DeviceNet™

Laser Measuring Device LE-200

_Additional safety instructions
_Installation
_Commissioning
_Parameterization
_Cause of faults and remedies

User Manual

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Font styles

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

`Courier` font displays text, which is visible on the display or screen and software menu selections.

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

Brand names

DeviceNet is a trademark of ODVA, Inc.

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Pin assignment downloads:..www.tr-electronic.com/f/TR-ELE-TI-GB-0009

Drawing downloads: www.tr-electronic.com/f/04-K2200-002

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First release	07/22/03	00
Expansion of the function for the error output, service 00C • Speed-check, configurable via TRWinProg	0918/03	01
New parameter, service 00F • "Intensity in %"	10/09/03	02
Revision of the laser warning label.	12/18/03	03
• Revision of the shielding concept • General technical modifications • Layout modifications	06/01/07	04
Max. measuring range 240 m	12/18/07	05
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1 General information

This interface-specific User Manual includes the following topics:

- Safety instructions in additional to the basic safety instructions defined in the Assembly Instructions
- Installation
- Commissioning
- Parameterization
- Troubleshooting and diagnostic options

As the documentation is arranged in a modular structure, this User Manual is supplementary to other documentation, such as product datasheets, dimensional drawings, leaflets and the assembly instructions etc.

The User Manual may be included in the customer's specific delivery package or it may be requested separately.

1.1 Applicability

This User Manual applies exclusively to the following measuring systems with *DeviceNet™* interface:

- LE-200

The products are labelled with affixed nameplates and are components of a system.

The following documentation therefore also applies:

- see chapter "Other applicable documents" in the Assembly Instructions www.tr-electronic.de/f/TR-ELE-BA-DGB-0018.

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2 Additional safety instructions

2.1 Definition of symbols and instructions

⚠ WARNING means that death or serious injury can occur if the required precautions are not met.

⚠ CAUTION means that minor injuries can occur if the required precautions are not met.

NOTICE means that damage to property can occur if the required precautions are not met.

indicates important information or features and application tips for the product used.

2.2 Additional instructions for intended use

The measurement system is designed for operation with CAN DeviceNet™ networks according to the International Standard ISO/DIS 11898 and 11519-1 up to max. 500 kbit/s.

The technical guidelines for the structure of the CAN DeviceNet™ network from the CAN User Organization ODVA™ are always to be observed in order to ensure safe operation.

Intended use also includes:

- observing all instructions in this User Manual,

- observing the assembly instructions. The *"Basic safety instructions"* in particular must be read and understood prior to commencing work.

2.3 Organizational measures

- This User Manual must always kept accessible at the site of operation of the measurement system.

- Prior to commencing work, personnel working with the measurement system must have read and understood

  - the assembly instructions, in particular the chapter *"Basic safety instructions"*,

  - and this User Manual, in particular the chapter *"Additional safety instructions"*.

  This particularly applies for personnel who are only deployed occasionally, e.g. at the parameterization of the measurement system.

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3 DeviceNet™ information

DeviceNet™ was developed by Rockwell Automation and the ODVA™ as an open field bus standard, based on the CAN protocol and is standardized in the European standard EN 50325. Specification and maintenance of the DeviceNet standard is regulated by the ODVA™. DeviceNet™, along with ControlNet™ and EtherNet/IP™, belongs to the family of CIP™-based networks. The CIP™ (Common Industrial Protocol) forms a common application layer for these 3 industrial networks. DeviceNet™, ControlNet™ and Ethernet/IP™ are therefore well matched to one another and present the user with a graduated communication system for the physical layer (Ethernet/IP™), cell layer (ControlNet™) and field layer (DeviceNet™). DeviceNet™ is an object-oriented bus system and works according to the producer/consumer model.

DeviceNet™ Protocol

The DeviceNet™ protocol is an object-oriented protocol. It is typically used for networking sensors and actuators with the superordinate automation devices (PLC, IPC).

DeviceNet™ Data Link Layer

Layer 2 (Data Link Layer) is based on the Controller Area Network (CAN), which was originally designed for use in motor vehicles.

DeviceNet™ Network and Data Transport Layer

The link is set up with the Group 2 Unconnected Port. Selected CAN identifiers are used for the link set-up. A link, once set up, can be used for transmitting explicit messages or for setting up additional I/O links. As soon as an I/O link has been set up, I/O data can be exchanged between the DeviceNet™ users. The 11 bit identifier is used exclusively for coding I/O data. The 8-byte wide CAN data field is fully available for user data.

DeviceNet™ Application Layer – CIP™ Protocol

The CIP™ (Common Industrial Protocol) forms the application layer for DeviceNet™. The CIP™ defines the exchange of I/O data in realtime via I/O messages (I/O messaging or implicit messaging), as well as the exchange of data required for configuration, diagnosis and management via explicit messages (explicit messaging). The communication between two devices always takes place according to a connection-oriented communication model, either via a point-to-point or a multicast-V1 connection. This allows both master/slave and multi-master systems to be realized. Data are known as objects and are logged in the object directory of each device.

Predefined Master-Slave Connection Set

The so-called "Predefined Master/Slave Connection Set" is used for the DeviceNet™ measuring system. This subset of the DeviceNet™ protocol simplifies the transmission of I/O data between an automation system (PLC) and the decentralized peripheral devices (slaves): Only "Group2 Messages" are supported, with the exception of "Group1 Message for Slave I/O Poll Response".

DeviceNet™ Device Profiles

Beyond the specification of the pure communication functions, DeviceNet™ also includes the definition of device profiles. These profiles define the respective device types for minimally available objects and communication functions. The device type number 08hex was defined for the DeviceNet™ measuring system.

Vendor ID

The vendor IDs (manufacturer's identifiers) are assigned and administrated by the ODVA™. The TR-Electronic vendor ID for DeviceNet™ is "134" (dec).

You can obtain further information on DeviceNet™ from the Open DeviceNet Vendor Association (ODVA) or the following Internet addresses:

www.odva.org
e-mail: mailto:odva@odva.org

4 Installation / Preparation for start-up

4.1 Electrical connection

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.
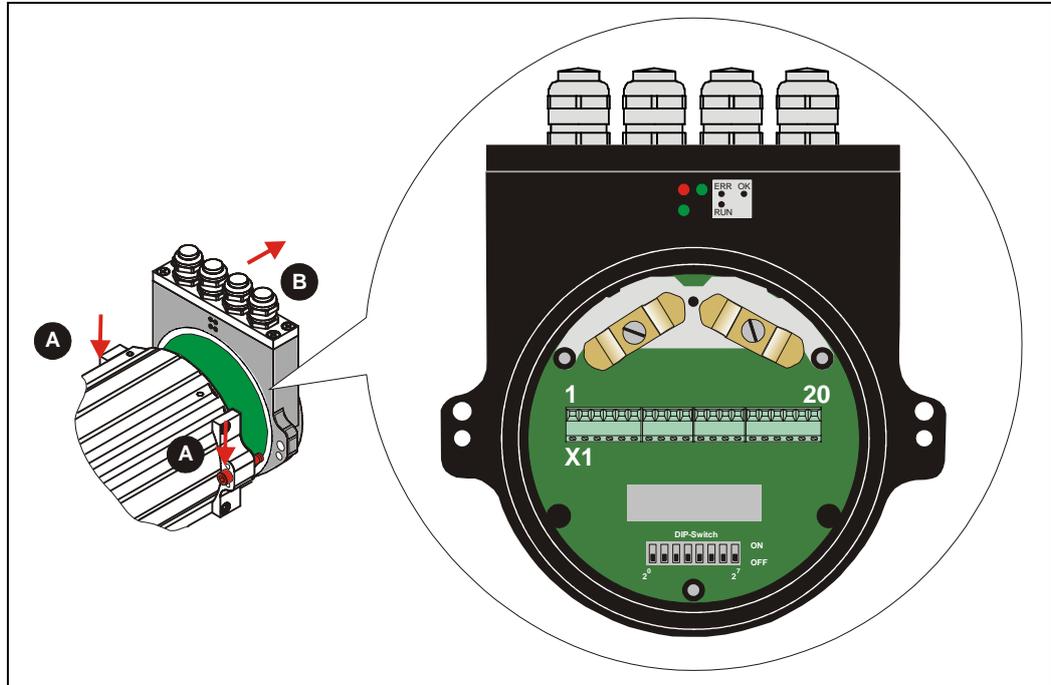
4.1.1 Supply voltage

Pin 7   0V, GND

Pin 8   Standard: 18 – 27 V DC
Device with heating: 24 V DC ($\pm$5%)
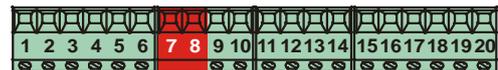
4.1.2 CAN

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
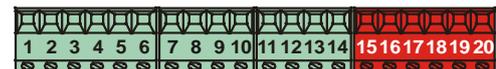
4.1.2.1 Bus termination

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.

4.1.2.2 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 bus.
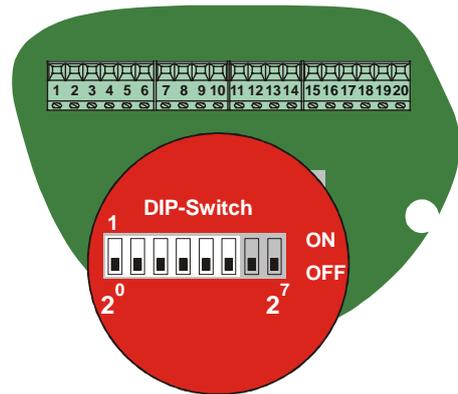
4.1.2.3 Baud rate

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
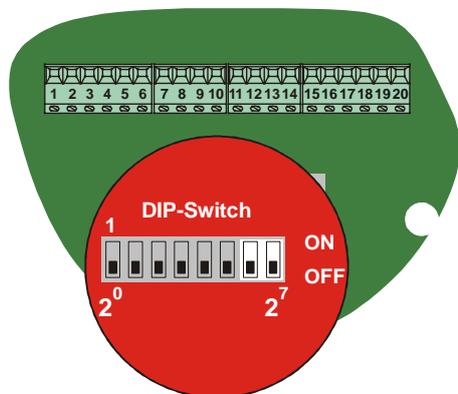
4.1.2.4 Length of the bus line

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

4.1.3 Switching input / Switching output

⚠ WARNING NOTICE	***Risk of injury and damage to property by an actual value jump when the `preset function` is performed!*** • The `preset function` should only be performed at rest, otherwise the resulting actual value jump must be permitted in the program and application!

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
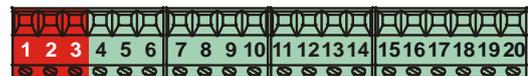
4.1.4 RS485 - programming interface

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

Pin 9   RS485–

Pin 10   RS485+
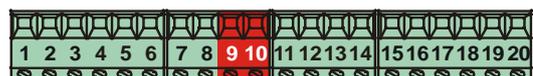
4.1.5 General interference suppression measures

- 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 4.1.2 on page 11 and chapter 4.1.6 on page 15. In order to correspond to the CAN 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 internal screen clamp (A), see following figure.
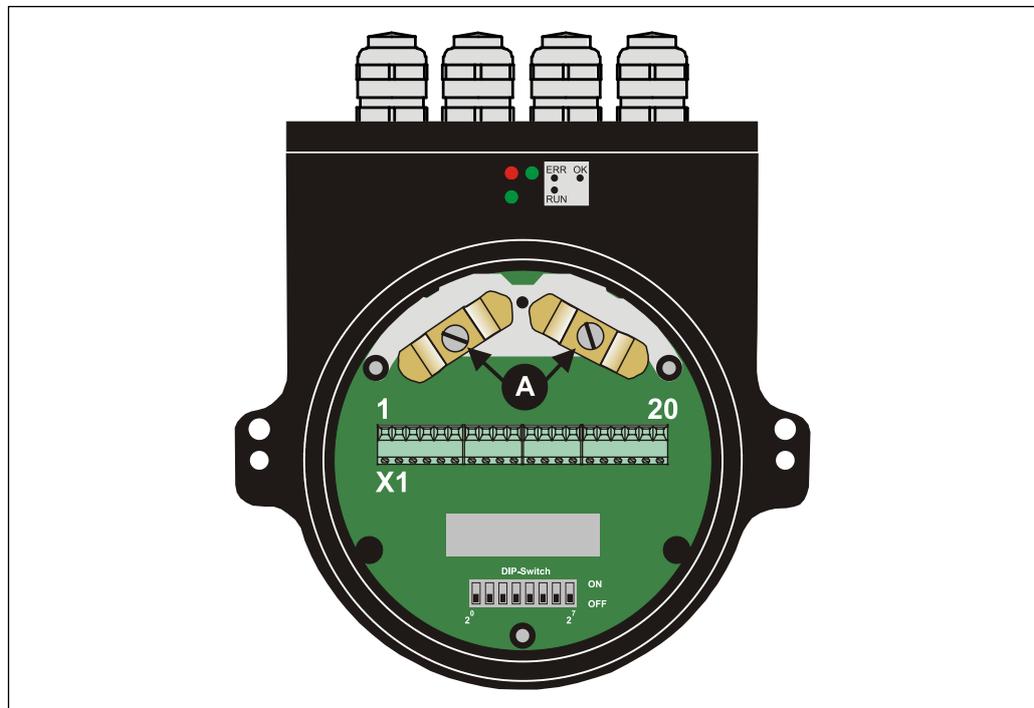
4.1.6 Wiring examples

> *Observe the "General interference suppression measures", chapter 4.1.5 page 14.*

CAN connection
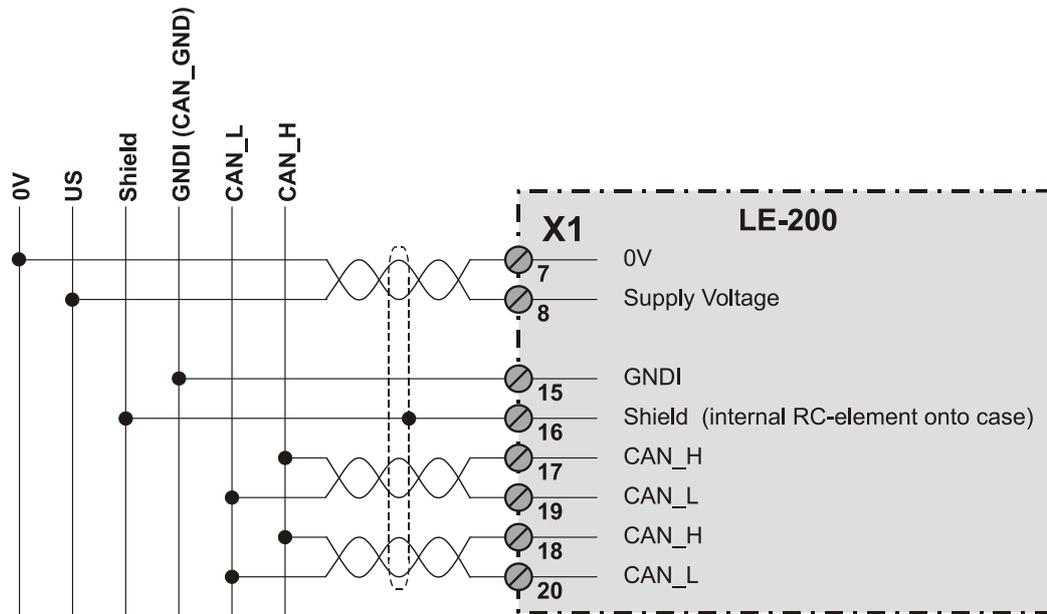
RS485-connection with parameter setting via "TRWinProg"
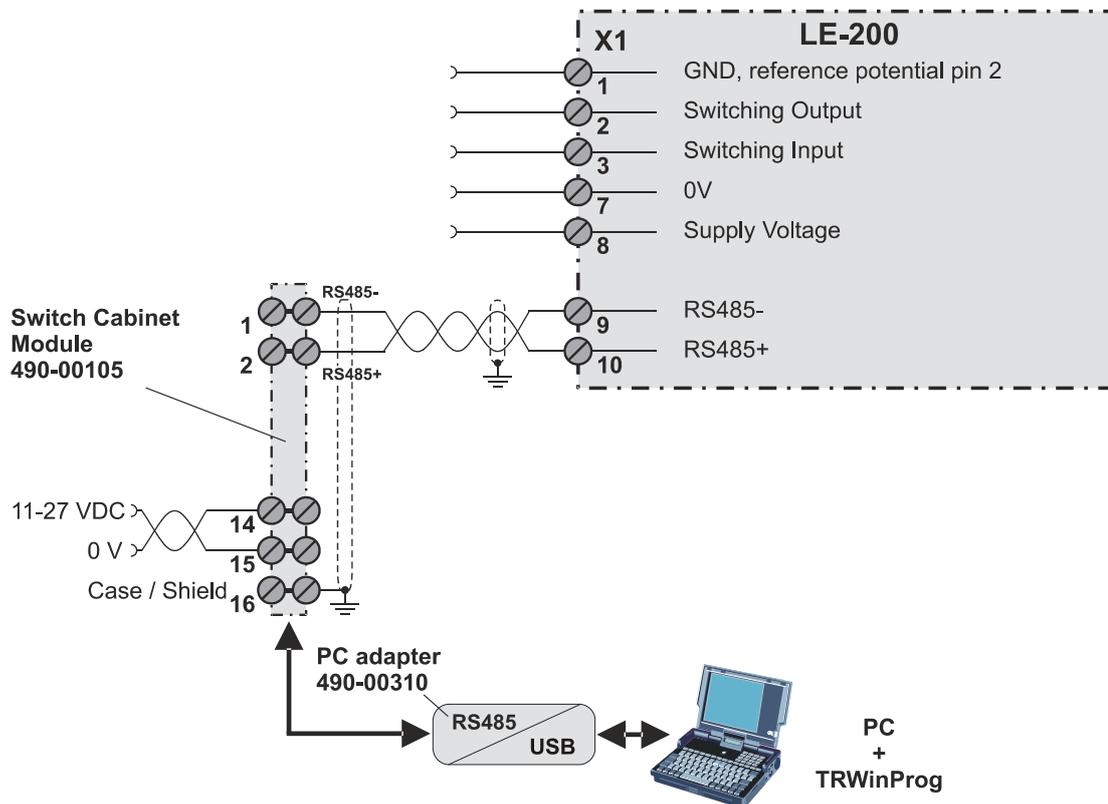
5 Commissioning

5.1 CAN 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.

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

5.2 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
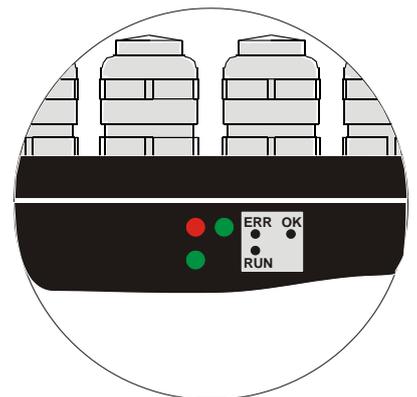
5.3 EDS-file

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"*.

Download:

- www.tr-electronic.de/f/TR-ELE-ID-MUL-0008

5.4 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 sendsback to the master the Poll Response I/O Message.

- Explicit Response/Request Message
  Explicit Request Messages are used for processing of write/read attributes.
  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.

5.5 Classes

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

Object Class	Number of instances
0x01: Identity	1
0x02: Message Router	1
0x03: DeviceNet	1
0x04: Assembly	2
0x05: Connection	2
0x0F: Parameter	15

5.6 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.

⚠ WARNING

NOTICE

Risk of injury and damage to property by an actual value jump when the `preset function` ***is performed!***

- The `preset function` should only be performed at rest, otherwise the resulting actual value jump must be permitted in the program and application!

[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 21. Preset cycles lower than 500 ms 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 23 = "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 23 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 Parameterization and configuration

The configuration of the laser occurs alternatively via the configuration software of the CAN 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 master is described. The PC program TRWinProg is described in an instruction of its own.

6.1 Configuration Assembly Data Attribute Format

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.

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

6.2 Parameter Object Instances, Class 0x0F

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.

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

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

---

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

6.3.2 Clear Preset - Service 002 hex

⚠ WARNING	*Danger of physical injury and damage to property due to an actual value jump during execution of the* `Clear Preset - function!`
NOTICE	• The `Clear Preset - function` should only be executed when the measuring system is stationary, or the resulting actual value jump must be permitted by both the program and the application!

Via this attribute, the calculated zero-point is deleted (difference of the desired adjustment- or preset-value to the physical laser position). After deletion of the zero-point correction the measuring system outputs his "real" physical position. With the adjusting = "0" no `adjustment- and no preset-function` can be executed.

0	Clear Preset
1	No clearing

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 18 / "Function external input - Service 00A hex", page 23).
The preset value must be programmed in the range from 0 ... measuring length (see "Range" in the device specific data sheet). *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 Adjustment - Service 007 hex

⚠ **WARNING** **NOTICE**	*Danger of physical injury and damage to property due to an actual value jump during execution of the `Adjustment - function`!* • The `Adjustment - function` should only be executed when the measuring system is stationary, or the resulting actual value jump must be permitted by both the program and the application!

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" in the device specific data sheet). *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

⚠ WARNING / NOTICE	*Risk of injury and damage to property by an actual value jump when the `Preset function` is performed!* • The *preset function* should only be performed at rest, otherwise the resulting actual value jump must be permitted in the program and application!

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 21. 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 18.
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 18.
3	Error acknowledgement	External switching input is used as error acknowledge-ment. Software acknowledgement see chapter "I/O Instance", page 18.

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 18) 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 25.
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 18 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 18 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 23 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 25. Depending on setting the error messages must be acknowledged for resetting the error code (see chapter "I/O Instance", page 18 table "Output Data Format" and "Function external input - Service 00A hex", page 23).

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.

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8 Appendix

8.1 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 125 m	
[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 > 125 m	
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 130 m

[1] can be supplied only transitionally