

User Manual

Laser Measuring Device LE-200 with SSI - interface

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

• Software/Support CD: 490-01001 - Soft-No.: 490-00416



TR-Electronic GmbH

D-78647 Trossingen Eglishalde 6 Tel.: (0049) 07425/228-0 Fax: (0049) 07425/228-33 E-mail: <u>info@tr-electronic.de</u> http://www.tr-electronic.de

Copyright protection

This Manual, including the illustrations contained therein, is subject to copyright protection. Use of this Manual by third parties in contravention of copyright regulations is forbidden. Reproduction, translation as well as electronic and photographic archiving and modification require the written content of the manufacturer. Offenders will be liable for damages.

Subject to amendments

Any technical changes that serve the purpose of technical progress, reserved.

Document information

Release date/Rev. date:21.12.2007Document rev. no.:TR - ELE -File name:TR-ELE-BAAuthor:MÜJ

21.12.2007 TR - ELE - BA - GB - 0011 - 02 TR-ELE-BA-GB-0011-02.DOC MÜJ

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>).



Revision History

i

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:

24.10.2003

Revision	Date
- Revision of the warning label in chapter "Intended purpose"	18.12.2003
 Modification of the Laser Standard DIN EN 60825-1 Warning bit "Plausibility measured value" Additional reflector foils, chap. Accessories Max. measuring range 240 m Modification of the parameters 	21.12.2007



Table of Contents

Revision History	3
Table of Contents	4
1 Safety	6
1.1 General risk potential	6
1.2 Safety information	6
1.2.1 Hints on installation	7
1.2.1.1 General interference suppression measures	8
1.3 Intended purpose	9
1.4 Authorized operators	11
1.5 Safety measures at the installation site	11
2 General Description	12
3 Transportation / Storage	13
4 Assembly instructions	14
4.1 Aligning of the laser light spot to the reflector / foil inclination	14
4.2 Parallel operation of laser linear naths	16
	10
5 Commissioning / Installation	17
5.1 Electrical connection	17
5.1.1 Supply voltage	17
5.1.2 SSI interface	17
5.1.3 Switching input / Switching output	18
5.1.4 RS485 - programming interface	18
5.1.5 wiring examples	19
5.2 SSI interface	20
6 Configuration / Parameter setting via TRWinProg	22
6.1 Basic parameter	22
6.1.1 Count direction	22
6.1.2 Resolution	22
6.1.3 Measuring-Dynamic	22
6.1.4 Measuring-Output-Time	23
6.1.5 Physical Resolution	23
6.2 SSI interface	24
6.2.1 Number of data bits	24
6.2.2 Code	24
6.2.3 Fail-Bit SSI	24
6.2.4 Output value SSI	25
6.3 Failure-Handling	26
6.3.1 Fail Output	26
6.3.2 Level Fail Output	26
6.3.3 Failure-quit	26
6.3.4 Output value in case of an error	27
6.3.5 Warning bit Temperature from	27
6.3.6 Warning bit Intensity under	27



6.4 Preset	28
6.4.1 Function ext. Input (Switching Input)	28
6.4.2 Active Input-Slope	28
6.4.3 Input-Active-Time	28
6.4.4 Preset-Value	29
6.4.5 Preset reset	29
6.5 Actual values	
6.5.1 Position	
6.5.2 Device state	31
6.5.3 Hardware-Info	31
6.6 Speed	
6.6.1 Speed-Values	32
6.6.2 Dynamic	32
6.6.3 Output-Format	
6.6.4 Sign	33
7 Causes of Faults and Remedies	34
9 Maintonanco	35
	JJ
8.1 General Maintenance Information	
8.1 General Maintenance Information	
8.1 General Maintenance Information	
 8.1 General Maintenance Information	35 35 36 36 36 36 36 37 37 37

Safety



1 Safety

1.1 General risk potential

The Laser Measuring Device LE-200 SSI 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, over a hardware output or over the SSI format different error messages such as temperature-, intensity- or hardware-errors can be read out. Depending on setting, for resetting an acknowledgement of the error is to be made. More information's see chapter "Failure-Handling", page 26. 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:



1

Warning

Note

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

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

Printed in the Federal Republic of Germany



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.



- 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

Safety

- 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 0.25 mm² for the SSI-signals data+/- and clock +/-.
- Use a minimum earthing cable (machine base) cross-section of 10 mm² 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.
- Ensure continuous wiring of the shield and a large contact area on special cable screw glands (mating connector, female connector):



Step A:

- Push clamp ring and cable clamp with seal over cable. (If required insert sleeve order no. FC6CX004I00X is helpful)
 Strip cable 24mm.
- 4. Push shielding back over cable.

Step B:

5. Strip cores 5mm.

Step C:

- 6. Put shielding ring on.
- 7. Twist remaining shielding around shielding ring.

Step D:

8. Solder wires in contacts.

Step E:

- 9. Snap distance ring over insulation body.
- **10.** Push insulation body into bridge of plug housing.
- **11.** Screw clamp ring onto plug housing.





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 synchronous-serial interface (SSI).

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 37)





 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.

ĭ



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



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: $18-27 \vee DC (\pm 5 \%)$ Device with heating: $24 \vee DC (\pm 5 \%)$

Clean lens opening of the laser and the reflecting foil regularly! (see chapter "Maintenance", page 35)

i

Note

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

© TR-Electronic GmbH 2007, All Rights Reserved



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 SSI are configured 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 1: 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.

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.

1



Procedure:

- Figure 2: 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 3: 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



(A)

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

Figure 2: Detection of the surface reflectivity



Figure 3: Transmitting away the surface reflectivity

(B) Surface reflectivity

(interference signal)

(C)

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



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 4: Minimum distance in parallel operation



5 Commissioning / Installation

5.1 Electrical connection

Note

İ

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



5.1.1 Supply voltage



Pin 11 Standard: 18 – 27 V DC Device with heating: 24 V DC (±5%) Pin 12 0V, GND



5.1.2 SSI interface







5.1.3 Switching input / Switching output

The programming of the switching input /switching output is carried out directly 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
- every fail
- Speed-check
- Plausibility measured value
- Switching output position



Switching output

Switching input



5.1.4 RS485 - programming interface

Via the PC software "TRWinProg" and a PC adapter the connection to the laser measuring device is established. More information's see page 19 or in the TRWinProg software manual.









5.1.5 Wiring examples

* Shield connection, see chapter 1.2.1.1 page 8.



RS485 / SSI - connection with parameter setting via "TRWinProg"



5.2 SSI interface

In the idle condition the signals Data+ and Clock+ are high. This corresponds the time before item (1) is following, see chart indicated below.

With the first change of the clock pulse from high to low (1) the internal-devicemonoflop (can be retriggered) is set with the monoflop time t_{M} .

The time t_M is set to 20 µs and determines the lowest transfer frequency of approximately 80 kHz. The upper limit frequency results from the total of all the signal delay times and is limited additional by the built-in filter circuits to approx. 820 kHz.

With each further falling clock edge the active condition of the monoflop extends by further $20\mu s$, at last at item (4).

With setting of the monoflop (), the bit-parallel data on the parallel-serial-converter will be stored via an internal signal in the input latch of the shift register. This ensures that the data cannot change during the transmission of a position value.

With the first change of the clock pulse from low to high (2) the most significant bit (MSB) of the device information will be output to the serial data output. With each following rising edge of the clock pulse, the next lower significant bit is set on the data output.

When the clock sequence is finished, the system keeps the data lines at 0V (Low) for the duration of the mono period, t_{M} (4). With this, the admissible break time t_{p} between two successive clock sequences is determined and is >20µs.

Caused be the delay time t_v (approx. 100ns, without cable), the evaluation electronic must be read-in the data only at time (3). This corresponds to the second rising clock edge. For this reason the number of clock pulses corresponds the number of data bits +1.



Typical SSI - transmission sequences

SSI transmission format





The maximum cable length depends on the SSI clock frequency and should be conditioned to the following diagram.

Pay attention, that per meter cable with an additional delay-time of approx. 6ns must be calculated.



Cable length [m]	SSI-clock frequency [kHz]
12,5	810
25	750
50	570
100	360
200	220
400	120
500	100



6 Configuration / Parameter setting via TRWinProg

6.1 Basic parameter

6.1.1 Count direction

The counting direction defines whether increasing or decreasing position values are output.

Selection	Description	Default
Up	With increasing distance to the laser, values increasing	Х
Down	With increasing distance to the laser, values decreasing	

6.1.2 Resolution

Definition of the measuring system resolution.

Selection	Default
10 mm	
1 mm	Х
1/10 mm	
1/100 mm	
1 Inch	
1/10 Inch	
1/8 mm	
Free resolution (in 1/100 mm), valid values are 1 - 65535	
For example 1 mm corresponds the input value of 100. That means the laser outputs 1 step/mm.	100

6.1.3 Measuring-Dynamic

Measuring-dynamic is an parameter, who characterize mathematic calculation of the measure-value. With high measuring-dynamic there is no mathematic calculation on the measure-value, but the noise of the measure-value is larger, in case of small measuring-dynamic the noise is lower, but there exist a small time-delay for the measure-value.

Selection	Default
slow	
mid	Х
high	



6.1.4 Measuring-Output-Time

The Measuring-Output-Time defines the time for calculating the measuring value.

Selection	Default
1 ms	Х
2 ms	
3 ms	
4 ms	
5 ms	
6 ms	
7 ms	
8 ms	
9 ms	
10 ms	
15 ms	
20 ms	
25 ms	
30 ms	
50 ms	
100 ms	
200 ms	
500 ms	

6.1.5 Physical Resolution

The physical resolution of the measuring system is the smallest possible resolution, with which the measured value can be produced.

Selection	Default
0.76 mm	Х
0.1 mm	



6.2 SSI interface

6.2.1 Number of data bits

The number of data bits defines the max. number of data bits which can be transferred on the SSI interface. A possibly defined error bit is not contained.

Selection	Description	Default
12 bit	Number of SSI data bits = 12	
24 bit	Number of SSI data bits = 24	Х
25 bit	Number of SSI data bits = 25	
26 bit	Number of SSI data bits = 26	
27 bit	Number of SSI data bits = 27	
28 bit	Number of SSI data bits = 28	
29 bit	Number of SSI data bits = 29	
30 bit	Number of SSI data bits = 30	
31 bit	Number of SSI data bits = 31	
32 bit	Number of SSI data bits = 32	

6.2.2 Code

Defines the SSI output code.

Selection	Description	Default
Gray	SSI output code = Gray	Х
Binary	SSI output code = Binary	

6.2.3 Fail-Bit SSI

The SSI error bit is an additional bit in the SSI protocol and is attached after the "LSB-bit". Definition of errors see "Device state", page 31.

Х



6.2.4 Output value SSI

The SSI output value specifies the value, which is output on the SSI interface.

Selection	Description	Default
Position	Output of the Laser position	Х
Intensity	Output of the Laser intensity value	
Speed	Output of the Laser actual speed	
Position + Speed	21 bit position data, 11 bit speed. The number of data bits must be set to 32. Max. possible resolution = 0.1 mm.	



6.3 Failure-Handling

6.3.1 Fail Output

Determines the function of the error output (external switching output). Definition of errors see "Device state", page 31.

Selection	Default
disabled	Х
Temperature	
Intensity	
Hardware-Fail	
every fail	
Speed-check	
Plausibility measured value	
Switching output position	

6.3.2 Level Fail Output

Specifies the active output level of the selected error, if the error occurs.

Selection	Description	Default
active HIGH	Error active, Switching Output = HIGH	Х
active LOW	Error active, Switching Output = LOW	

6.3.3 Failure-quit

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

Selection	Description	Default
automatic	An occurring error report is cleared automatically after remedying of the error.	Х
not automatic	An occurring error report can be cleared only via the external switching input (see "Function ext. Input (Switching Input)", page 28).	



6.3.4 Output value in case of an error

Determines, which data value is to be transmitted 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.

Selection	Description	Default
all 0	The position is set to "0"	Х
all 1	All 24 bits are set to '1' (0xFFFFFF or -1)	
last valid value	Output of the last valid position	

6.3.5 Warning bit Temperature from

Determines, starting from which temperature the warning bit or switching output will be set.

Selection	Description	Default
47	Message, if device temperature ≥ 47 °C	
48	Message, if device temperature ≥ 48 °C	
49	Message, if device temperature ≥ 49 °C	
50	Message, if device temperature ≥ 50 °C	Х

6.3.6 Warning bit Intensity under

Determines, starting from which intensity value of the laser beam the warning bit or switching output will be set.

Input	Description	Default
1 – 100 [%]	Message, if intensity value < Input value	12 %



6.4 Preset

6.4.1 Function ext. Input (Switching Input)

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 chapter "Preset-Value", page 29. 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.

Selection	Description	
disabled	Function switched off, following parameters without meaning.	х
Preset function	External switching input is determined as Preset input.	
LD switching input	External switching input is used for switching-off of the laser diode.	
Error acknowledgement	External switching input is used as error acknowledgement.	

6.4.2 Active Input-Slope

It determines whether the function of the switching input is activated with an rising or falling edge at the switching input.

Selection	Description	Default
Low->High	Function release with rising edge	Х
High->Low	Function release with falling edge	

6.4.3 Input-Active-Time

It determines the response time of the switching edge of the switching input up to the actual execution. This parameter is used for the interference suppression of the signal at the switching input.

Selection	Description	Default
100 ms	Response time = 100 ms	Х
200 ms	Response time = 200 ms	
500 ms	Response time = 500 ms	
1000 ms	Response time = 1000 ms	



6.4.4 Preset-Value

Definition of the position value to which the laser is adjusted, when the preset function is executed (see "Function ext. Input (Switching Input)", page 28). The preset value must be programmed in the range from 0 ... measuring length (see

"Range", chapter "Specifications", page 36). *Default value is "0".*

6.4.5 Preset reset

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. With the adjusting = "Yes" no Preset/Adjustment can be executed.

Selection	Description	Default
Yes	Clear Preset	Х
No	No clearing	



6.5 Actual values

In this tab all required operation parameters will be displayed:

- Position, with the resolution adjusted in the basic parameters
- Intensity [%]
- Device-Temperature [°C]
- Speed, with the output format adjusted in the speed parameters
- Device state
- Hardware-Info

6.5.1 Position

By writing of a value into the field position the laser can be adjusted on the desired position value. The execution is carried out with transmission of the values to the laser measuring device.

The value must be programmed in the range from 0 ... measuring length (see "Range", chapter "Specifications", page 36).



6.5.2 Device state

The device state displays the actual state of the device and is coded bitwise:

Error-Code	Description
Intensity Bit 0	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 chapter "6.3.4", page 26).
Temperature Bit 1	The bit is set, if the device temperature is outside of the range from 0 - 50 $^{\circ}$ C. A low range deviation has still no influence on the measurement and is therefore to be regarded as a warning.
Hardware Bit 2	The bit is set, if an internal hardware error were noticed and leads to the error value output (see chapter "6.3.4", page 26).
Laser diode switched off Bit 3	The bit is set, if the laser diode was switched off over the switching input. Serves only for information purposes.
Intensity warning Bit 4	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	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.
Warning bit Plausibility Bit 6	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.

6.5.3 Hardware-Info

The Hardware-Info refers to bit two "Hardware Error" in the Device state and specifies the hardware error in detail.

Error-Code
Bit 0, Failure Fieldbus-Chip
Bit 1, undefined Measuring length
Bit 2, Failure Temperature-Sensor
Bit 3, Failure ext. Flash



6.6 Speed

6.6.1 Speed-Values

Adjusting of the velocity level. If the adjusted velocity level is exceeded, this is signalized with the setting of the switching output. For this, about the function of the switching output the output must be defined as "Speed-check" (see "Fail Output", page 26).

Selection	Description	Default
0	Function disabled	Х
free input: 1 - 200	Speed in 0,1 m/s	

6.6.2 Dynamic

Time constant for calculating the speed.

Selection	Description	Default
Auto-Dynamic	Dynamic ranging depending from the speed level.	Х
Range 1	lower delay, higher noise	
Range 2	middle delay, middle noise	
Range 3	higher delay, lower noise	

6.6.3 Output-Format

Definition of the output format for the speed which is displayed in the tab $\ensuremath{\textit{Actual}}\xspace$ values.

Selection	Description	Default
1 mm / sec	Output of the speed in 1 mm/s	
10 mm / sec	Output of the speed in 10 mm/s	Х



6.6.4 Sign

Definition if the speed, which is displayed in the tab ${\it Actual}~value,$ is output with sign or without sign.

Selection	Description	Default
no sign, always positive	Output without sign	Х
direction depending sign	Output as value with sign	



7 Causes of Faults and Remedies

The error causes are determined in chapter "Device state", page 31. Depending on setting the error messages must be acknowledged for resetting the error, see chapter "Failure-quit", page 26.

Error	Cause	Remedy
Bit 0 Intensity error	The device checks the intensity of the received laser signal continuously, it was detected a below- minimum intensity.	 Clean measuring system optics Clean reflecting foil 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 deter- mined 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 guaran-teed any more.	This message is a warning and means that possibly corresponding measures must be taken, so that no system components will be damaged.

© TR-Electronic GmbH 2007, All Rights Reserved



8 Maintenance

8.1 General Maintenance Information

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

i

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

i

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 (measurem. on reflecting foil):	0,2 – 125 m standard, 170m, 195m, 240m (special devices)
* Resolution:	selectable, physical resolution 0,7 mm
Linearization	
complete measuring length:	absolute linearity error ±3 mm 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)
Max. laser power:	$P \le 1 \text{ mW}$
Laser protection class:	2 according to DIN EN 60 825-1: 2003-10 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)
SSI Interface:	Clock/Data, twisted pair cables and shielded
Clock input:	Optocoupler
Clock frequency:	80 KHZ - 820 KHZ Binany, Cray
* SSL output value:	Dilidiy, Glay Position Intensity Sneed
Cable length:	Depending on cable cross section, shielding, clock frequency etc.
Data output:	RS422 (4-wire)
* Number of data bits:	12-26, with error bit transmission (Temperature, Intensity, Hardware)
* Switching input / Switching output	
Levels switching input:	1-level > +8V, 0-level < +2V, up to \pm 35V, 5 kOhm

* 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: Device with heating:	0-50°C -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:	\le 50 m/s ² (5g)
Shock (11ms) DIN IEC 68-2-27:	\leq 300 m/s ² (30g)

* Valid for the device with screwed-on mating connector and screwed-together cable gland.

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	
Reflecting foils for measurements up to 125m		
49-500-020	200 x 200 mm, package contents	
49-500-038	200 x 300 mm	
49-500-031	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	