

Rotary  
Encoders

Linear  
Encoders

Motion

System

**PROFI**<sup>®</sup>  
**BUS**

**SSI**



- Software/Support DVD: 490-01001  
- Soft-No.: 490-00406

# User Manual

## Laser Measuring Device LE-200 with PROFIBUS-DP and SSI - interface

- [Additional safety instructions](#)
- [Installation](#)
- [Commissioning](#)
- [Configuration / Parameterization](#)
- [Troubleshooting / Diagnostic options](#)



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**Revision index**

Revision	Date	Index
First release	09/12/02	00
<ul style="list-style-type: none"> <li>General completions for the usability of the device</li> <li>Function expansion of the module "Preset" (new: Function ext. input) and "Control bits with acknowledgement"</li> </ul>	10/21/02	01
<ul style="list-style-type: none"> <li>Correction: Bit 0 = Intensity error, Bit 1 = Device temperature</li> </ul>	10/30/02	02
Completion of the module "Error Display": <ul style="list-style-type: none"> <li>Bit 4 = Intensity warning</li> </ul>	12/13/02	03
<ul style="list-style-type: none"> <li>Additional notes in the technical data for linearized devices</li> <li>Ordering informations</li> </ul>	01/29/03	04
<ul style="list-style-type: none"> <li>New GSD file TR040458.GSD                             <ul style="list-style-type: none"> <li>- Free resolution in module Position</li> <li>- SSI-Output value in module SSI interface</li> </ul> </li> </ul>	02/13/03	05
<ul style="list-style-type: none"> <li>New GSE file TR050458.GSE                             <ul style="list-style-type: none"> <li>- Laser-Diode-Operating hours counter</li> </ul> </li> </ul>	03/27/03	06
<ul style="list-style-type: none"> <li>New GSE file TR060458.GSE, 08.07.2003                             <ul style="list-style-type: none"> <li>- Function ext. Input: Failure quit</li> </ul> </li> <li>Module Error Display: Implementation of the Speed-check</li> <li>General technical- and layout modifications</li> </ul>	09/25/03	07
<ul style="list-style-type: none"> <li>Revision of the warning label in chapter "Intended purpose"</li> </ul>	12/18/03	08
New functions in the module "Error Display": <ul style="list-style-type: none"> <li>Warning Bit "Fail Plausibility Measured Value"</li> </ul>	12/01/04	09
New GSE file: "TR070458.GSE" <ul style="list-style-type: none"> <li>New module: "Switching position"</li> <li>Module "Function external input" renamed in "Function external IO pins"                             <ul style="list-style-type: none"> <li>- Now the functions of the external output are also programmable over the PROFIBUS (before only via TRWinProg)</li> </ul> </li> <li>Module "SSI interface"                             <ul style="list-style-type: none"> <li>- Number of SSI bits = 12 – 26 (before: 24 – 26)</li> </ul> </li> </ul>	02/26/05	10

<ul style="list-style-type: none"> <li>• Text correction in „Module control bits with quit“: Clear Preset</li> <li>• Completion of the ordering information's</li> </ul>	01/23/06	11
<ul style="list-style-type: none"> <li>• Correction in „Module Speed“: Default output format = 10mm / sec</li> </ul>	01/08/07	12
<ul style="list-style-type: none"> <li>• Introduction of the Software/Support CD: 490-01001</li> <li>• Additional reflector foils, chap. Ordering information</li> </ul>	02/28/07	13
<ul style="list-style-type: none"> <li>• Max. measuring range 240 m</li> </ul>	12/18/07	14
<p>New GSE file: "TR080458.GSE"</p> <ul style="list-style-type: none"> <li>• Correction of the byte sequence for Preset HI/LO word</li> </ul>	03/25/08	15
<ul style="list-style-type: none"> <li>• Implementation of new reflectors</li> <li>• Physical resolution = 0,1mm</li> </ul>	02/05/09	16
<ul style="list-style-type: none"> <li>• Shield connection via cable screw glands removed</li> </ul>	01/12/10	17
<ul style="list-style-type: none"> <li>• Speed output: Specification of the accuracy</li> </ul>	11/08/11	18
<ul style="list-style-type: none"> <li>• Scope of DP-V0 functionality</li> </ul>	01/30/12	19
<ul style="list-style-type: none"> <li>• General changes; Modification of the warnings; Mounting removed</li> </ul>	08/20/12	20

## 1 General information

This interface-specific User Manual includes the following topics:

- Safety instructions in addition to the basic safety instructions defined in the Assembly Instructions
- Electrical characteristics
- Installation
- Commissioning
- Configuration and 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 **PROFIBUS-DP** and **SSI** interface:

- LE-200

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

The following documentation therefore also applies:

- the operator's operating instructions specific to the system,
- this User Manual,
- and the assembly instructions **TR-ELE-BA-DGB-0018**, which is enclosed when the device is delivered

## 1.2 Abbreviations used / Terminology

LE-200	<i>L</i> aser <i>M</i> easuring <i>D</i> evice, LE-200 series
DDL <i>M</i>	<i>D</i> irect <i>D</i> ata <i>L</i> ink <i>M</i> apper, interface between PROFIBUS-DP functions and laser software
DP	<i>D</i> ecentralized <i>P</i> eriphery
EMC	<i>E</i> lectro <i>M</i> agnetic <i>C</i> ompatibility
GSE	Device Master File (english)
GSD	Device Master File (german)
PNO	PROFIBUS User Organization (PROFIBUS Nutzerorganisation)
PROFIBUS	Manufacturer independent, open field bus standard
SSI	<i>S</i> ynchron- <i>S</i> erial- <i>I</i> nterface



## 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 PROFIBUS-DP networks according to the European standards EN 50170 and EN 50254 up to max. 12 Mbaud.

The technical guidelines for the structure of the PROFIBUS-DP network from the PROFIBUS User Organization 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 be 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.

### 3 Technical data



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

#### 3.1 Electrical characteristics

<b>Supply voltage</b> .....	18 - 27 V DC ( $\pm 5\%$ )
with heating, optional .....	24 V DC ( $\pm 5\%$ )
<b>Current consumption (no-load)</b> .....	< 350 mA
with heating, optional .....	< 2.5 A
<b>Measuring principle</b> .....	Phase delay time measurement
<b>Measuring range (on reflecting foil)</b> .....	0.2 – 125 m standard, 170 m, 195 m, 240 m (special devices) other measuring ranges on request
<b>* Resolution</b> .....	selectable, physical resolution 0.1 mm
<b>Linearization</b>	
up to 12 m (standard).....	absolute linearity error $\pm 3$ mm
complete measuring length .....	absolute linearity error $\pm 5$ mm
<b>Reproducibility</b> .....	$\pm 2$ mm
<b>Opto-transmitter</b> .....	Laser diode (red light)
Wavelength $\lambda$ .....	670 nm
Max. laser power.....	$P \leq 1$ mW
Laser protection class .....	2 according to DIN EN 60 825-1: 2003-10
Lifetime .....	50 000 h
<b>Measured value output / refresh cycle</b> .....	1000 values / s
<b>Integration time</b> .....	1 ms
<b>Programming via RS485</b> .....	WINDOWS <sup>®</sup> compatible (TRWinProg) / Profibus-DP
<b>Profibus-DP Interface</b> .....	acc. to IEC 61158 and IEC 61784
Output code .....	Binary
Baud rate .....	9.6 kBaud to max. 12 MBaud
Special features .....	Programming is performed via the parameterization message at the start-up of the laser or the PROFIBUS-DP master
Station addresses .....	3 – 99
<b>SSI Interface</b>	
* Output code.....	Binary, Gray
Clock input .....	Optocoupler
Clock frequency .....	80 kHz - 820 kHz
Cable length.....	Depending on cable cross-section, shielding
Data output .....	RS422 (2-Draht)
* Number of data bits .....	12 - 26, with error bit transmission
<b>Speed output, 16 bit</b> .....	Accuracy: $\pm 10\%$ related of the output value
<b>* Switching input/output</b>	
Levels switching input .....	1 level > +8 V, 0 level < +2 V, up to $\pm 35$ V, 5 kOhm
Levels switching output .....	1 level > US-2 V, 0 level < 1 V, up to 100 mA
<b>EMC</b>	
Immunity to disturbance .....	DIN EN 61000-6-2: 2006
Transient emissions .....	DIN EN 61000-6-3: 2007

\* programmable parameter

## 4 PROFIBUS information's

PROFIBUS is a continuous, open, digital communication system with a broad range of applications, particularly in manufacturing and process automation. PROFIBUS is suitable for fast, time-sensitive and complex communication tasks.

PROFIBUS communication is based on the international standards IEC 61158 and IEC 61784. The application and engineering aspects are defined in the PROFIBUS User Organization guidelines. These serve to fulfil the user requirements for a manufacturer independent and open system where the communication between devices from different manufacturers is guaranteed without modification of the devices.

Further information on PROFIBUS are available from the PROFIBUS User Organization:

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**PROFIBUS Nutzerorganisation e.V.,**  
Haid-und-Neu-Str. 7,  
D-76131 Karlsruhe,  
<http://www.profibus.com/>  
Tel.: ++ 49 (0) 721 / 96 58 590  
Fax: ++ 49 (0) 721 / 96 58 589  
e-mail: <mailto:germany@profibus.com>

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### 4.1 DP Communication protocol (DP-V0)

The LE-200 measuring system series support the **DP** communication protocol, which is designed for fast data exchange on the field level. The basic functionality is defined by the performance level **V0**. This includes cyclic data exchange, as well as the stationspecific diagnosis.



*Functionalities for e.g.*

- *acyclic data traffic*
- *isochronous operation*

*are defined in the performance levels V1 or V2 and will not be supported by the Laser!*

---

## 5 Installation / Preparation for commissioning

### 5.1 PROFIBUS-DP, RS485 Data transmission technology

All devices are connected in a bus structure (line). Up to 32 subscribers (master or slaves) can be connected together in a segment.

The bus is terminated with an active bus termination at the beginning and end of each segment. For stable operation, it must be ensured that both bus terminations are always supplied with voltage. The bus termination can be switched on the connecting board in the connection hood of the measuring system.

Repeaters (signal amplifiers) have to be used with more than 32 subscribers or to expand the network scope in order to connect the various bus segments.

All cables used must conform to the PROFIBUS specification for the following copper data wire parameters:

Parameter	Cable type A
Wave impedance in $\Omega$	135...165 at a frequency of 3...20 MHz
Operating capacitance (pF/m)	30
Loop resistance ( $\Omega$ /km)	$\leq 110$
Wire diameter (mm)	$> 0.64$
Wire cross-section (mm <sup>2</sup> )	$> 0.34$

The PROFIBUS transmission speed may be set between 9.6 kbit/s and 12 Mbit/s and is automatically recognized by the measuring system. It is selected for all devices on the bus at the time of commissioning the system.

The range is dependent on the transmission speed for cable type A:

<b>Baud rate (kbits/s)</b>	9.6	19.2	93.75	187.5	500	1500	12000
<b>Range / Segment</b>	1200 m	1200 m	1200 m	1000 m	400 m	200 m	100 m

A shielded data cable must be used to achieve high electromagnetic interference stability. The shielding should be connected with low resistance to protective ground using large shield clips at both ends. It is also important that the data line is routed separate from current carrying cables if at all possible. At data speed  $\geq 1.5$  Mbit/s, drop lines should be avoided under all circumstances.

On the connecting board in the connection hood of the measuring system the inward and outward data cables can be connected separately. This avoids drop lines.



*To ensure safe and fault-free operation, the*

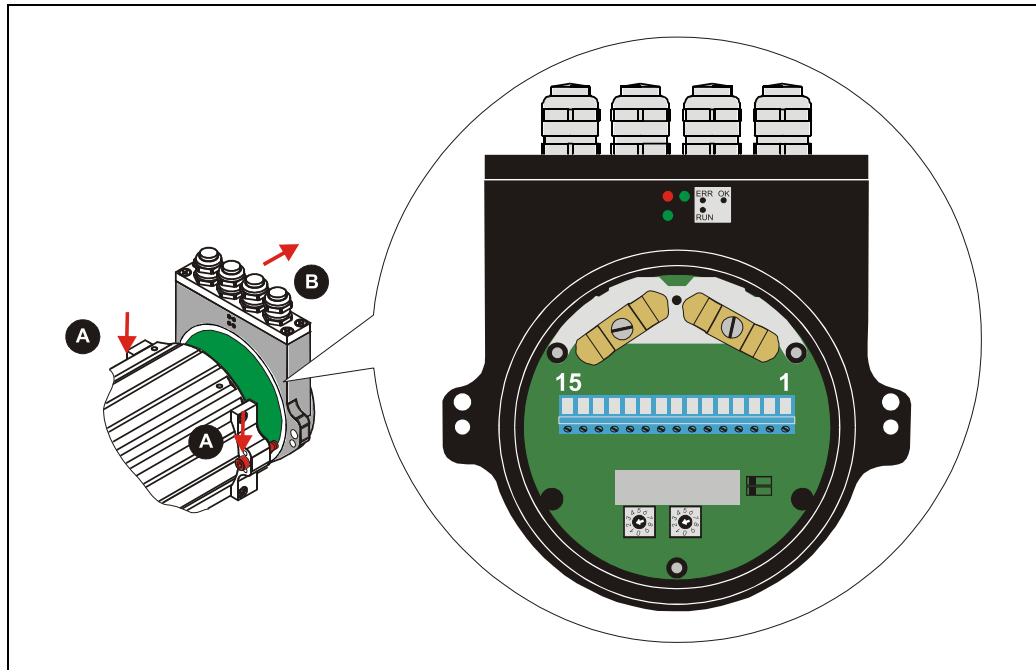
- *PROFIBUS Planning Guideline, PNO Order no.: 8.012*
- *PROFIBUS Assembly Guideline, PNO Order no.: 8.022*
- *PROFIBUS Commissioning Guideline, PNO Order no.: 8.032*
- *and the referenced Standards and PNO Documents contained in it must be observed!*

*In particular the EMC directive in its valid version must be observed!*

## 5.2 Connection

In order to be able to carry out the connection, the connection hood must be removed from the measuring system first.

For this the screws **(A)** are loosened and the hood **(B)** is removed away from the measuring system.



### 5.2.1 Supply voltage

A cable cross section of minimum 0.75 mm<sup>2</sup> is recommended.

**Pin 10** Standard: 18 – 27 V DC  
Device with heating: 24 V DC (± 5%)

**Pin 11** 0V, GND



### 5.2.2 Profibus-DP

Simultaneous use of the Profibus DP- and SSI - interface possible.

**Pin 1** Profibus Data PB\_A\_IN

**Pin 2** Profibus Data PB\_B\_IN

**Pin 3** Profibus Data PB\_A\_OUT

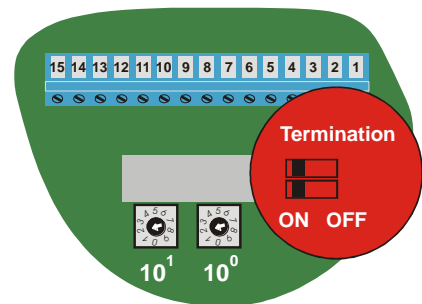
**Pin 4** Profibus Data PB\_B\_OUT



### 5.2.2.1 Bus termination

All PROFIBUS networks must be terminated by a resistor at the ends of the bus segments. The termination resistor and resistors for connecting to the data reference potential are located in the bus cap with the terminals, and can be connected via DIL-switches if necessary, provided the Laser Measuring Device is the last station of a bus segment.

***In this case the outgoing bus line (PB\_A\_OUT, PB\_B\_OUT) is interrupted!***



### 5.2.2.2 Bus addressing

The station address of the Laser Measuring Device is set exclusively via the rotary switches which becoming visible after removing the cover:

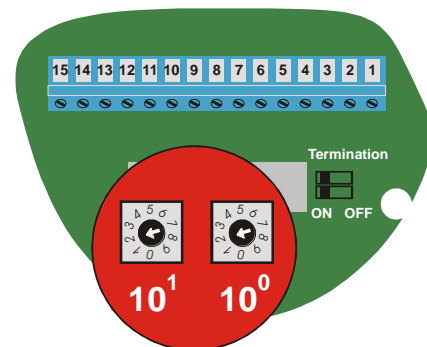
$10^0$ : Setting of the units position

$10^1$ : Setting of the decimal position

The addressing of the Laser Measuring Device is limited within the Profibus address area.

Valid station addresses are 3 - 99.

If an invalid station address is set, the device will not start up!



### 5.2.3 Switching input / Switching output

The function of the switching input or switching output is programmed primarily directly about the PROFIBUS-DP. Alternatively this can be made also by means of the PC software "TRWinProg".

**Functions of the switching input**

**⚠ WARNING**

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

**NOTICE**

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

- Preset input
- Switch off Laser-Diode
- Failure quit

**Functions of the switching output**

- Temperature fail
- Intensity fail
- Hardware fail
- Every fail
- Speed-check
- Plausibility measured value
- Switch-Output Actual Position

- Pin 5** Switching input
- Pin 6** Switching output
- Pin 7** GND, reference potential pin 6



### 5.2.4 SSI interface

Shielded cables with twisted core pairs and with a minimum cross section of 0.22 mm<sup>2</sup> are recommended!

Simultaneous use of the SSI- and Profibus DP - interface possible.

- Pin 12** SSI-Clock +
- Pin 13** SSI-Clock -
- Pin 14** SSI-Data +
- Pin 15** SSI-Data -





### 5.2.5 RS485 - programming interface

The RS485 programming interface was developed mainly only as service interface for the technician.

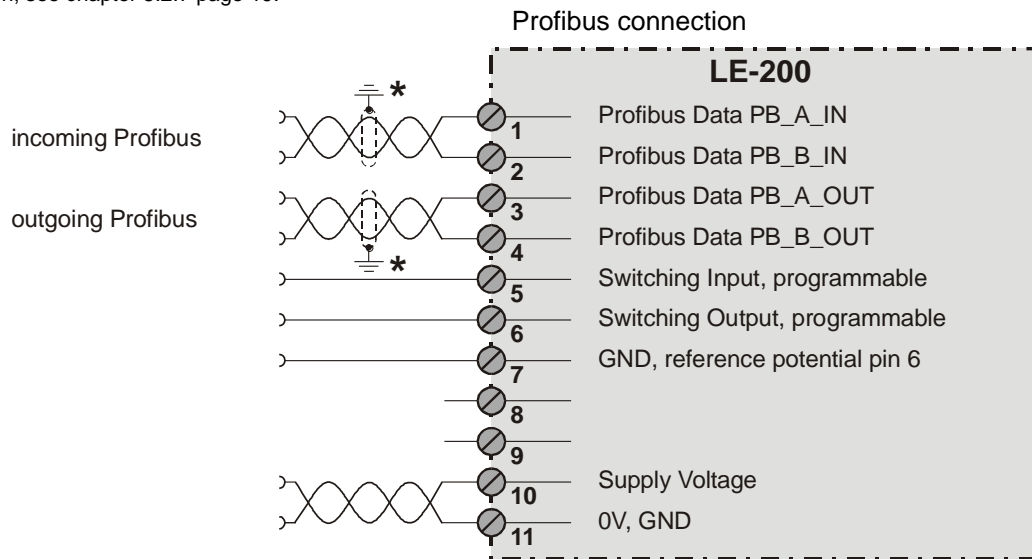
Primarily therefore the programming possibilities via the Profibus-DP should be used. Via the PC software "TRWinProg" and a PC adapter the connection to the laser measuring device is established. More informations see below or in the TRWinProg software manual.

A cable cross section of minimum 0.75 mm<sup>2</sup> is recommended.

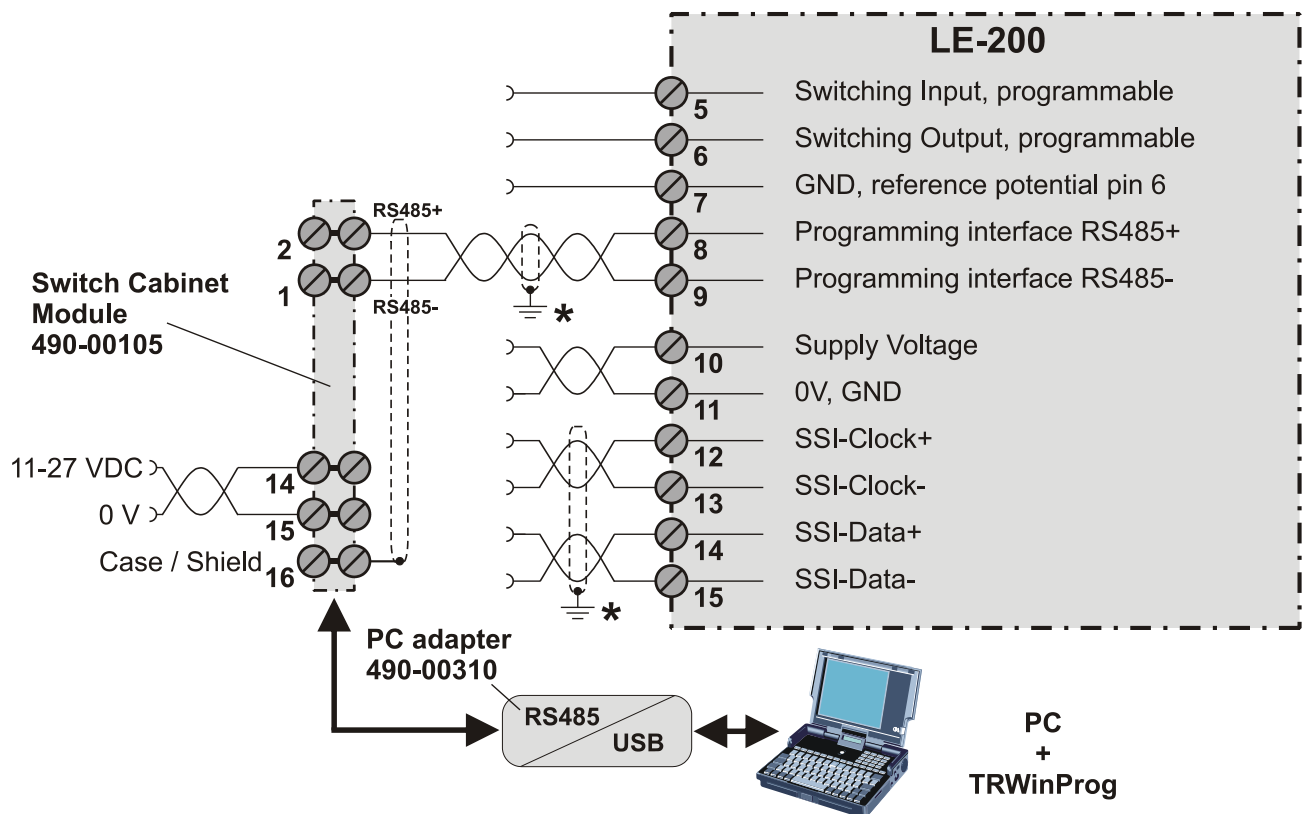
<b>Pin 8</b>	RS485+	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
<b>Pin 9</b>	RS485-	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗

### 5.2.6 Wiring examples

\* Shield connection, see chapter 5.2.7 page 19.



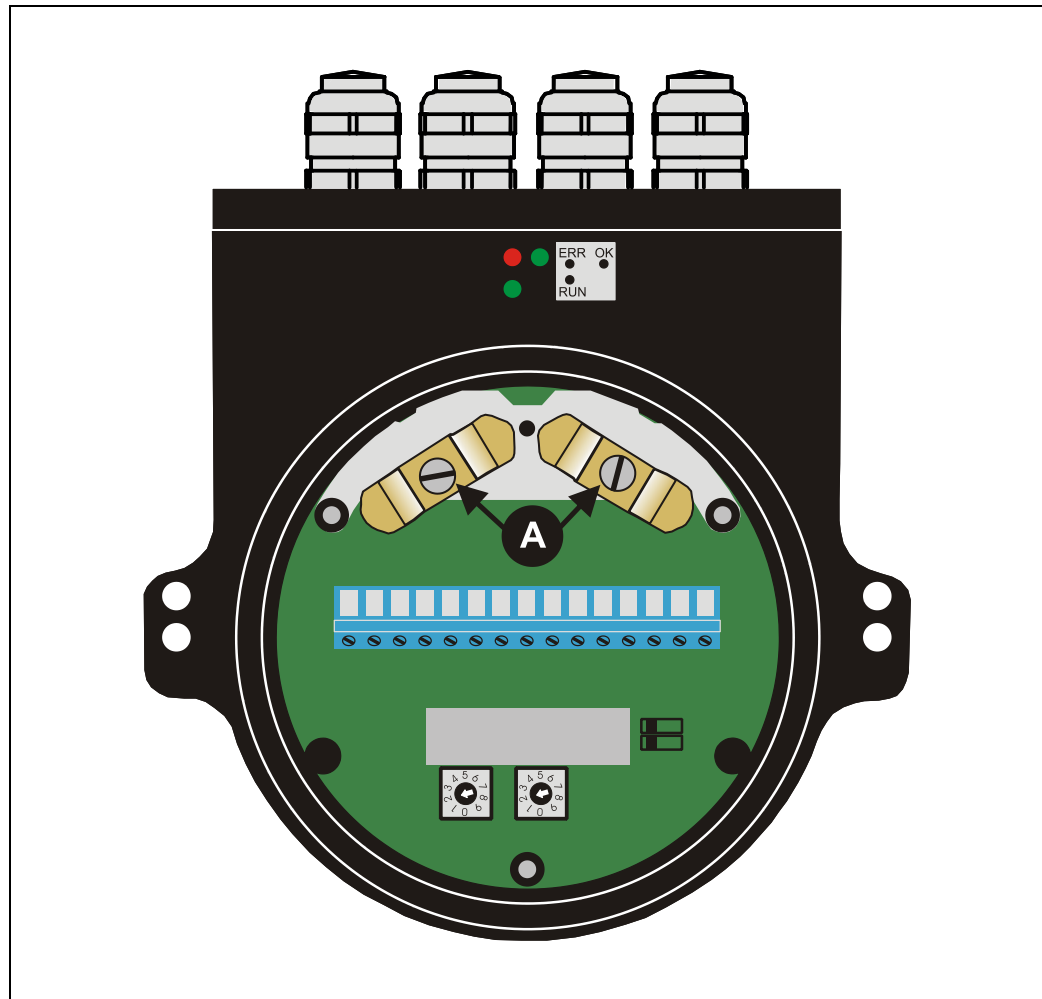
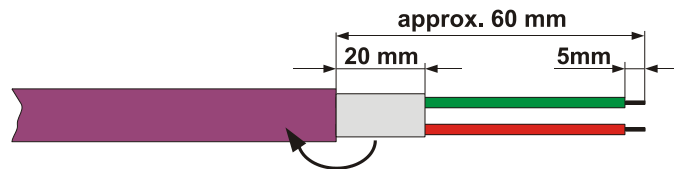
SSI-connection with parameter setting via "TRWinProg"



### 5.2.7 Shield cover

The shield cover is connected via cable clamps in the connection hood, see point **(A)** in the picture. For this the cables must be prepared accordingly. The following example shows a 2-wire PROFIBUS cable:

Perform wire stripping, pull screening braiding via the cable jacket



### 5.3 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-device-monoflop (can be retriggered) is set with the monoflop time  $t_M$ .

The time  $t_M$  is set to 20  $\mu s$  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**.

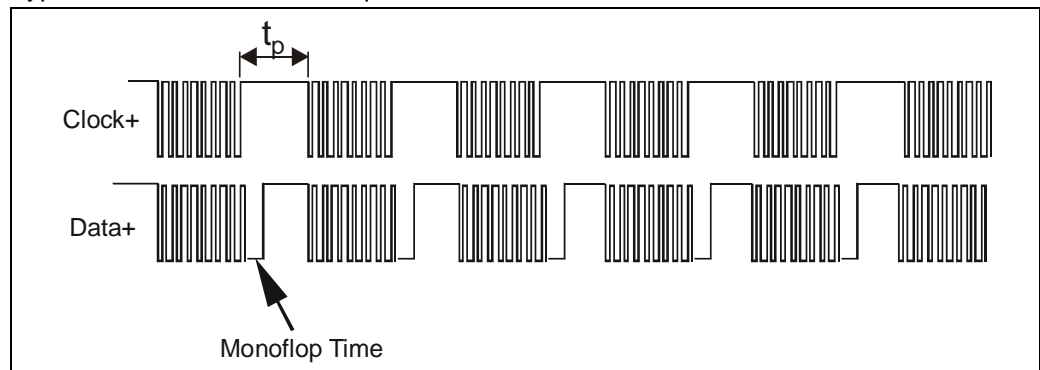
With setting of the monoflop **1**, the bit-parallel data on the parallel-serial-converter will be stored via an internal signal in the input latch of the shift register. This ensures that the data cannot change during the transmission of a position value.

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.

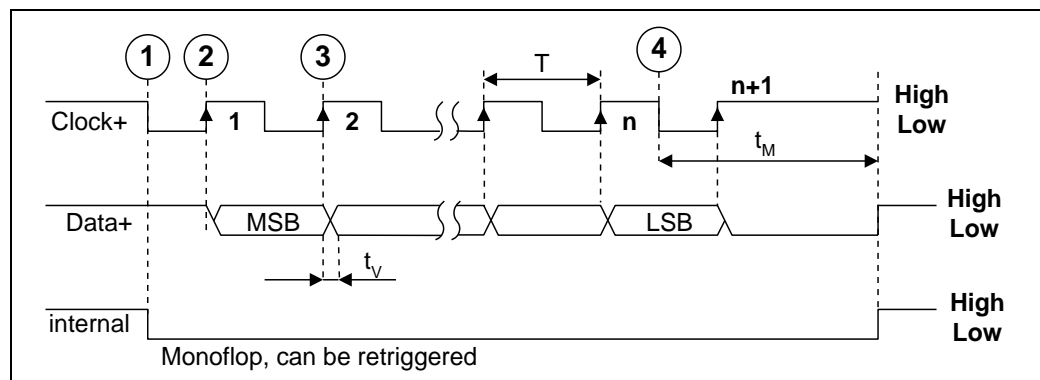
When the clock sequence is finished, the system keeps the data lines at 0V (Low) for the duration of the mono period,  $t_M$  **4**. With this, the admissible break time  $t_p$  between two successive clock sequences is determined and is  $>20\mu s$ .

Caused by 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

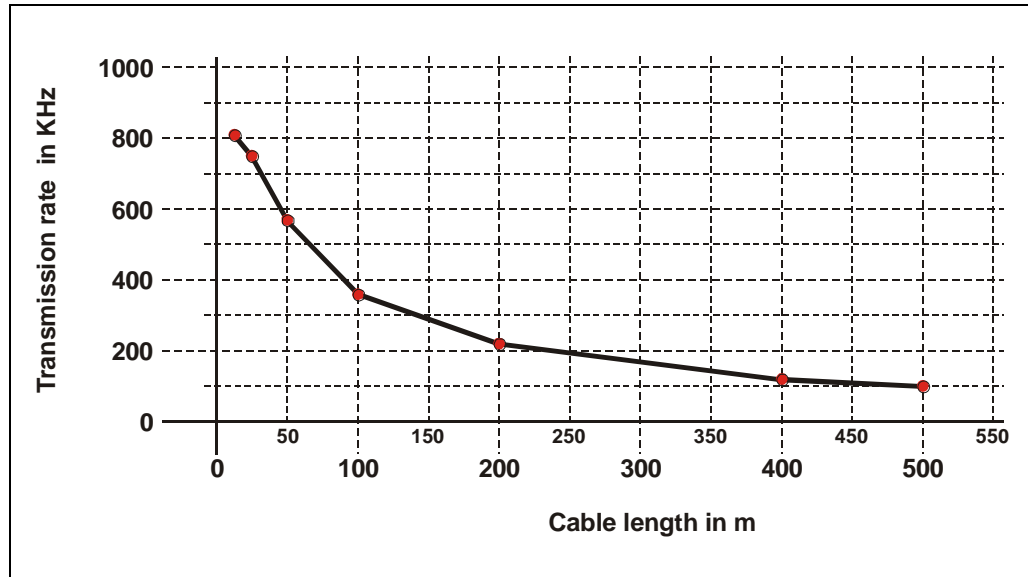


SSI transmission format



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 Commissioning

### 6.1 Device Master File (GSE)

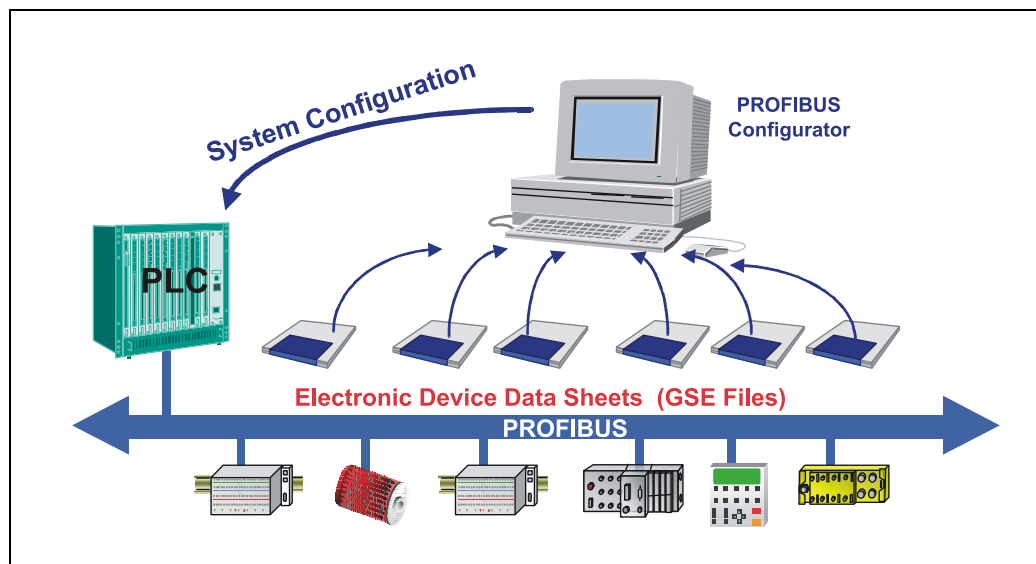
In order to achieve a simple plug-and-play configuration for PROFIBUS, the characteristic communication features for PROFIBUS devices were defined in the form of an electronic device datasheet (device master file, GSE file).

The defined file format allows the projection system to easily read the device master data of the PROFIBUS measuring system and automatically take it into account when configuring the bus system.

The GSE file is a component of the measuring system and has the file name "**TRxx0458.GSE**" (English), in which "**xx**" stands for the actual revision of the file. The measuring system also includes two bitmap files with the names "**Tr\_0458N.bmp**" and "**Tr\_0458S.bmp**", which show the measuring system in normal operation as well as with a fault.

The files are on the Software/Support DVD:

Order number: 490-01001, Soft-No.: 490-00406.



Theoretically, the measuring system can be connected to any PROFIBUS-DP network, however the PROFIBUS-DP master is capable to transmit a parameter message. Similarly, the configuration software should be able to display the parameter structure specified in the device master file in order to allow the parameters to be entered. If this is not the case, the measuring system can not be put into operation.

**6.1.1 Overview of the previous device master file versions:**

GSD file:	TR010458.GSD, 12/01/99
Device type:	LE-100
Entry hardware catalogue:	TR LE100 DP
Version no.:	1
Comment:	Base version device type LE-100.
GSD file:	TR020458.GSD, 14/02/2001
Device type:	LE-100
Entry hardware catalogue:	TR LE100 DP
Version no.:	2
Comment:	<b>Functional expansion:</b> <ul style="list-style-type: none"> <li>▪ Module "Adjustment",</li> <li>▪ Module "Control Bits With Acknowledgement"</li> </ul>
GSD file:	TR030458.GSD, 14/10/2002
Device type:	LE-200
Entry hardware catalogue:	TR LE200 DP
Version no.:	2
Comment:	Base version device type LE-200
GSD file:	TR040458.GSD, 12/02/2003
Device type:	LE-200
Entry hardware catalogue:	TR LE200 DP
Version no.:	3
Comment:	<b>Functional expansion:</b> <ul style="list-style-type: none"> <li>▪ Parameter "Free resolution" in module Position</li> <li>▪ Parameter "SSI output value" in module SSI interface</li> </ul> <b>Compatibility to LE-100 device master file TR020458.GSD:</b> Generally, a compatible operation with LE-100 DP-projects is problem-free possible. However the following restrictions must be made: <ul style="list-style-type: none"> <li>▪ The module "Control Bits" may not be used, instead of its, the module "Control Bits With Acknowledgement" is to be used.</li> <li>▪ The module "Signal Bits" may not be used</li> <li>▪ The following parameters are not evaluated and have therefore no influence:                             <ul style="list-style-type: none"> <li>- Parameter "Initial value" in module "Position"</li> <li>- Parameter "Input" in module "Error Display"</li> <li>- Parameter "26-bit-repetition" and "Negative values" in module "SSI interface"</li> </ul> </li> </ul>

Continuation see next page

GSD file:	TR050458.GSE, 27/03/2003
Device type:	LE-200
Entry hardware catalogue:	TR LE200 DP
Version no.:	5
Comment:	<p><b>Functional expansion:</b></p> <ul style="list-style-type: none"> <li>▪ Module "Laser-Diode-Operating hours counter"</li> </ul> <p><b>Compatibility to LE-100 device master file TR020458.GSD:</b> see comment device master file "TR040458.GSD"</p>
GSD file:	TR060458.GSE, 08/07/2003
Device type:	LE-200
Entry hardware catalogue:	TR LE200 DP
Version no.:	6
Comment:	<p><b>Functional expansion:</b></p> <ul style="list-style-type: none"> <li>▪ Module "Function ext. Input": - Failure quit</li> </ul> <p><b>Compatibility to LE-100 device master file TR020458.GSD:</b> see comment device master file "TR040458.GSD"</p>
GSD file:	TR070458.GSE, 23/02/2005
Device type:	LE-200
Entry hardware catalogue:	TR LE200 DP
Version no.:	7
Comment:	<p><b>Functional expansion / Adaptation:</b></p> <ul style="list-style-type: none"> <li>▪ New: Module "Switching position"</li> <li>▪ The module "Function ext. input" was renamed in "Function ext. IO pins". Now this module contains all features to program the external switching output also over the PROFIBUS.</li> <li>▪ Module "SSI interface": So far the number of SSI-data bits were programmable from 24 - 26. New: 12 – 24</li> </ul> <p><b>Compatibility to LE-100 device master file TR020458.GSD:</b> see comment device master file "TR040458.GSD"</p>
GSD file:	TR080458.GSE, 14/03/2008
Device type:	LE-200
Entry hardware catalogue:	TR LE200 DP
Version no.:	8
Comment:	<p><b>Correction of the byte sequence:</b></p> <ul style="list-style-type: none"> <li>▪ Module "Function External IO Pins": - Preset HI/LO word, byte sequence 4, 6 --&gt; 3, 5</li> </ul> <p><b>Compatibility to LE-100 device master file TR020458.GSD:</b> see comment device master file "TR040458.GSD"</p>



## 6.2 PNO ID number

Every PROFIBUS slave and every Class 1 master must have an ID number. It is required so that a master can identify the type of the connected device without significant protocol overhead. The master compares the ID numbers of the devices connected with the ID numbers of the projection data specified in the projection tool. The transfer of utility data only starts once the correct device types have been connected with the correct station addresses on the bus. This achieves a high level of security against projection errors.

The measuring system has the PNO ID number 0458 (hex). This number is reserved and is stored at the PNO.

## 6.3 Starting up on the PROFIBUS

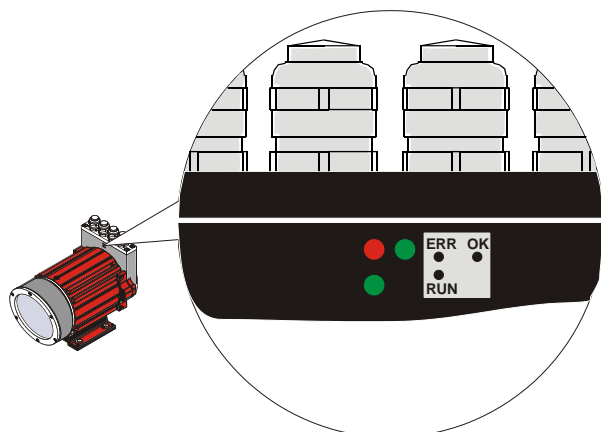
Before the measuring system can be accepted for "Data\_Exchange", the master must firstly initialize the measuring system at start-up. The resulting data exchange between the master and the measuring system (slave) is divided into the parameterization, configuration and data transfer phases.

It is checked whether the projected nominal configuration agrees with the actual device configuration. The device type, the format and length information as well as the number of inputs and outputs must agree in this check. The user is therefore reliably protected against parameterization errors.

If the check was successful, it is switched over into the DDLM\_Data\_Exchange mode. In this mode, the measuring system e.g. sends its actual position, and the preset function can be performed.

## 6.4 Bus status

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



RUN (green): Profibus-DP active  
 ERR (red): flashing = Profibus-DP not active, static = hardware failure  
 OK (green): Hardware ok

Corresponding measures in case of an error see chapter "Troubleshooting and diagnosis options", page 51.

## 7 Parameterization and configuration

The configuration of the measuring system is carried out primarily via the configuration software of the PROFIBUS-DP - master. Alternatively this can be made also by means of the PC software "TRWinProg".



***If the control executes a download of the control parameters, the parameters which were configured by means of the TRWinProg-software are overwritten.***

In this instruction only the configuration via the PROFIBUS-DP - master is described. The PC program TRWinProg is described in an instruction of its own.

### Parameterization

Parameterization means providing a PROFIBUS-DP slave with certain information required for operation prior to commencing the cyclic exchange of process data. The measuring system requires e.g. data for Resolution, Count direction etc.

Normally the configuration program provides an input mask for the PROFIBUS-DP master with which the user can enter parameter data or select from a list. The structure of the input mask is stored in the device master file. The number and type of the parameter to be entered by the user depends on the choice of the module-configuration.

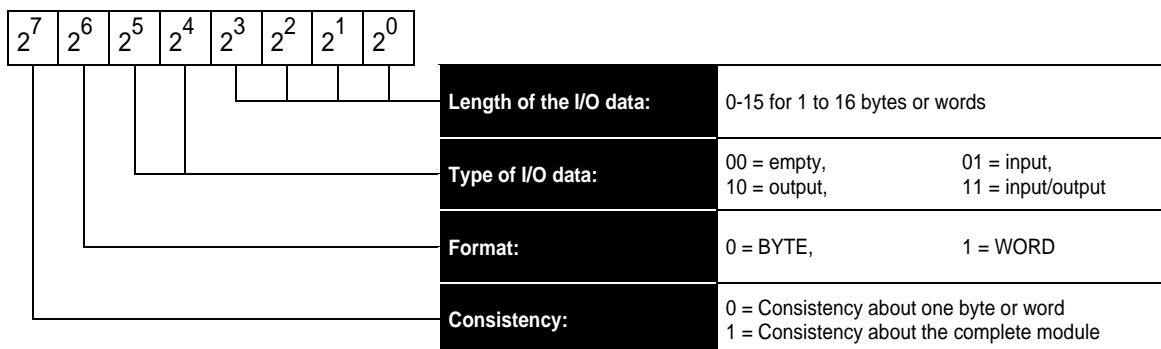
### Configuration

Configuration means that the length and type of process data must be specified and how it is to be treated. The configuration program normally provides an input list for this purpose, in which the user has to enter the corresponding identifiers.

As the measuring system supports several possible module-configurations, the identifier to be entered is preset dependent on the required module-configuration, so that only the I/O addresses need to be entered. The identifiers are stored in the device master file.

The measuring system uses a different number of input and output words on the PROFIBUS dependent on the required module-configuration.

**Structure of the configuration byte (compact format):**



## 7.1 Modular configuration

Since all functions of the measuring system are used not at any time, individual functions can be disabled on the bus.

For this, in the mask of the configuration software of the PROFIBUS-master, the measuring system is represented as a modular compact device.

That means after insertion of the measuring system into the configuration list of the master, the corresponding configuration list at first is empty.

Every module requires inputs and outputs and has a parameter data set. The parameter data set must be set dependent of the application.



**That the measuring system starts up at the PROFIBUS, in the configuration list at least one module must be entered.**

## 7.2 Overview

Module	Operating parameters	* Length	Features
<b>Position</b> page 28	<ul style="list-style-type: none"> <li>- Resolution</li> <li>- Count-direction</li> <li>- Free resolution</li> </ul>	32 Bit IN	<ul style="list-style-type: none"> <li>- Output of the current actual position with the adjusted resolution and counting direction</li> </ul>
<b>Speed</b> page 30	<ul style="list-style-type: none"> <li>- no operating parameters</li> </ul>	16 Bit IN	<ul style="list-style-type: none"> <li>- Output of the actual speed in 10 mm/s</li> </ul>
<b>Failure-display</b> page 31	<ul style="list-style-type: none"> <li>- Failure-value</li> </ul>	8 Bit IN	<ul style="list-style-type: none"> <li>- Output of the laser error message and definition of the data value in the module "Position" in the event of an error</li> </ul>
<b>Switch-Position</b> page 33	<ul style="list-style-type: none"> <li>- no operating parameters</li> </ul>	32 Bit OUT	<ul style="list-style-type: none"> <li>- Definition of the position value, on which the external switching output is switched actively.</li> </ul>
<b>Function ext. IO-Pins</b> page 33	<ul style="list-style-type: none"> <li>- Function ext. Input</li> <li>- Function ext. Outputs 1-4</li> <li>- Preset HI-Word</li> <li>- Preset LO-Word</li> <li>- Active slope ext. Input</li> <li>- Delay to enable ext. Input</li> <li>- active Output-Level</li> </ul>	blank	<ul style="list-style-type: none"> <li>- Specification of the function for the ext. input / outputs</li> <li>- Definition of the position value, on which the measuring system is set when the preset function is executed</li> <li>- Definitions for the external input:                             <ul style="list-style-type: none"> <li>- high-active / low-active</li> <li>- Response time</li> </ul> </li> <li>- Definition of the output level for the external outputs</li> </ul>
<b>Counter meas.-cycle</b> page 38	<ul style="list-style-type: none"> <li>- no operating parameters</li> </ul>	32 Bit IN	<ul style="list-style-type: none"> <li>- Output of the counter reading of the measuring cycle</li> </ul>
<b>SSI-Port</b> page 39	<ul style="list-style-type: none"> <li>- SSI-Data bits</li> <li>- Code</li> <li>- SSI-Failure bit</li> <li>- SSI-Output-Value</li> </ul>	blank	<ul style="list-style-type: none"> <li>- Configuration of the optional SSI interface</li> </ul>
<b>Adjustment</b> page 42	<ul style="list-style-type: none"> <li>- no operating parameters</li> </ul>	32 Bit OUT	<ul style="list-style-type: none"> <li>- Adjustment of the position (deposited in the Master)</li> </ul>
<b>Control bits with quit</b> page 43	<ul style="list-style-type: none"> <li>- Failure quit</li> </ul>	8 Bit IN / 8 Bit OUT	<ul style="list-style-type: none"> <li>- Execution of measuring system - specific functions over the bus</li> <li>- Definition of the error acknowledgment</li> </ul>
<b>Working-time Laser-Diode</b> , page 46	<ul style="list-style-type: none"> <li>- no operating parameters</li> </ul>	16 Bit IN	<ul style="list-style-type: none"> <li>- Output of the operation hours for the implemented laser diode</li> </ul>

\* from the bus master perspective

### 7.3 Module position

The module uses two input words which are consistently transferred via the bus. About these two input words the position of the measuring system is transmitted.

#### Data exchange

##### DDL<sub>M</sub>\_Data\_Exchange

Input double word ID<sub>x</sub>

Rel. byte address	0	1	2	3
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^8$	$2^7 - 2^0$
Data_Exchange – 32 bits for the position output				

#### Configuration data

**Identifier: 0xD1** (1 double word input data for the position value, consistent)

##### DDL<sub>M</sub>\_Chk\_Cfg

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	1	1	01	1
	<b>D</b>			<b>1</b>
	Consistency	Word format	Input data	Length code

#### Overview of operating parameters

Parameter	Data type	Relative byte-address	Range of values (dec.)
Resolution	unsigned8	0	0 – 7
Count-direction	unsigned8	1	0 – 1
* Free resolution (in 1/100mm)	unsigned16	2 – 3	1 – 65 535

\* As of GSD file “TR040458.GSD” (02/12/03)

Freely selectable resolution, by input of the corresponding data value.

### 7.3.1 Operating parameters

#### 7.3.1.1 Resolution

Specification of the measuring system resolution.

##### *DDL\_M\_Set\_Prm*

unsigned8

<b>Rel. byte address</b>	<b>0</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>1</b>

Value	Assignment	Description
0	Centimeter	1 Digit = 1 Centimeter
1	Millimeter	1 Digit = 1 Millimeter
2	1/10 Millimeter	1 Digit = 1/10 Millimeter
3	1/100 Millimeter	1 Digit = 1/100 Millimeter
4	Inch	1 Digit = 1 Inch
5	1/10 Inch	1 Digit = 1/10 Inch
6	* Free resolution (in 1/100 mm)	1 Digit = 1/100 mm

**\* As of GSD file “TR040458.GSD” (02/12/03)**

Freely selectable resolution, by input of the corresponding data value.

#### 7.3.1.2 Count-direction

Specification of the counting direction for the position value.

##### *DDL\_M\_Set\_Prm*

unsigned8

<b>Rel. byte address</b>	<b>1</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	positive	With increasing distance to the measuring system, values increasing
1	negative	With increasing distance to the measuring system, values decreasing

### 7.3.1.3 Free resolution (in 1/100mm)

#### As of GSD file “TR040458.GSD” (02/12/03)

Definition of the measuring system resolution, if in parameter “Resolution” the value “Free resolution (in 1/100mm)” was selected.

#### DDLML\_Set\_Prm

unsigned16

Rel. byte address	2	3
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$
Default (dec.)	0	100

Range of values	Description
1 – 65 535	e.g. input value = 100: 1 Digit = 1mm

If e.g. a resolution shall be adjusted of 1 mm, you must type in the data value 100.

## 7.4 Module Speed

The module uses one input word which is consistently transferred via the bus. About this input word the momentary actual speed is transmitted in 10 mm/s = 0.01 m/s.

### Data exchange

#### DDLML\_Data\_Exchange

Input word IWx

Rel. byte address	0	1
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$
Data_Exchange – 16 bits for the speed output		

### Configuration data

**Identifier: 0xD0** (1 word input data for the speed, consistent)

#### DDLML\_Chk\_Cfg

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	1	1	01	0
	<b>D</b>			<b>0</b>
	Consistency	Word format	Input data	Length code

## 7.5 Module failure display

The module uses one input byte, which is coded bit-by-bit. Over the input byte the error message of the measuring system is transferred and is reset, if the error was removed or is no more present.

### Data exchange

#### DDL\_M\_Data\_Exchange

Input byte IBx

<b>Rel. byte address</b>	<b>0</b>
Bit	7 – 0
Data	$2^7 - 2^0$
Data_Exchange – 8 bits for the error message	

No error Input, byte = 0x00 corresponds to the normal condition.

“1” = active

Bit	Function	Description
0	Intensity	The bit is set, if an intensity value of < 8% is present, or the laser beam is interrupted and leads to the failure value output.
1	Temperature	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.
2	Hardware	The bit is set, if an internal hardware error or a station address < 3 is detected and leads to the failure value output.
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.
4	Warning bit Intensity	The bit is set, if an intensity value of < 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.
5	Warning bit Speed-check	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.
6	Warning bit Plausibility	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.

**Configuration data**

**Identifier: 0x10** (1 byte input data for the error message, consistent)

**DDL\_M\_Chk\_Cfg**

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	0	0	01	0
	1			0
	Consistency	Word format	Input data	Length code

**Overview of operating parameters**

Parameter	Data type	Relative byte-address	Range of values (dec.)
Failure-value	unsigned8	0	0 – 2

**7.5.1 Operating parameters**

**7.5.1.1 Failure-value**

Definition of the data value, which is transmitted in the module "Position" if an error is present. The data value is output, if the measuring system can output no more measurement. This is given e.g., if a beam interruption is present.

**DDL\_M\_Set\_Prm**

unsigned8

Rel. byte address	0
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	Null	The position is set to "0"
1	0xFF	All 24 bits are set to '1' (0xFFFFFFFF or -1)
2	last valid value	Output of the last valid position



## 7.6 Module switch position

As of GSE file "TR070458.GSE" (02/23/05).

The module uses two output words which are consistently transferred via the bus. The module specifies the position value, on which the switching output is switched actively, when the function "Switching output position" (see "Function ext. output" page 35) is preselected.

### Data exchange

#### DDL<sub>M</sub>\_Data\_Exchange

Output double word OD<sub>x</sub>

Rel. byte address	0	1	2	3
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^8$	$2^7 - 2^0$
Data_Exchange – 32 bits for the switch position				

### Configuration data

**Identifier: 0xE1** (1 double word output data for the switch position, consistent)

#### DDL<sub>M</sub>\_Chk\_Cfg

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	1	1	10	1
<b>E</b>				<b>1</b>
	Consistency	Word format	Input data	Length code

## 7.7 Module function ext. IO-Pins

The module uses no inputs and no outputs and is only used for the parameterization of the function for the external input/output at the measuring system.

### Overview of operating parameters

Parameter	Data type	Relative byte-address	Range of values (dec.)
Function ext. input	unsigned8	0	0 – 3
Function ext. output	unsigned8	1	0 – 7
Preset HI-Word	unsigned16	2 – 3	0 – 65 535
Preset LO-Word	unsigned16	4 – 5	0 – 65 535
Active slope ext. input	unsigned8	6	0 – 1
Wait-time to enable ext. input	unsigned8	7	0 – 3
Active output level	unsigned8	8	0 – 1

## 7.7.1 Operating parameters

### 7.7.1.1 Function ext. input

Definition of the function for the external switching input.

#### **⚠ WARNING**

***Danger of physical injury and damage to property due to an actual value jump during execution of the Preset - function!***

#### **NOTICE**

- The *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!

#### ***DDL\_M\_Set\_Prm***

unsigned8

<b><i>Rel. byte address</i></b>	<b><i>0</i></b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b><i>Default (dec.)</i></b>	<b><i>0</i></b>

<b><i>Value</i></b>	<b><i>Assignment</i></b>	<b><i>Description</i></b>
0	Disabled	Function switched off, following parameters without meaning.
1	Preset-function	With connection of the switching input or by executing the control bit "Execute Preset" in the module "Control bits with quit", the laser is adjusted to the predefined position value (Preset HI- and LO-Word).
2	LD-switch-input	With connection of the switching 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 switching input does not have a function.
3	Fail-quit-input	<b>As of GSE file "TR060458.GSE" 07/08/03</b> Switching input is used as error acknowledgement. Software acknowledgement see "Module control bits with quit", page 43.

## 7.7.1.2 Function ext. output

As of GSE file "TR070458.GSE" (02/23/05).

Defines the output level of the switching output.

**DDL\_M\_Set\_Prm**

unsigned8

<b>Rel. byte address</b>	<b>8</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	Disabled	Function switched off, following parameters without meaning.
1	Temperature	The switching output 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.
2	Intensity	The switching output is set, if an intensity value of smaller 8 % is present, or the laser beam is interrupted and leads to the error value output.
3	Hardware fail	The switching output is set, if an internal hardware error or a station address < 3 were detected and leads to the error value output.
4	every fail	The switching output is set, if one of the errors, listed here, is active.
5	Speed-check	The switching output 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.
6	Plausibility measured value	The switching output 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.
7	Switching output position	The switching output is set, if the stored value (see "Module switch position" page 33) is reached.

### 7.7.1.3 Preset HI-Word / Preset LO-Word

Defines the position value to which the measuring system is adjusted, when the preset function is executed. The preset value must be programmed in the range from 0 ... measuring length.

#### **DDL\_M\_Set\_Prm**

unsigned16, Preset HI-Word

<b>Rel. byte address</b>	<b>2</b>	<b>3</b>
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>	<b>0</b>

<b>Range of values</b>	<b>Description</b>
0 – 65 535	Preset value high-word

#### **DDL\_M\_Set\_Prm**

unsigned16, Preset LO-Word

<b>Rel. byte address</b>	<b>4</b>	<b>5</b>
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>	<b>0</b>

<b>Range of values</b>	<b>Description</b>
0 – 65 535	Preset value low-word

### 7.7.1.4 Active slope ext. input

Defines whether the function of the switching input is activated with an rising or falling slope at the switching input.

This parameter has no influence on the triggering of a function over a control bit via the PROFIBUS. There is always the rising slope valid.

#### **DDL\_M\_Set\_Prm**

unsigned8

<b>Rel. byte address</b>	<b>6</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

<b>Value</b>	<b>Assignment</b>	<b>Description</b>
0	L->H	Execution with rising slope
1	H->L	Execution with falling slope

### 7.7.1.5 Delay to enable ext. Input

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

#### **DDL\_M\_Set\_Prm**

unsigned8

<b>Rel. byte address</b>	<b>7</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	100 ms	Response time = 100 ms
1	250 ms	Response time = 250 ms
2	500 ms	Response time = 500 ms
3	1000 ms	Response time = 1000 ms

### 7.7.1.6 Active output level

As of GSE file “TR070458.GSE” (02/23/05).

Defines the output level of the switching output.

#### **DDL\_M\_Set\_Prm**

unsigned8

<b>Rel. byte address</b>	<b>8</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	active low	When the event is active, switching output = "0"
1	active high	When the event is active, switching output = "1"

## 7.8 Module counter measuring cycle

The module uses two input words which are consistently transferred via the bus. Over the input words the counter reading of the measuring-cycle counter is transferred. Every correct measuring cycle in the device increases the counter reading by 1. An overflow of the 32-bit counter causes a new beginning with "0".

### Data exchange

#### DDLML\_Data\_Exchange

Input double word IDx

Rel. byte address	0	1	2	3
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^8$	$2^7 - 2^0$
Data_Exchange – 32 bits for the measuring cycle counter				

### Configuration data

**Identifier: 0xD1** (1 double word input data for the measuring cycle counter, consistent)

#### DDLML\_Chk\_Cfg

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	1	1	01	1
	D			1
	Consistency	Word format	Input data	Length code

## 7.9 Module SSI interface

The module SSI-Port uses no inputs and no outputs and is used only for the parameterization of the measuring system SSI interface.

### Overview of operating parameters

Parameter	Data type	Relative byte-address	Range of values (dec.)
SSI-Data bits	unsigned8	0	0 – 14
Code	unsigned8	1	0 – 1
SSI-Failure bit	unsigned8	2	0 – 5
SSI-Output-Value	unsigned8	3	0 – 2

### 7.9.1 Operating parameters

#### 7.9.1.1 SSI data bits

##### DDL\_M\_Set\_Prm

unsigned8

<b>Rel. byte address</b>	<b>0</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	24 Bit	Number of SSI data bits = 24
1	25 Bit	Number of SSI data bits = 25
2	26 Bit	Number of SSI data bits = 26
3	12 Bit	Number of SSI data bits = 12
4	13 Bit	Number of SSI data bits = 13
5	14 Bit	Number of SSI data bits = 14
6	15 Bit	Number of SSI data bits = 15
7	16 Bit	Number of SSI data bits = 16
8	17 Bit	Number of SSI data bits = 17
9	18 Bit	Number of SSI data bits = 18
10	19 Bit	Number of SSI data bits = 19
11	20 Bit	Number of SSI data bits = 20
12	21 Bit	Number of SSI data bits = 21
13	22 Bit	Number of SSI data bits = 22
14	23 Bit	Number of SSI data bits = 23

**As of GSE file "TR070458.GSE"  
(02/23/05)**

### 7.9.1.2 Code

#### **DDL\_M\_Set\_Prm**

unsigned8

<b>Rel. byte address</b>	<b>1</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

<b>Value</b>	<b>Assignment</b>	<b>Description</b>
0	Gray	SSI output code = Gray
1	Binary	SSI output code = Binary

### 7.9.1.3 SSI failure bit

The SSI-Failure bit is an additional bit in the SSI protocol and is attached after the "LSB bit".

#### **DDL\_M\_Set\_Prm**

unsigned8

<b>Rel. byte address</b>	<b>2</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

<b>Value</b>	<b>Assignment</b>	<b>Description</b>
0	Disabled	No SSI error bit
1	Temperature	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.
2	Intensity	The bit is set, if an intensity value of < 8% is present, or the laser beam is interrupted and leads to the failure value output (see also "Module failure display", page 31).
3	Hardware	The bit is set, if an internal hardware error or a station address < 3 is detected and leads to the failure value output (see also "Module failure display", page 31).
* 4	Every failure	The bit is set, if one of the errors, which can be detected by the device, is active (see also "Module failure display", page 31).
* 5	Plausibility measured value	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.

\* As of GSE file "TR070458.GSE" (02/23/05).



**7.9.1.4 SSI output value**
***DDL\_M\_Set\_Prm***

unsigned8

<b><i>Rel. byte address</i></b>	<b>3</b>
Bit	7 – 0
Data	$2^7 - 2^0$
<b><i>Default (dec.)</i></b>	<b>0</b>

<b><i>Value</i></b>	<b><i>Assignment</i></b>	<b><i>Description</i></b>
0	Position	Output of the measuring system position
1	Intensity	Output of the laser intensity value
2	Speed	Output of the measuring system actual speed

## 7.10 Module adjustment

**⚠ WARNING**

**Danger of physical injury and damage to property due to an actual value jump during execution of the *Adjustment - function!***

**NOTICE**

- 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!

The module adjustment uses two output words which are consistently transferred via the bus. With executing of the adjustment function (see "Module control bits with quit", page 43) the measuring system is adjusted to the position value deposited in the control. The adjustment value must be programmed in the range from 0 ... measuring length. In contrast to the Preset function the adjustment value isn't transmitted in the parameterization phase. In the control the adjustment value can be redefined and triggered at any time.

**Data exchange**

**DDL\_M\_Data\_Exchange**

Output double word ODx

Rel. byte address	0	1	2	3
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^8$	$2^7 - 2^0$
Data_Exchange – 32 bits for the adjustment				

**Configuration data**

**Identifier: 0xE1** (1 double word output data for the adjustment, consistent)

**DDL\_M\_Chk\_Cfg**

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	1	1	10	1
<b>E</b>				<b>1</b>
	Consistency	Word format	Input data	Length code

## 7.11 Module control bits with quit

The module uses one input byte and one output byte. The bytes are coded bit-by-bit. Via the output byte control commands can be transmitted to the measuring system. Via the input byte the control commands transmitted to the measuring system are acknowledged by the measuring system.

### ⚠ WARNING

**Risk of injury and damage to property by an actual value jump when the Preset-, Adjustment- or Preset Clear function is performed!**

### NOTICE

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

### Data exchange

#### DDL\_M\_Data\_Exchange

Input byte IBx

<b>Rel. byte address</b>	<b>0</b>
Bit	7 – 0
Data	$2^7 - 2^0$
	Data_Exchange – 8 Bits for acknowledgment of the control command

"1" = active

Bit	Function	Description
0	Laser diode switched off	Acknowledgment
1	Laser diode switched on	Acknowledgment
2	unused	-
3	unused	-
4	Adjustment executed	Acknowledgment
5	Preset executed	Acknowledgment
6	Preset cleared	Acknowledgment
7	Error cleared	Acknowledgment

**DDL\_M\_Data\_Exchange**

Output byte OBx

<b>Rel. byte address</b>	<b>0</b>
Bit	7 – 0
Data	$2^7 - 2^0$
Data_Exchange – 8 Bits for execution of the control command	

"1" = active

Bit	Function	Description
0	Switch off laser diode	By setting this bit the laser diode is switched off for the extension of the life time. If under the operating parameter "Function ext. input" = "LD-switch-input" (page 34) 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.
1	Switch on laser diode	By setting this bit the laser diode is switched on. This function is ineffective if: see "Switch off laser diode" above.
2	unused	-
3	unused	-
4	Execute adjustment	By setting this bit the measuring system is adjusted to the value deposited in the external control (Module adjustment).
5	Execute Preset	By setting this bit the measuring system is adjusted to the value deposited in the operating parameter "Preset HI-Word / Preset LO-Word", page 36.
6	Clear Preset	By setting this bit, 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.
7	Clear Error	If in the "Module control bits with quit" in the operating parameter "Failure quit" the setting is preselected "Not automatic", by setting this bit an occurring error report is deleted. If the error could not be eliminated, the corresponding bit in the "Module failure display" is set in the next cycle again.

**Configuration data**

**Identifier: 0x30** (1 byte input data for acknowledgment of the control command, consistent)  
 (1 byte output data for execution of the control command, consistent)

**DDL\_M\_Cfg**

Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	0	0	11	0
	3			0
	Consistency	Word format	Input data	Length code

**Overview of operating parameters**

Parameter	Data type	Relative byte-address	Range of values (dec.)
Failure quit	unsigned8	0	0 – 1

**7.11.1 Operating parameter**
**7.11.1.1 Failure quit**

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

**DDL\_M\_Set\_Prm**

unsigned8

Rel. byte address	0
Bit	7 – 0
Data	$2^7 - 2^0$
<b>Default (dec.)</b>	<b>0</b>

Value	Assignment	Description
0	Not automatic	An occurring error report can be cleared via bit 7 in the output byte.
1	Automatic	An occurring error report is cleared automatically after remedying of the error.

## 7.12 Module working time laser diode

### As of GSE file "TR050458.GSE" (03/27/03)

The module uses one input word which is consistently transferred via the bus. About this input word the operation hours of the **activated laser diode** are transmitted.

#### Data exchange

#### DDL<sub>M</sub>\_Data\_Exchange

Input word IW<sub>x</sub>

Rel. byte address	0	1
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$
Data_Exchange – 16 bits for output of the operating hours		

#### Configuration data

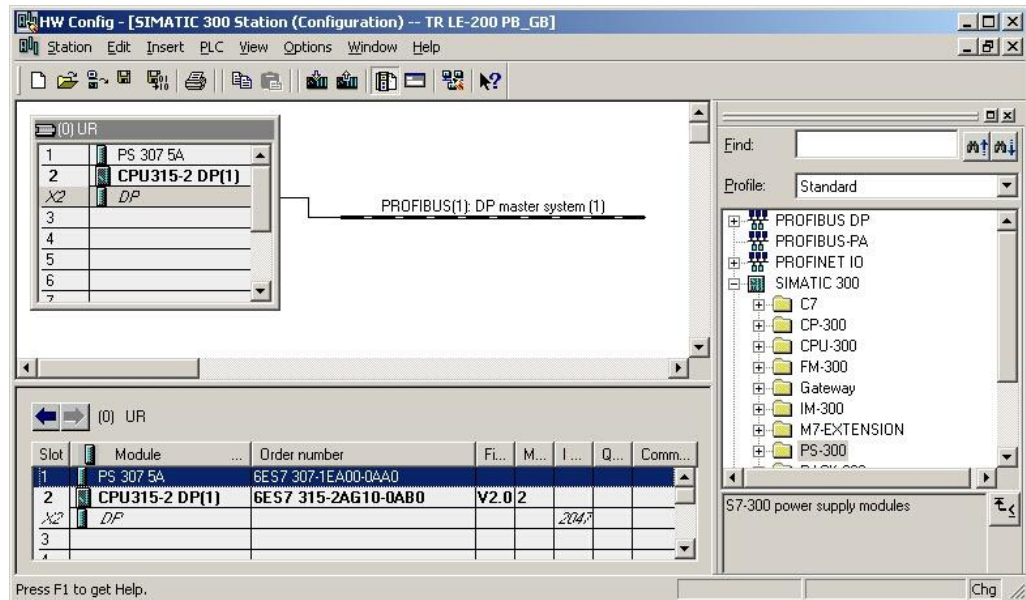
**Identifier: 0xD0** (1 word input data for the operating hours, consistent)

#### DDL<sub>M</sub>\_Chk\_Cfg

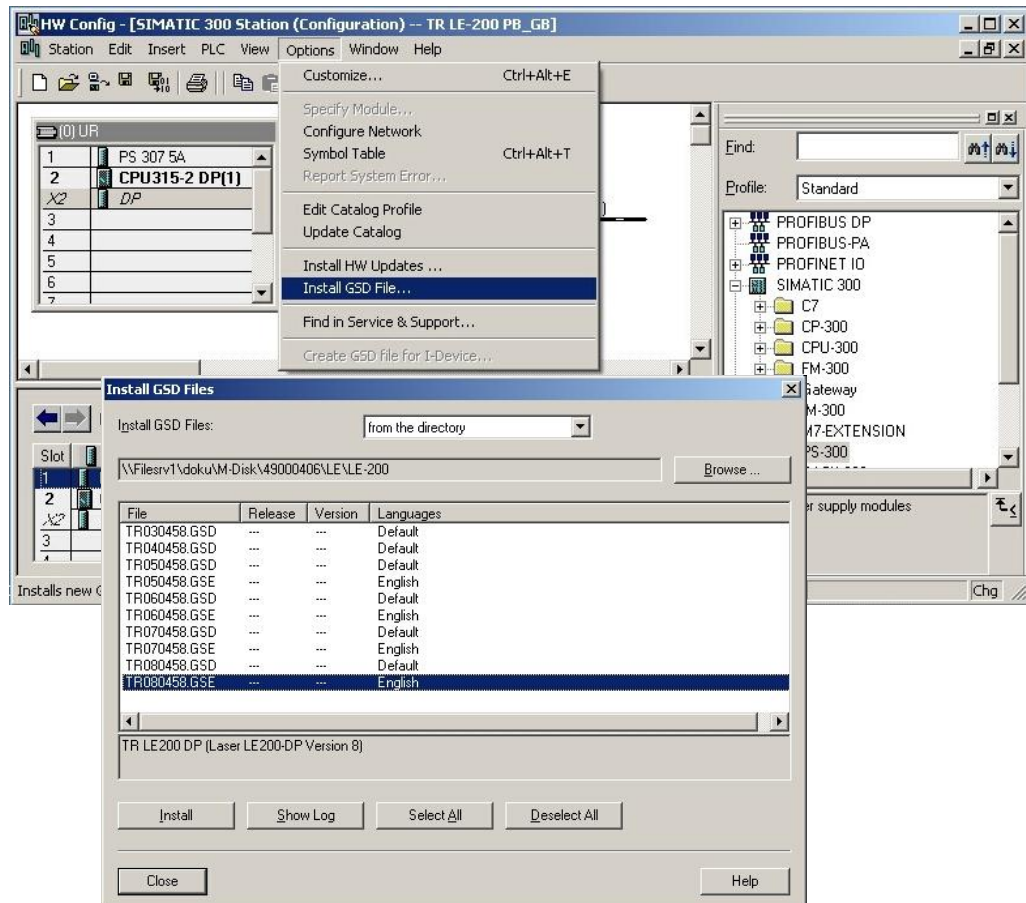
Byte	0			
Bit	7	6	5 – 4	3 – 0
Data	1	1	01	0
	<b>D</b>			<b>0</b>
	Consistency	Word format	Input data	Length code

### 7.13 Configuration example, SIMATIC® Manager V5.4

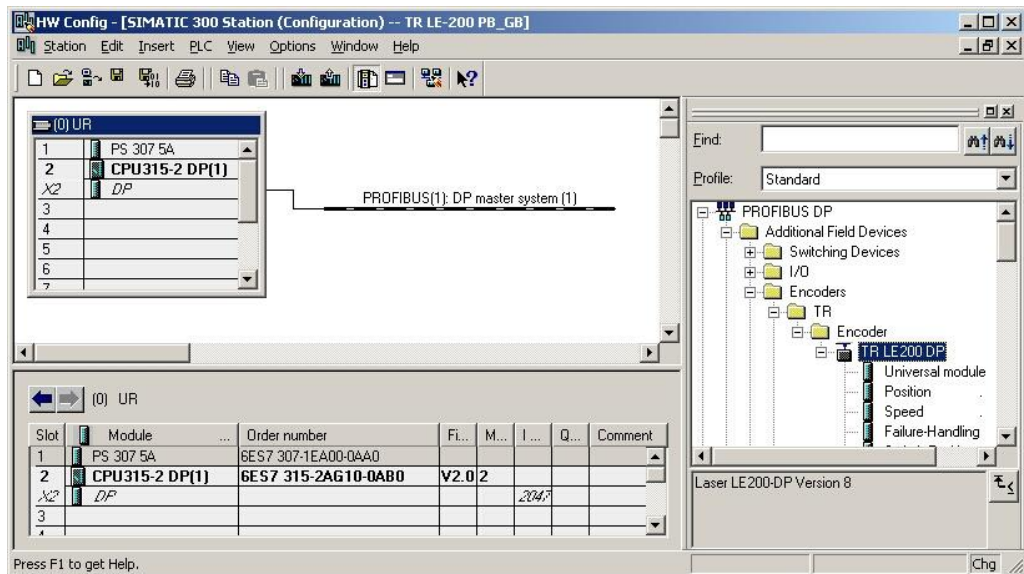
For the configuration example, it is assumed that the hardware configuration has already taken place. The **CPU315-2 DP** with integrated PROFIBUS-interface is used as CPU:



For the GSE file to be transferred to the catalogue, it must first be installed:



A new entry appears in the catalogue after installation of the GSE file:  
*PROFIBUS DP-->Additional Field Devices-->Encoders-->TR-->Encoder*



The sequence of the respective module-configuration options is given in this entry:

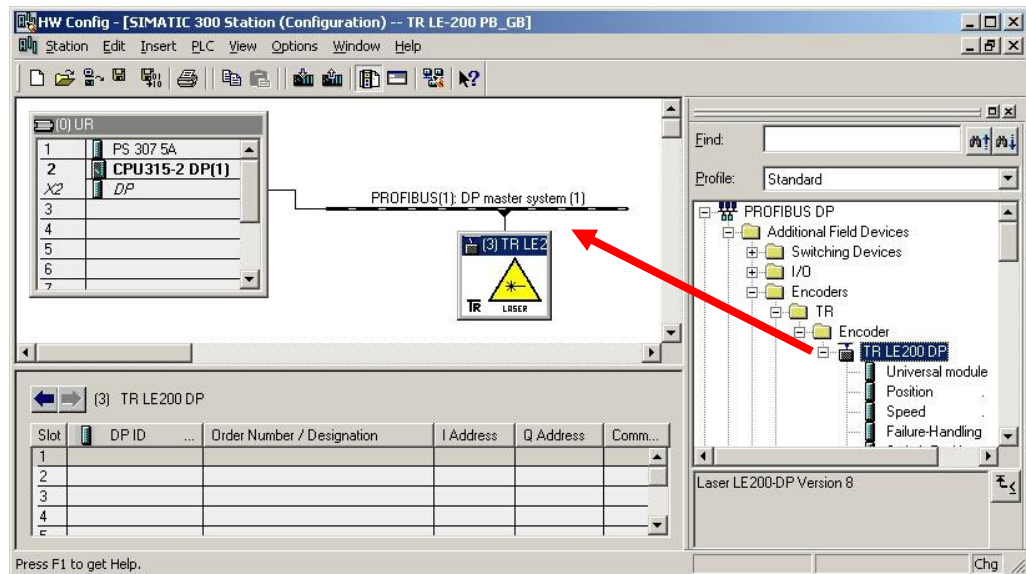
- Position, see page 28
- Speed, see page 30
- Failure-display, see page 31
- Switch-Position see page 33
- Function ext. IO-Pins, see page 33
- Counter measuring-cycle, see page 38
- SSI-Port, see page 39
- Adjustment, see page 42
- Control bits with quit, see page 43
- Working-time Laser-Diode see page 46



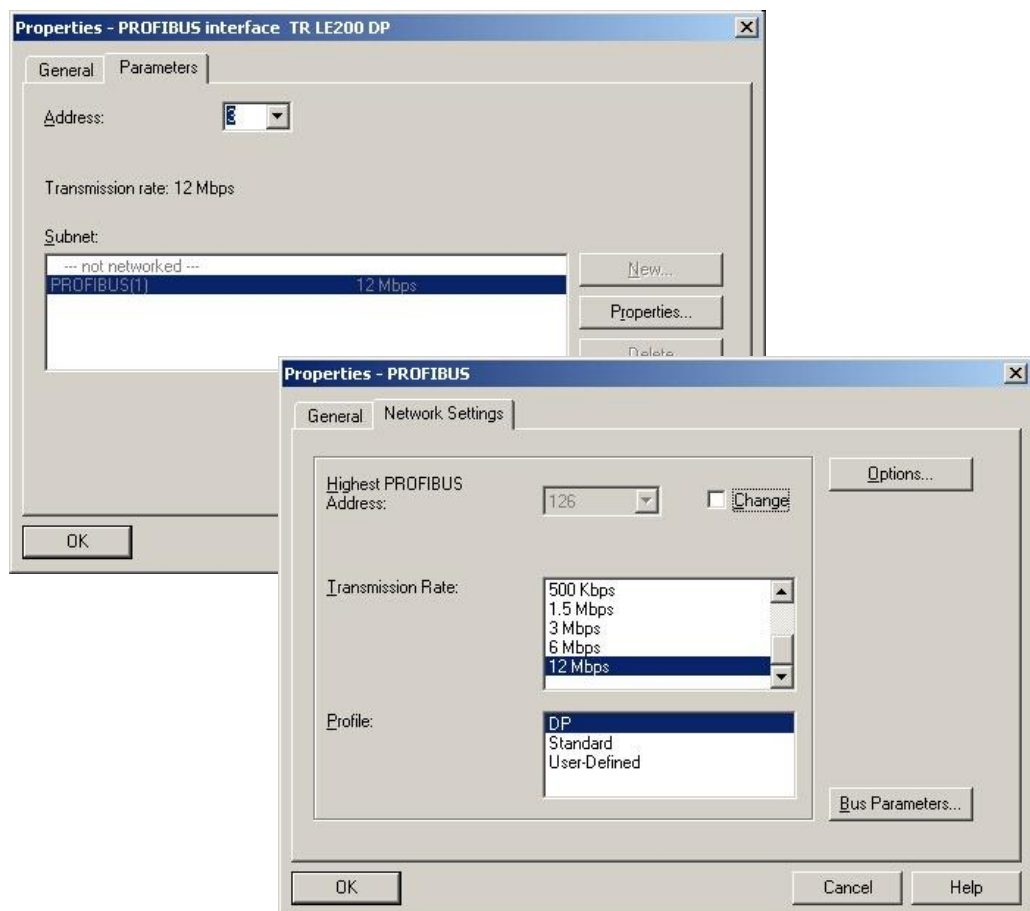
*The entry **Universal module** is erroneously available for some systems, but must not be used!*



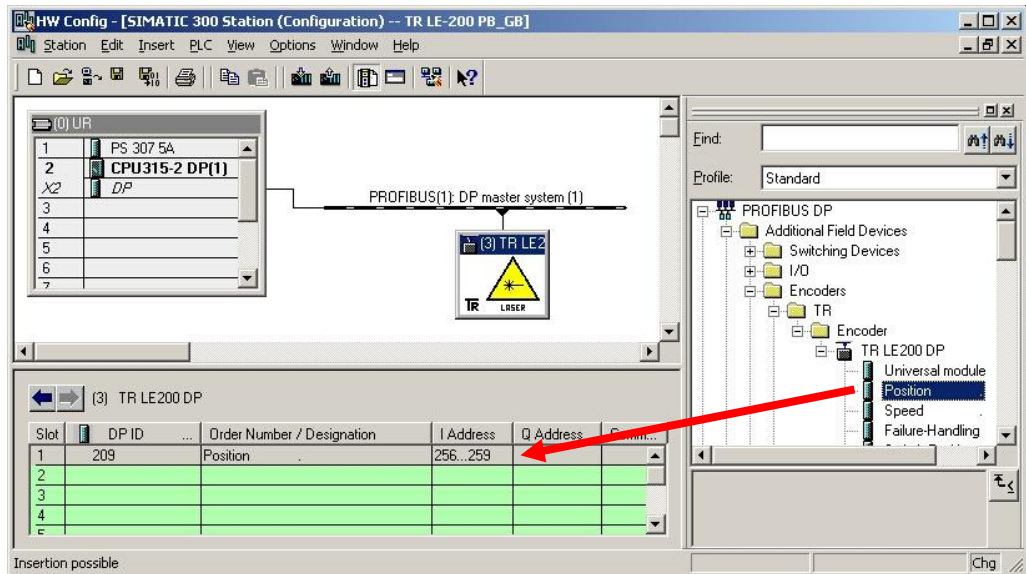
Connect measuring system to the master system (drag&drop):



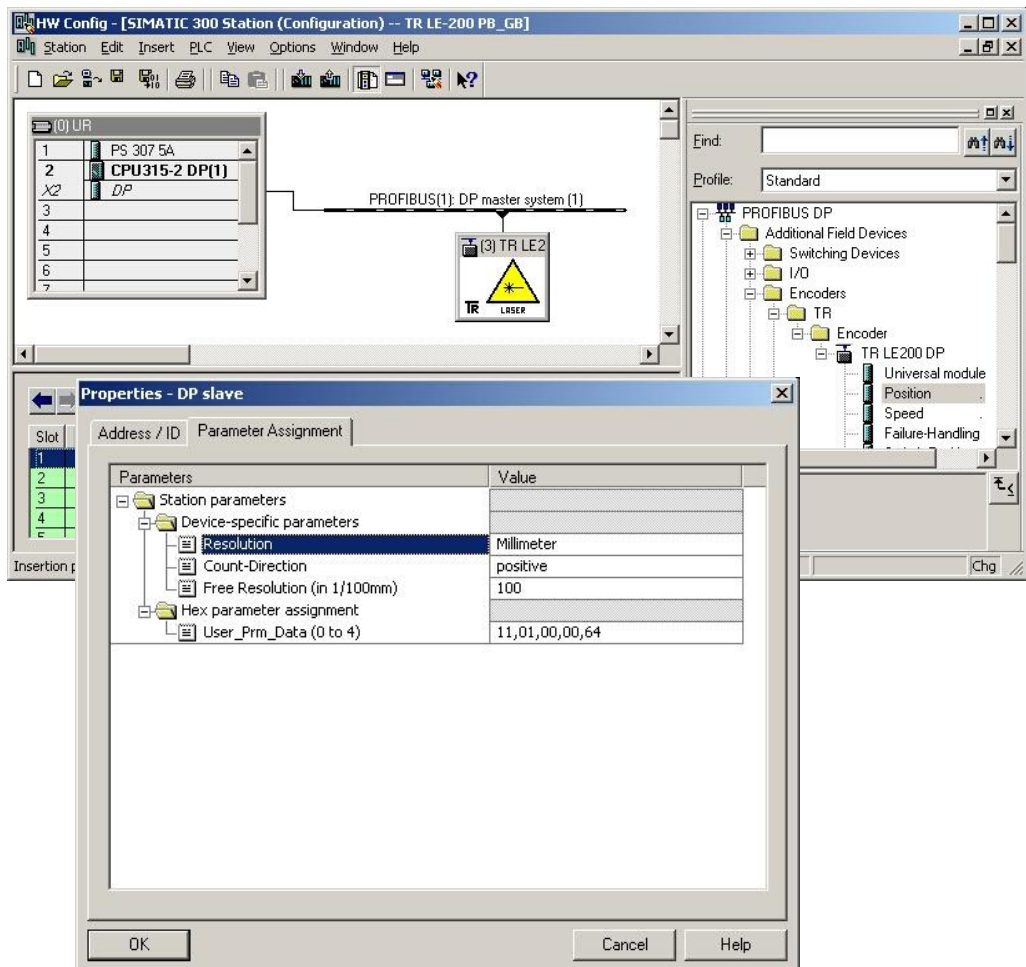
With connecting the measuring system to the master system, the network settings can be performed (click with the right mouse button on the laser symbol --> *Object Properties...*):



Transfer the required module configuration(s) from the catalogue to the slot (drag&drop). The laser symbol must be active.



Perform parameterization with a double click on the slot number:

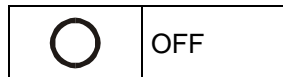
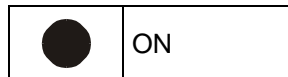

















## 8 Troubleshooting and diagnosis options

### 8.1 Optical displays

The measuring system has three LEDs on the upper side of the housing (see also chapter "Bus status", page 25). A red LED (ERR) to display of faults, a green LED (RUN) to display the status information and in addition a green LED (OK) to display hardware faults.

When the measuring system starts up both LEDs flash briefly. The display then depends on the operational state.



ERR	OK	RUN	Cause	Remedy
			While switching on the voltage an under-voltage of the supply voltage was detected.	Check supply voltage, see "Technical data".
			During operation an under-voltage of the supply voltage was detected.	Check supply voltage, see "Technical data".
			PROFIBUS-DP inactive, measuring system has not been addressed by the master.	<ul style="list-style-type: none"> <li>- Check projection and operating status of the PROFIBUS-DP master.</li> <li>- Does the projected PROFIBUS address agree with the adjusted PROFIBUS address at the device?</li> <li>- Is configured at least one module?</li> <li>- Switch off the voltage and then switch on the voltage again. If the error is existing furthermore, the device must be replaced.</li> </ul>
			Normal operating state. PROFIBUS-DP active, hardware ok.	-
			<ul style="list-style-type: none"> <li>- internal hardware fault</li> <li>- no valid PROFIBUS address</li> </ul>	<ul style="list-style-type: none"> <li>- Check PROFIBUS address. Valid address range: 3 – 99.</li> <li>- Switch off the voltage and then switch on the voltage again. If the error is existing furthermore, the device must be replaced.</li> </ul>

## 8.2 How to use the PROFIBUS diagnostics

In a PROFIBUS system, the PROFIBUS masters supply the process data to a so-called host system, e.g. a PLC-CPU. If a slave is not accessible, or no longer accessible, on the bus, or if the slave itself reports a fault, the master must communicate this fault to the host system in some form or other. There are several possible ways of doing this, the evaluation of which depends entirely on the application in the host system.

As a general rule, a host system cannot be stopped following the failure of only one component on the bus, but must respond appropriately to the failure as prescribed by the safety regulations. The master normally provides the host system initially with a summary diagnosis, which the host system reads cyclically from the master, and which serves to report the states of the individual bus stations to the application. If a station is reported to be faulty in the summary diagnosis, the host can request further data from the master (slave diagnostics), which then allow a more detailed evaluation of the causes. The indications thus obtained may either have been generated by the master, if the relevant slave does not respond (or no longer responds) to the master's requests, or they may come directly from the slave, if the slave itself reports a fault. The generation or reading of the diagnostic message between the master and slave takes place automatically, and does not have to be programmed by the user.

### 8.2.1 Standard diagnosis

The standard DP diagnosis is structured as follows (always from the point of view of the master in relation to the slave).

	<b>Byte no.</b>	<b>Significance</b>	
<b>Standard diagnosis</b>	Byte 1	Station status 1	General part
	Byte 2	Station status 2	
	Byte 3	Station status 3	
	Byte 4	Master address	
	Byte 5	Manufacturer's identifier HI byte	
	Byte 6	Manufacturer's identifier LO byte	

## 8.2.1.1 Station status 1

<b>Standard diagnosis byte 1</b>	Bit 7	Master_Lock	Slave has been parameterized by another master (bit is set by master)
	Bit 6	Parameter_Fault	The last parameterization message to have been sent was rejected by the slave
	Bit 5	Invalid_Slave_Response	Set by the master if the slave does not respond
	Bit 4	Not_Supported	Slave does not support the requested functions
	Bit 3	Ext_Diag	Bit = 1 means that there is an extended diagnostic message from the slave
	Bit 2	Slave_Cfg_Chk_Fault	The configuration identifier(s) sent by the master was/were rejected by the slave
	Bit 1	Station_Not_Ready	Slave is not ready to exchange cyclical data
	Bit 0	Station_Non_Existent	The slave has been configured but is not present on the bus

## 8.2.1.2 Station status 2

<b>Standard diagnosis byte 2</b>	Bit 7	Deactivated	Slave has been deleted from the poll list by the master
	Bit 6	Reserved	
	Bit 5	Sync_Mode	Set by slave on receipt of SYNC command
	Bit 4	Freeze_Mode	Set by slave on receipt of FREEZE command
	Bit 3	WD_On	Slave watchdog is activated
	Bit 2	Slave_Status	Always set for slaves
	Bit 1	Stat_Diag	Static diagnosis
	Bit 0	Prm_Req	The slave sets this bit if it has to be re-parameterized and re-configured.

## 8.2.1.3 Station status 3

<b>Standard diagnosis byte 3</b>	Bit 7	Ext_Diag_Overflow	Overflow in extended diagnosis
	Bit 6-0	Reserved	

#### 8.2.1.4 Master address

##### ***Standard diagnosis byte 4***

In this byte, the slave enters the station address of the first master to have sent a valid parameterization message. If several masters access the bus simultaneously, their configuration and parameterization information must coincide exactly in order to ensure correct operation of the PROFIBUS.

#### 8.2.1.5 Manufacturer's identifier

##### ***Standard diagnosis byte 5 + 6***

In these bytes, the slave enters the manufacturer-specific identification number, an unambiguous number for each device type which is reserved and filed with the PNO. The identifier number of the measuring system is 0458 (h).

### 8.3 Other faults

The error causes are determined in the "Module failure display" (see page 31). Depending on setting the error must be possibly acknowledged for resetting the malfunction code in the input byte (see "Module control bits with quit", page 43 and "Module function ext. IO-Pins", page 33).

Bit	Malfunction Code	Cause	Remedy
0	Intensity error	The device checks the intensity of the received laser signal continuously, it was detected a below-minimum intensity.	<ol style="list-style-type: none"> <li>1. Clean measuring system optics</li> <li>2. Clean reflecting foil</li> <li>3. Rule out an interruption of the laser beam</li> </ol> If the possibility of soiling or interruption of the laser signal can be ruled out, the device must be replaced.
1	Device temperature	The temperature has exceeded or fallen short of the range of 0 - 50°C at the device housing.	Appropriate measures must be taken to prevent the device from overheating or under-cooling.
2	Hardware error	The device has detected an internal hardware error or an adjusted station address < 3.	<ul style="list-style-type: none"> <li>- If the error occurs repeated, the device must be replaced.</li> <li>- Check station address (3 – 99).</li> </ul>
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.
4	Warning bit Intensity	The device detected 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.
5	Warning bit Speed-check	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.
6	Warning bit Plausibility	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.

## 9 Appendix

### 9.1 Ordering information

#### 9.1.1 Laser devices

Article-No.:	Description
2200-04102	Laser device Profibus+SSI 50 m, linearized
2200-04112	Laser device Profibus+SSI+Heating 50 m, linearized
2200-00102	Laser device Profibus+SSI 125 m, linearized
2200-00112	Laser device Profibus+SSI+Heating 125 m, linearized
2200-01100	Laser device Profibus+SSI 170 m
2200-01102	Laser device Profibus+SSI 170 m, linearized
2200-01112	Laser device Profibus+SSI+Heating 170 m, linearized
2200-02102	Laser device Profibus+SSI 195 m, linearized
2200-02112	Laser device Profibus+SSI+Heating 195 m, linearized