderedly emerge by an approx. 2 cm hole. Now, the interfering signal (B) should get visible on the paper (C). To the better location of the interfering signal (B) the reflector foil can be moved also a little. Here it is valid: angle of incidence = angle of reflection

- **Figure 4: Transmitting away the surface reflectivity:**
  - Rotate the reflector foil in the Y- or in the Z-axis so, that the interference signal (B) always is outside the laser lens. Nevertheless keeping the inclination of the reflector foil as low as possible to minimize measuring errors caused by misalignments in the procedure movement. For example, if the light spot drifts on the reflector foil around, small differences arise as a result of the oblique position.
  - Fix reflector foil

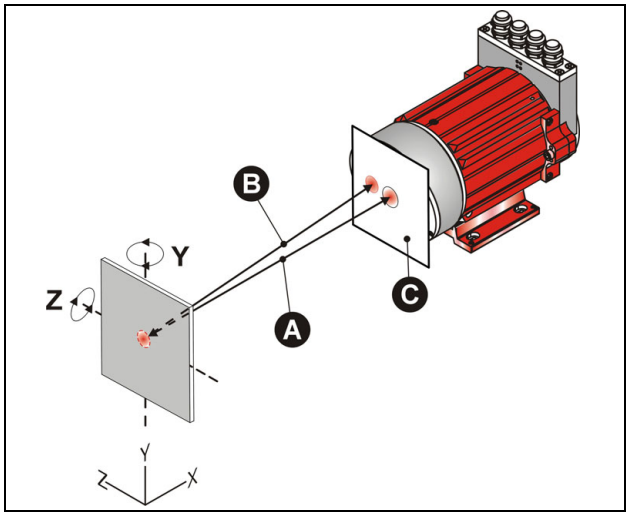


Figure 3: Detection of the surface reflectivity

(A)
real wanted signal, is always thrown back 180° independently of the reflector inclination

(B)
Surface reflectivity (interference signal)

(C)
Paper with an approx. 2 cm large hole in the center

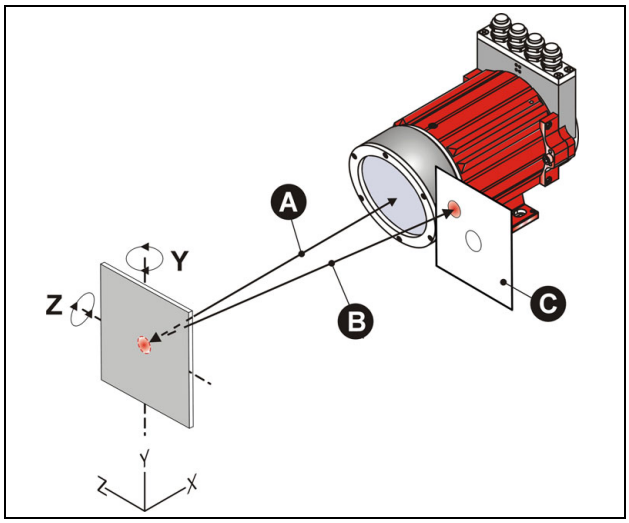


Figure 4: Transmitting away the surface reflectivity

4.2 Parallel operation of laser linear paths

It has to be taken care in the parallel operation of laser linear paths that a minimum distance of 1 m is kept. The reflector foil inclination must be made in such a way that the surface reflectivity (see arrows) points not into the other laser linear path.
The alignment is carried out as described in chapter 4 / 4.1.

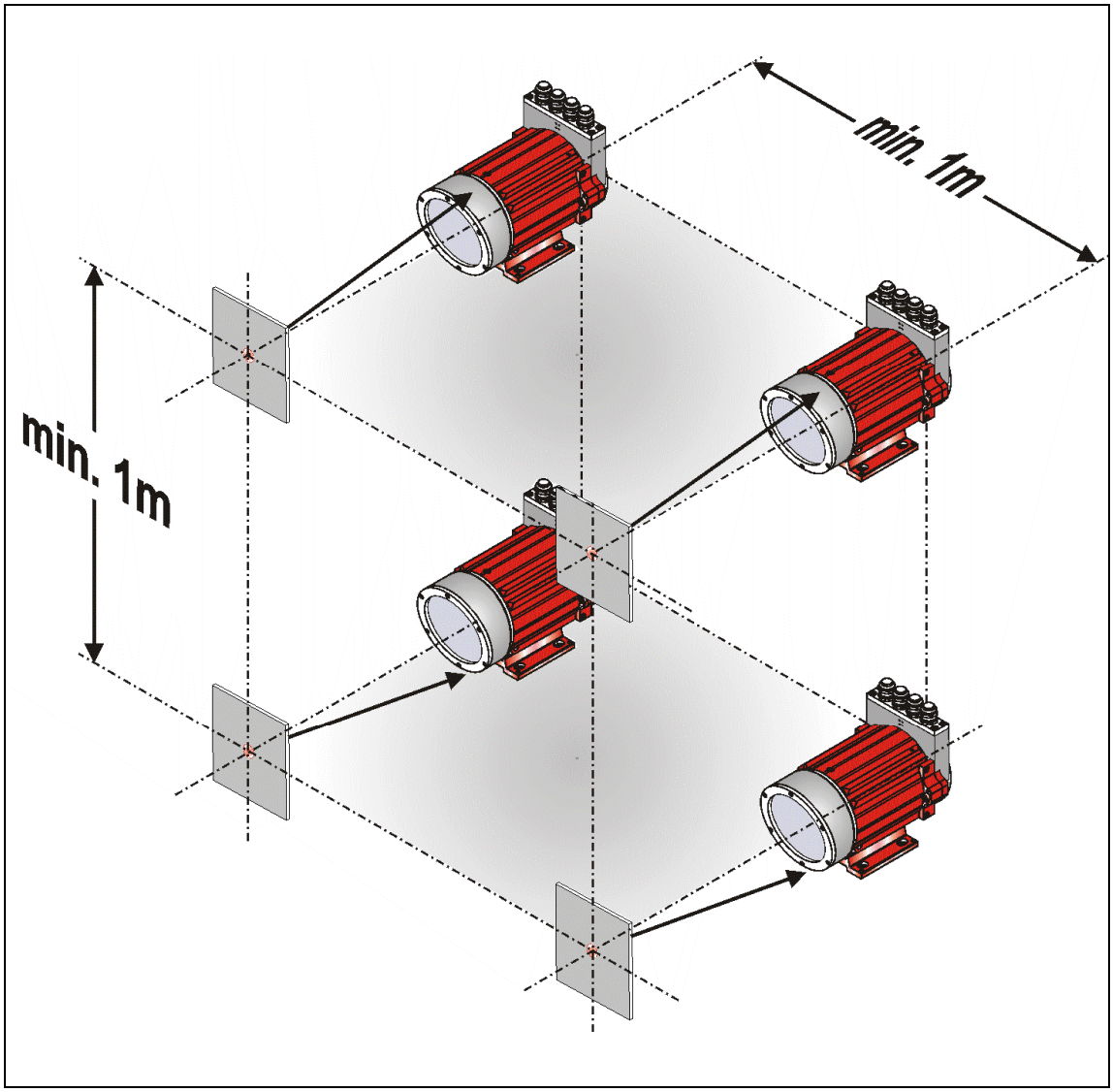


Figure 5: Minimum distance in parallel operation

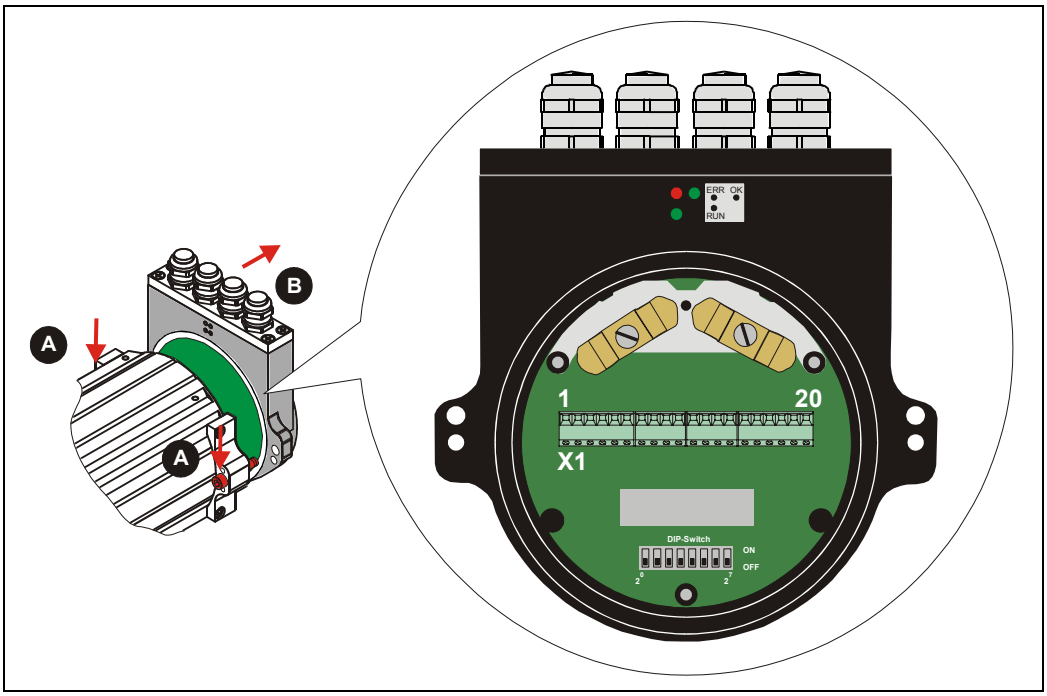
5 Commissioning / Installation

5.1 Electrical connection

Note

At the realization of the electrical connection the references in chapter 1.2.1, starting from page 7 must be considered.

In order to be able to carry out the connection, the connection cap must be removed from the laser first.
For this the screws (A) are loosened and the cap (B) is removed away from the laser.



5.1.1 Supply voltage

Pin 7 0V, GND

Pin 8 Standard: 18 – 27 V DC
Device with heating: 24 V DC (±5%)

5.1.2 CAN DeviceNet

Pin 15 GNDI (reference potential CAN_L / CAN_H)

Pin 16 Shield (internal RC-element onto case)

Pin 17 CAN_H

Pin 18 CAN_H

Pin 19 CAN_L

Pin 20 CAN_L

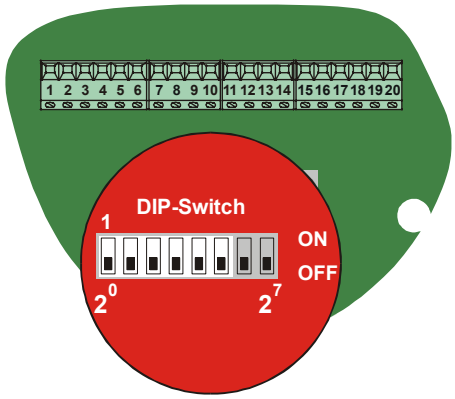
5.1.2.1 Bus termination

For the communication a defined no-signal level must be guaranteed on the CAN bus. To this both line ends have to be terminated with terminating resistors.
In the laser measuring device is not provided an add-on connection of the terminating resistor. Therefore, if the laser measuring device is the last slave in the CAN bus line, the termination must be made manually with a terminating resistor of 121 ohms between the CAN_H and CAN_L lines.

5.1.2.2 Identifier (MAC-ID)

The identifier (laser address) 0 – 63 is adjusted via the DIL-switches 1-6:
DIL-1 = ID 2^0, DIL-6 = ID 2^5

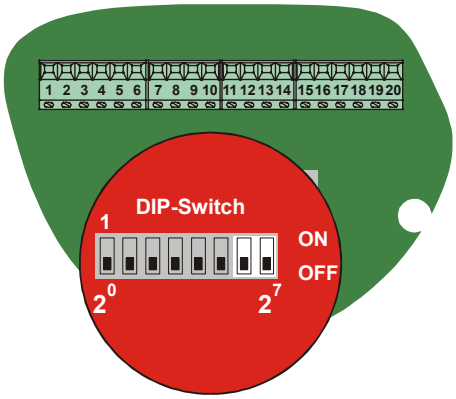
Note:
The adjusted address may be assigned only once in the CAN DeviceNet bus.



5.1.2.3 Baud rate

The baud rate is adjusted via the DIL-switches 7-8:

DIP-7	DIP-8	Baud rate
OFF	OFF	125 kbps
ON	OFF	250 kbps
OFF	ON	500 kbps



5.1.2.4 Length of the bus line

The max. bus line length is dependent on the adjusted baud rate:

Baud rate [kbps]	Line length [m]
125	approx. 500
250	approx. 250
500	approx. 100

5.1.3 Switching input / Switching output

The programming of the switching input / switching output is carried out either directly via the bus, or via the PC software "TRWinProg".

Functions of the switching input:

- Preset
- Switch off laser diode
- Failure quit

Functions of the switching output:

- Temperature- ,
- Intensity- ,
- Hardware-Fail-Output or
- every fail
- Speed-check
- Plausibility measured value
- Switching output position

Pin 1 GND, reference potential pin 2

Pin 2 Switching output

Pin 3 Switching input

5.1.4 RS485 - programming interface

The RS485 programming interface was developed mainly only as service interface for the technician.
Primarily therefore the programming possibilities via the CAN DeviceNet should be used.
Via the PC software "TRWinProg" and a PC adapter the connection to the laser measuring device is established. More informations see page 20 or in the TRWinProg software manual.

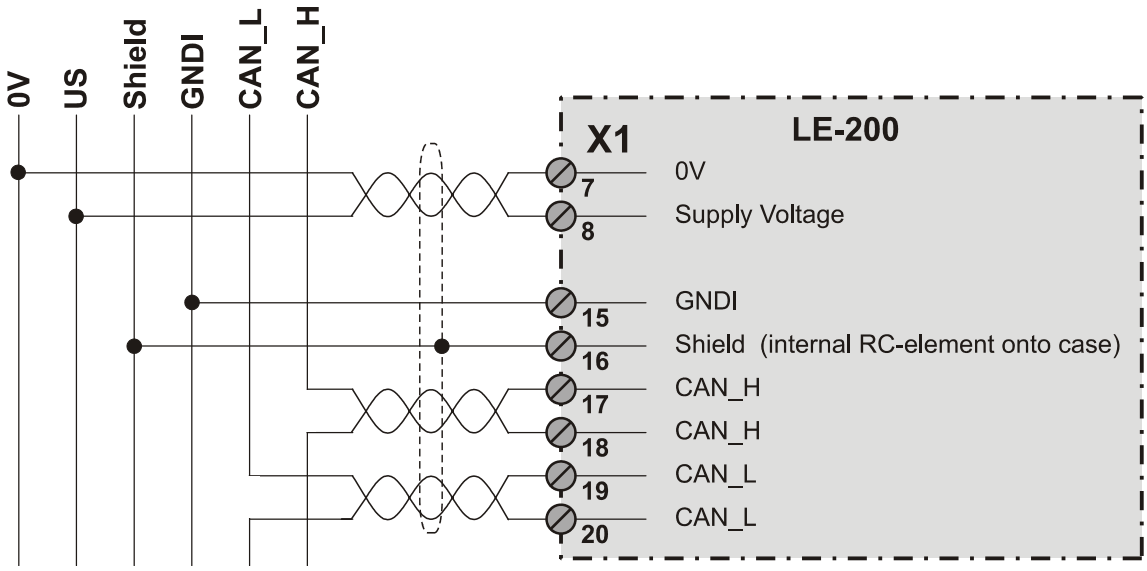
Pin 9 RS485–

Pin 10 RS485+

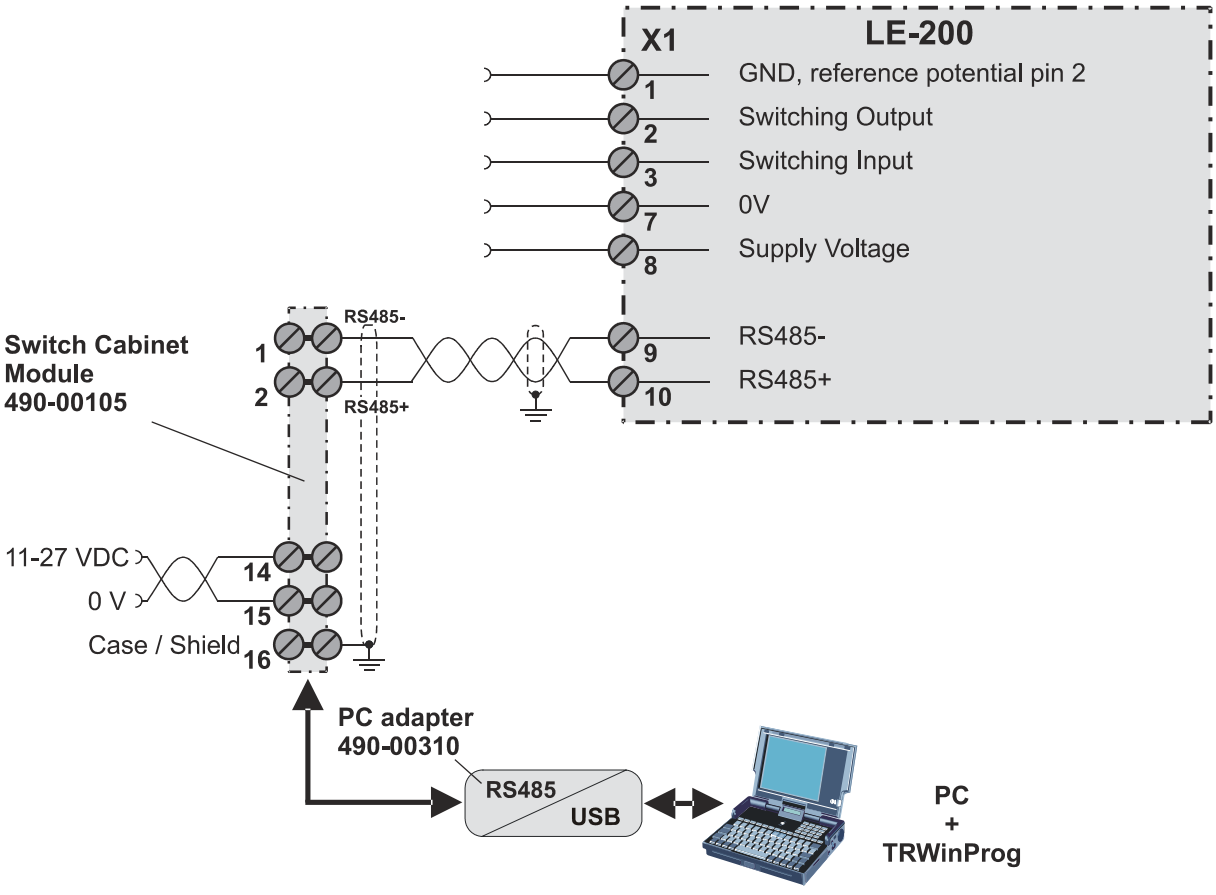
5.1.5 Wiring examples

Note
Observe the “General interference suppression measures”, chapter 1.2.1.1 page 8.

CAN DeviceNet connection



RS485-connection with parameter setting via "TRWinProg"



5.2 CAN DeviceNet interface

The CAN-Fieldbus-Interface (separated galvanically by CAN-BUS-Driver PCA82C251) in the Laser is determined according to the international standard ISO/DIS 11898 and covers the two lower layers of the ISO/OSI reference module.
The transformation of Laser information into the CAN protocol occurs by the protocol chip SJA1000. The function of the protocol chip is monitored by a watchdog.

The **PREDEFINED MASTER/SLAVE CONNECTION SET** is used for the Laser who only works as a slave. It will be used only the **Group 2 Messages** with the exception of the **Group 1 Message For Slave I/O Poll Response**.

Establishing or breakdown of a connection must occur via **Group 2 Only Unconnected Explicit Request Message**.

The Laser contains an **I/O Communication Port** and an **Explicit Message Communication Port**. The I/O **communication port** is used for polling the Laser position and must be made accessible by setting the watchdog (after the I/O connection master/slave was set up before). Is the I/O port not retriggered (polled) punctually the connection is interrupted and the red LED flashes. The connection for the I/O port must be installed again.

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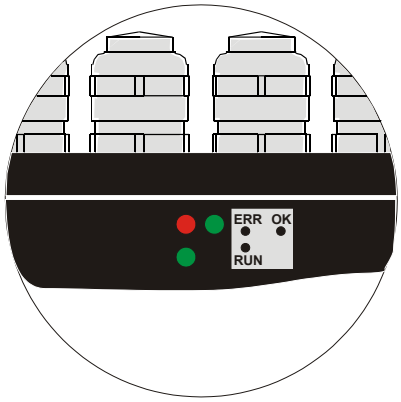
Note
During programming, data is exchanged between the Laser and the master in binary code.

5.2.1 Bus status

At the connection cap the laser has 3 LEDs, which display the bus status of the laser:

LEDs Off	Laser is not on-line - No Dup_MAC_ID test - Device may not be powered
RUN, green	On-line, with connections in the established state - Device is allocated to a master
RUN, green flashing	Recoverable faults - e.g. I/O-connections are in the time-out state
ERR, red	- Turn off system, after that turn on system - Replace laser device
ERR, red flashing	- Dup-MAC-ID test successful - No allocation to a master
OK, green	Laser hardware ok



5.2.2 EDS-file

The EDS-file (electronic data sheet) contains all informations about the laser specific parameters and operating modes of the laser measuring device. The EDS-file is needed by the DeviceNet network configuration tool to be able to configure or to take into operation the laser measuring device duly.

The EDS-file has the file name **"LE200.EDS"**

The file is on the Software/Support CD:
Order number: 490-01001, Soft-No.: 490-00407.

5.2.3 Messages

Following messages are supported by the Laser:

- I/O Poll Command/Respond Message
  This message is sent directly by the master to the desired slave (point-to point). For every slave which is polled the master must sent an own poll command message.
  As response on a Poll Command the slave sends back to the master the Poll Response I/O Message.

- Explicit Response/Request Message
  Explicit Request Messages are used for processing of write/read attribute's. Explicit Response Messages contains the result of an Explicit Request Message Service.

- Group 2 Only Unconnected Explicit Request Message
  Group 2 Only Unconnected Explicit Request Message serves for the establishing or breakdown of connections for the Predefined Master/Slave Connection Set.

- Duplicate MAC ID Check Message
  After switch-on the slave he reports Duplicate MAC ID Messages.

5.2.4 Classes

The communication objects are divided into classes. The Laser supports the following classes:

Object Class	Number of instances
Identity	1
Message Router	1
DeviceNet	1
Connection	2
Assembly	2
Parameter	15
Position Sensor	1

5.2.5 I/O Instance

Input Instance

Number	Name
1	Position Value

Input Data Format

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	Low Byte Position Value							
	1	.							
	2	.							
	3	High Byte Position Value / Error Status							

Output Instance

Number	Name
1	Control Bits

Output Data Format

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	0	0	0	0	FQ	LD-ON	LD-OFF	Preset

Via the output byte control commands can be transferred to the laser. It must be taken into account that for a repeated execution of a control bit the corresponding bit has to be reset to "0" for at least one polling cycle.

[Preset] Execute Preset Bit 0 in the output byte	By setting this bit the laser is adjusted to the value deposited in "Preset - Service 005 hex", page 26. Preset cycles lower than 500ms are not allowed.
[LD-OFF] Switch off laser diode Bit 1 in the output byte	By setting this bit the laser diode (LD) is switched off for the extension of the life time. If in "Function external input - Service 00A hex", page 27 = "LD-switching input" is preselected, or in the PC-program "TRWinProg" in the basic parameters the switching-off of the laser diode is carried out automatically, this function is ineffective.
[LD-ON] Switch on laser diode Bit 2 in the output byte	By setting this bit the laser diode is switched on. This function is ineffective if: see Bit 1 "Switch off laser diode" above.
[FQ] Clear Error Bit 3 in the output byte	If in parameter "Automatic error acknowledgement - Service 00B hex", page 27 the setting is preselected "not automatically", by setting this bit an occurring error report is deleted. If the error could not be eliminated, the corresponding bit in error status or error output is set in the next cycle again.
Bit 4 - 7	not used

6 Configuration / Parameter setting via the CAN DeviceNet master

The configuration of the laser occurs alternatively via the configuration software of the CAN DeviceNet - master or via the TRWinProg-software. With a download of the control parameters the parameters, which were configured via the TRWinProg-software, will be overwritten by the control.
In this instruction only the configuration via the CAN DeviceNet - master is described. The PC program TRWinProg is described in an instruction of its own.

6.1 Configuration Assembly Data Attribute Format

Note
The LE-200 laser measuring device can be operated also with LE-100 CAN DeviceNet projects, but then the functionality of the device is reduced. In this case the EDS-file "LE100.EDS" is to be used.

Instance	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
42	0	[1] Direction of counting							
	1	[1] Clear Preset							
	2 to 5	[1] Scaling in 1/1000 mm							
	6 to 9	Error value **(not supported)**							
	10 to 13	[1] Low Byte Preset [1] High Byte Preset							
	14 to 15	[1] Data-Check							
	16	Resolution							
	17	Function external input							
	18	Automatic error acknowledgement							
	19	Function error output							
	20	Output value in case of an error							
	21	Error status via the bus							

While programming the parameters via the "Assembly-Class" the Laser returns as response while reading the configured values to the master. At LE-100 projects altogether 16 bytes are returned, otherwise 22 bytes. The data check is carried out automatically.

[1] With LE-100 CAN DeviceNet projects supported parameters

6.2 Parameter Object Instances

Note

The LE-200 laser measuring device can be operated also with LE-100 CAN DeviceNet projects, but then the functionality of the device is reduced. In this case the EDS-file "LE100.EDS" is to be used.

Number	Name	Data Type
1	[2] Direction of Counting	USINT
2	[2] Clear Preset	USINT
3	[2] Scaling in 1/100 mm	UDINT
4	Error value **(not supported)**	UDINT
5	[2] Preset	USINT
6	[2] Data-Check	UINT
7	[2] Adjustment	UDINT
8	[2] Software version	UDINT
9	Resolution	USINT
10	Function external input	USINT
11	Automatic error acknowledgement	USINT
12	Function error output	USINT
13	Output value in case of an error	USINT
14	Error status via the bus	USINT
15	Intensity in %	USINT

If the parameters are programmed via the "Parameter-Class", for taking over the data, a Data-Check must be carried out subsequently (otherwise the programmed values are lost after Power off/on).

6.3 Parameters / Value Ranges

6.3.1 Direction of Counting - Service 001 hex

Definition of the counting direction:

0 (2^{23} to 2^{0}) ***(default)***	With increasing distance to the laser, values increasing
1 (2^{23} to 2^{0})	With increasing distance to the laser, values decreasing

The position value is max. 24 bit

6.3.2 Clear Preset - Service 002 hex

Via this parameter, the calculated zero-point is deleted (difference of the desired preset value to the physical laser position). After deletion of the zero-point correction the laser outputs his "real" physical position.

0	Clear Preset
1	No clearing

[2] With LE-100 CAN DeviceNet projects supported parameters

6.3.3 Scaling in 1/100 mm - Service 003 hex

If in parameter "Resolution - Service 009 hex" the selection "Free resolution" was carried out, via the scaling the resolution of the measuring system is defined.

Input value in 1/100 mm
1 mm e.g. corresponds to the input value of 100. That means, that the laser output 1 step / mm.

Default value: 100, maximum value: 65535

6.3.4 Preset - Service 005 hex

Definition of the position value to which the laser is adjusted, when the preset function is executed
(see "I/O Instance", page 23 / "Function external input - Service 00A hex", page 27).
The preset value must be programmed in the range from 0 ... measuring length (see "Range" chapter "Specifications", page 31). ***Default value is "0"***

6.3.5 Data-Check - Service 006 hex

Over the data check service the parameters are saved in the device permanently.
This function must be executed after each parameter modification otherwise the programmed values are lost after Power off/on.

6.3.6 Preset-Adjustment - Service 007 hex

By adjustment, via the CAN-bus the Laser is set to the desired position value.
After the adjustment, no Data-Check is necessary.
The value must be programmed in the range from 0 ... measuring length (see "Range" chapter "Specifications", page 31). ***Default value is "0"***

6.3.7 Resolution - Service 009 hex

Definition of the measuring system resolution.
Options:

0	Centimeter
1	***Millimeter (default)***
2	1/10 millimeter
3	1/100 millimeter
4	Inch
5	1/10 Inch
6	Free resolution (in 1/100 mm), valid values are 1 - 65535, ***default = 100***

With selection "Free resolution" the entered value of the parameter "Scaling in 1/100 mm - Service 003 hex" is used.

6.3.8 Function external input - Service 00A hex

Determines, whether the switching input is to be used as
- Preset input
- Switch-off Laser-Diode (LD) or
- Failure reset - input

With connection of the switching input as Preset-input the laser is adjusted on the predefined position value in "Preset - Service 005 hex", page 26. With connection the switching input as LD-input the laser diode is switched off for the extension of the life time. If in the PC-program "TRWinProg" in the basic parameters the switching-off of the laser diode is carried out automatically, the LD-switching input does not have a function.

0	***disabled (default)***	Function switched off, following parameters without meaning
1	Preset function	External switching input is determined as Preset input. Software execution see chapter "I/O Instance", page 23.
2	LD switching input	External switching input is used for switching-off of the laser diode. Software switching-off see chapter "I/O Instance", page 23.
3	Error acknowledgement	External switching input is used as error acknowledgement. Software acknowledgement see chapter "I/O Instance", page 23.

6.3.9 Automatic error acknowledgement - Service 00B hex

Determines, whether occurring error reports should be cleared automatically after eliminating the trouble.

0	***not automatically (default)***	An occurring error report can be cleared via bit 3 in the output byte (see chapter "I/O Instance", page 23) or also via the external switching input.
1	automatically	An occurring error report is cleared automatically after remedying of the error.

6.3.10 Function error output - Service 00C hex

Specifies the function of the error output (external switching output). Definition of the error see "Output of the error status via the bus - Service 00E hex", page 28.
Options:

0	***disabled (default)***
1	Temperature
2	Intensity
3	Hardware-Fail
4	every fail
5	Speed-check
6	Plausibility measured value

6.3.11 Output value in case of an error - Service 00D hex

Determines, which data value is to be transmitted as position value (see chapter I/O Instance, page 23 table "Input Data Format") in the case of an error. The data value is output, if the laser can output no more measurement. This is given e.g., if a beam interruption is present.

Options:

0	***Null (default)***	The position is set to "0"
1	0xFF	All 24 bits are set to '1' (0xFFFFFF or -1)
2	last valid value	Output of the last valid position

6.3.12 Output of the error status via the bus - Service 00E hex

Via this parameter it is determined whether in the high byte of the input information (see chapter I/O Instance, page 23 table "Input Data Format") the error status is to be transmitted. The error status is binary coded.

Over the error status the error message of the laser will transfer and is reset, if the error were recovered, or is no more present. If in "Automatic error acknowledgement - Service 00B hex", page 27 the selection was carried out "not automatically", the error must be acknowledged additionally.

No error Input byte = 0x00	Corresponds to the normal condition
Intensity Bit 0 in the input byte	The bit is set, if an intensity value of smaller 8% is present, or the laser beam is interrupted and leads to the error value output (see Service 00D).
Temperature Bit 1 in the input byte	The bit is set, if the device temperature is outside of the range from 0 - 50 °C. A low range deviation has still no influence on the measurement and is therefore to be regarded as a warning.
Hardware Bit 2 in the input byte	The bit is set, if an internal hardware error were noticed and leads to the error value output (see Service 00D).
Laser diode switched off Bit 3 in the input byte	The bit is set, if the laser diode was switched off over the bus, or the switching input. Serves only for information purposes.
Intensity warning Bit 4 in the input byte	The bit is set, if an intensity value of smaller 12% were determined and means that the measuring system optics, or the reflecting foil is to be cleaned. However, the device operates error-freely furthermore.
Overspeed warning Bit 5 in the input byte	The bit is set if the speed, adjusted in the PC program TRWinProg, is exceeded. About the default setting the speed-check is switched off. A configurability over the bus is not possible.
Warning bit Plausibility Bit 6 in the input byte	The bit is set if the plausibility of the measured value cannot be guaranteed. E.g. this is the case at a position jump if a second reflection foil is held into the laser beam.

6.3.13 Intensity in % - Service 00F hex

Via this parameter the momentary beam intensity of the laser measuring device in % (max. 100) is output. The value only can be read.

7 Causes of Faults and Remedies

The error causes are determined in "Output of the error status via the bus - Service 00E hex", page 28. Depending on setting the error messages must be acknowledged for resetting the error code (see chapter "I/O Instance", page 23 table "Output Data Format" and "Function external input - Service 00A hex", page 27).

Error code	Cause	Remedy
Bit 0 Intensity error	The device checks the intensity of the received laser signal continuously, it was detected a below-minimum intensity.	1. Clean measuring system optics 2. Clean reflecting foil 3. Rule out an interruption of the laser beam If the possibility of soiling or interruption of the laser signal can be ruled out, the device must be replaced.
Bit 1 Device temperature	The temperature has exceeded or fallen short of the range of 0 - 50°C at the housing of the device	Appropriate measures must be taken to prevent the device from overheating or undercooling.
Bit 2 Hardware error	The device has detected an internal hardware error.	If the error occurs repeated, the device must be replaced.
Bit 3 Laser diode switched off	The bit is set, if the laser diode was switched off over the bus, or the switching input.	Serves only for information purposes.
Bit 4 Intensity warning	The device determined an intensity of < 12%.	This message is only a warning and means that the measuring system optics, or the reflecting foil is to be cleaned. However, the device operates error-freely furthermore.
Bit 5 Speed-check warning	The speed level adjusted over the PC program TRWinProg was exceeded.	This message is a warning and means that possibly corresponding measures must be taken, so that no system components will be damaged.
Bit 6 Plausibility warning	The plausibility of the measured value couldn't be guaranteed any more.	This message is a warning and means that possibly corresponding measures must be taken, so that no system components will be damaged.

8 Maintenance

8.1 General Maintenance Information

The Laser Measuring Device does not, in general, require maintenance by the operator.

Note
If the lens opening of the laser or the reflecting foil become dirty, clean with a soft cloth.

Do not use an aggressive cleaning material such as thinner or acetone !

8.2 Repair, Maintenance

Repairs to the devices must only be carried out by the manufacturer.

Contact your TR-Electronic GmbH distributor or service organization should repairs be required. The addresses are listed on the last page of this description.

9 Appendix

9.1 Specifications

> ***Note***
> The electric characteristics have validity, only after an operating time of approximate 30 minutes.

9.1.1 Electrical ratings

Measuring principle: ..... Phase delay time measurement

Range (measurement on reflecting foil): ..... 0,2 – 125 m standard,
170m, 195m, 240m (special devices)
other measuring ranges on request

*** Resolution:** ..... selectable, physical resolution 0,1 mm

Linearization
up to 12m (standard): ..... absolute linearity error ±3 mm
complete measuring length: ..... absolute linearity error ±5 mm

Operating voltage
Standard device: ..... 18-27 V DC (± 5%)
Device with heating: ..... 24 V DC (± 5%)

Power consumption (no-load): ..... < 6 watts

Power consumption with heating: ..... < 60 watts

Opto-transmitter: ..... Laser diode (red light)
Wavelength λ: ..... 670 nm
Max. laser power: ..... P ≤ 1 mW
Laser protection class: ..... 2 according to DIN EN 60 825-1: 2003-10
Lifetime: ..... 50 000 h

Measured value output / refresh cycle: ..... 1000 values / s

Integration time: ..... 1 ms

Reproducibility: ..... ± 2 mm

Programming via RS485: ..... PC IBM compatible (TRWinProg) / CAN DeviceNet

CAN DeviceNet Interface: ..... CAN-Fieldbus-Interface (opto-isolated)
CAN-BUS-Driver (ISO/DIS 11898)
Baud rate (adjustable): ..... 125 kbaud, line length up to 500
250 kbaud, line length up to 250 m
500 kbaud, line length up to 100 m
Output code: ..... Binary
Special features: ..... Configuration of the following parameters via the CAN-Bus:
Direction of Counting, Clear Preset, Scaling, Preset, Preset-Adjustment, Resolution, Function ext. input, Automatic error acknowledgement, Function error output, Output value in case of an error, Output of the error status via the bus

*** Switching input / Switching output**
Levels switching input: ..... 1-level > +8V, 0-level < +2V, up to ±35V, 5 kOhm
Levels switching output: ..... 1-level > US-2V, 0-level < 1 V, up to 100mA

* programmable parameter

9.1.2 Environmental conditions

EMC: ..... EN 61000-4-2 (IEC-801-2) /
EN 61000-4-4 (IEC-801-4)

Operating temperature range: ..... 0-50°C
Device with heating: ..... -30 to +50°C

Thermal drift: ..... 1 ppm / °C, related to the max. measuring length of 125 m, 170 m, 195 m or 240 m

Storage temperature range: ..... -20 to +75°C

Relative air humidity: ..... 98 % (no moisture condensation)

*** Degree of protection:** ..... IP 65 (DIN 40 050)

Vibration (50-2000 Hz Sinusoidal) DIN IEC 68-2-6: ..... $\leq$ 50 m/s^2 (5g)

Shock (11ms) DIN IEC 68-2-27: ..... $\leq$ 300 m/s^2 (30g)

***** The protection class is valid for the device with screwed-together cable glands.

9.2 Accessories

Article-No.:	**Description**
490-00105	TR-PT-15/2: switch cabinet module for PC adapter connection
490-00310	Device: PC adapter (RS485 <--> USB)
490-01001	Soft-No.: 490-00416 "TRWinProg" PC-software with user manual German and English
	Soft-No.: 490-00407 EDS files
Reflecting foils for measurements up to 125m	
[1)] 49-500-020	200 x 200 mm, package contents / alternative type 49-500-046
49-500-038	200 x 300 mm / alternative type 49-500-048
49-500-031	749 x 914 mm / alternative type 49-500-047
49-500-046	200 x 200 mm, package contents
49-500-048	200 x 300 mm
49-500-047	749 x 914 mm
Other sizes upon request. In addition, the foils can be sticked-on side-by-side up to the desired size.	
Fresnel Reflecting foils for measurements > 125m	
49-500-032	554 x 480 mm, package contents
49-500-034	554 x 480 mm, predrilled
49-500-036	720 x 693 mm
49-500-037	1108 x 960 mm
49-500-039	200 x 200 mm, for measurements approx. up to 130m

[1)] can be supplied only transitionally