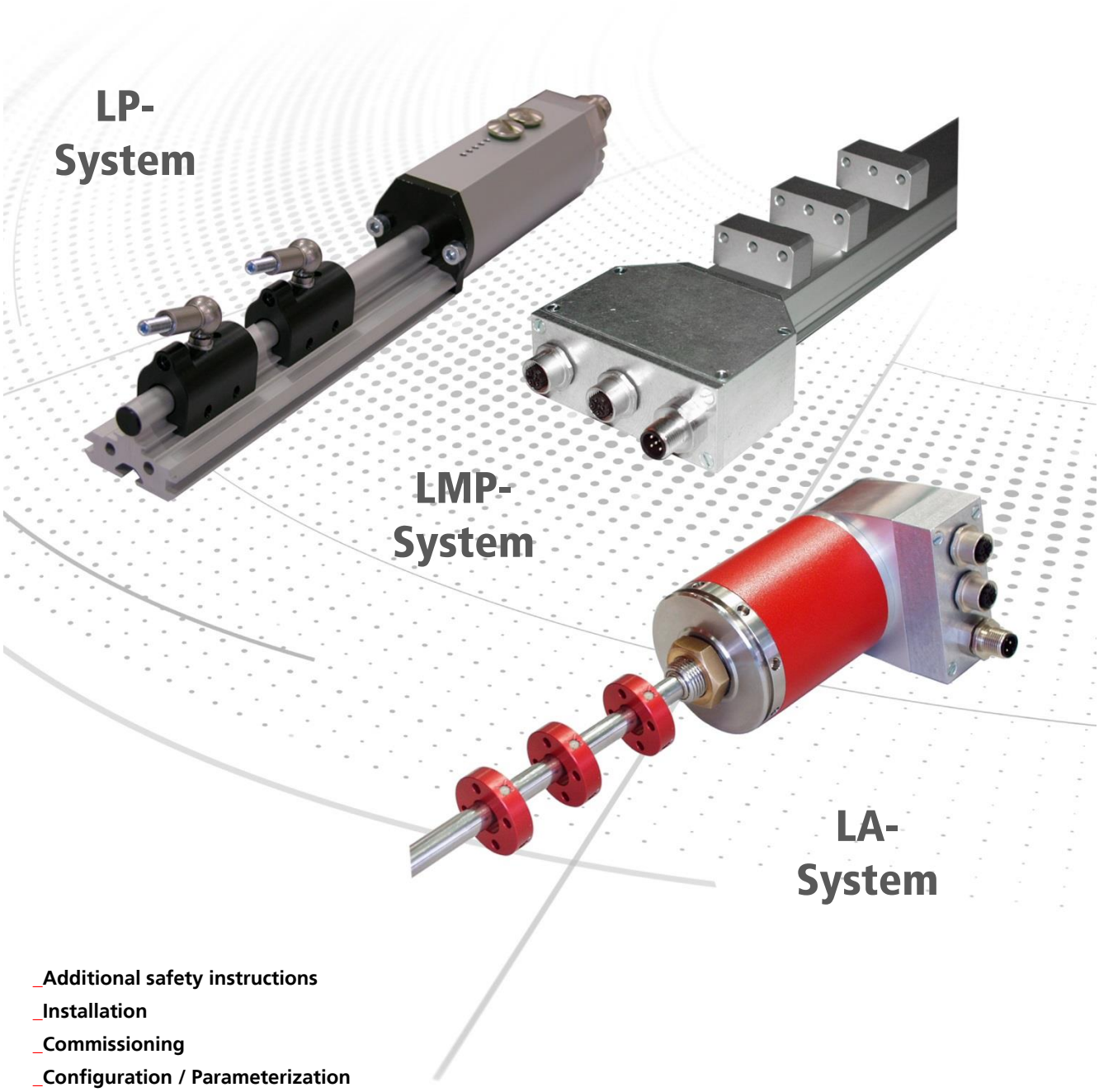
TR electronic

PROFIBUS®

Absolute linear encoder



_Additional safety instructions
_Installation
_Commissioning
_Configuration / Parameterization
_Troubleshooting and Diagnostic options

User Manual

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LA-66, 8-pol. MINI-COMBICON – Connector, Preset ... www.tr-electronic.de/f/TR-ELA-TI-GB-0005
LA-66, 5 x 2-pol. Screw terminal, Preset www.tr-electronic.de/f/TR-ELA-TI-GB-0024
LA-66, 5 x 2-pol. Screw terminal, 3 x M12 ..... www.tr-electronic.de/f/TR-ELA-TI-DGB-0047
LP-38 ..... www.tr-electronic.de/f/TR-ELA-TI-GB-0025
LA-46 / LP-46, Cable screw glands www.tr-electronic.de/f/TR-ELA-TI-GB-0044
LA-46 / LP-46, 2 x M12, 1 x M8 ..... www.tr-electronic.de/f/TR-ELA-TI-DGB-0051
LMP-30, 3 x M12 ..... www.tr-electronic.de/f/TR-ELA-TI-DGB-0055
LMP-30, 2 x M12, 1 x M8 ..... www.tr-electronic.de/f/TR-ELA-TI-DGB-0061

Revision index

Revision	Date	Index
First release	03/18/03	00
General technical modifications, layout modifications	08/10/07	01
Magnet distance: 50 mm --> 80 mm	07/15/09	02
Modification of the warnings; Pin assignment TR-ELA-TI-DGB-0060 removed	12/08/11	03
Class 2 functionality	09/18/14	04
Reference to Support-DVD removed	02/04/16	05

1 General information

This interface-specific User Manual includes the following topics:

- Safety instructions in additional to the basic safety instructions defined in the Assembly Instructions
- Electrical characteristics
- Installation
- Commissioning
- Configuration / 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 system models with ***PROFIBUS-DP*** interface:

- LA
- LP
- LMP

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, which is enclosed when the device is delivered www.tr-electronic.de/f/TR-ELA-BA-DGB-0004

1.2 Abbreviations used / Terminology

LA	Linear-Absolute Measuring System, type with tube-housing
LP	Linear-Absolute Measuring System, type with profile-housing
LMP	Linear-Absolute Measuring System, type with profile-housing
DDLM	***D***irect ***D***ata ***L***ink ***M***apper, interface between PROFIBUS-DP functions and measuring system software
DP	***D***ecentralized ***P***eriphery
EMC	***E***lectro ***M***agnetic ***C***ompatibility
GSD	Device Master File
PNO	PROFIBUS User Organization (PROFIBUS Nutzerorganisation)
PROFIBUS	Manufacturer independent, open field bus standard

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 proper use

The measuring 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 parameterization and the device diagnosis are performed through the PROFIBUS master according to the profile for encoders version 1.1 of the PROFIBUS User Organization (PNO).

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.

Proper use also includes:

- observing all instructions in this User Manual,
- observing the assembly instructions. The "Basic safety instructions" in particular must be read and understood prior to commencing work.

2.3 Organizational measures

- This User Manual must always kept accessible at the site of operation of the measuring system.
- Prior to commencing work, personnel working with the measuring 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 measuring system.

3 Technical data

3.1 Electrical characteristics

Supply voltage ..... 19…27 V DC, twisted in pairs and shielded

Current consumption without load..... < 450 mA

Measuring principle..... magnetostrictive

*** Resolution**..... 0.01 mm / 0.005 mm, see nameplate

Output capacity ..... ≤ 24 bit

Number of magnets..... ≤ 12
Distance between 2 magnets ..... ≥ 80 mm

Output code..... Binary

Standard baud rates..... 9.6 kBaud to 12 MBaud

Cycle time internally, LA-46/LP-46
≤ 0.75 m..... 1.0 ms
≤ 1.5 m..... 1.5 ms
≤ 2.0 m..... 2.0 ms
> 2.0 m..... 2.5 ms

Cycle time internally, LMP-30
≤ 0.65 m..... 1.0 ms
≤ 1.50 m..... 1.5 ms
≤ 2.00 m..... 2.0 ms
≤ 3.30 m..... 2.5 ms
> 3.30 m..... 3.0 ms

Station addresses..... 3 - 99, set on BCD rotary switch

PROFIBUS-DP standard..... EN 50170 and EN 50254

Transmission ..... RS485, twisted and shielded copper cable with a single conductor pair (cable type A)

Special features..... Programming takes place via the parameterization telegram when the measuring system or the PROFIBUS-DP master starts up.
- Measuring length in steps
- Code sequence
- Adjustment in cycle
- Preset value for ext. Preset input

EMC
Immunity to disturbance..... DIN EN 61000-6-2
Transient emissions..... DIN EN 61000-6-3

* parameterizable via PROFIBUS-DP

4 Interface information's

4.1 PROFIBUS

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.

The PROFIBUS User Organization has implemented a special profile for encoders. The profile describes the connection of rotary, angular and linear encoders with single turn or multi turn resolution to the DP. Two device classes define the basic and additional functions, e.g. scaling, alarm management and diagnosis.
The measuring systems support Device Classes 1 and 2 as defined in the profile, as well as additional TR-specific functions.

A description of the encoder profile (order no.: 3.062) and further information on PROFIBUS is available from the PROFIBUS User Organization:

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

4.1.1 DP Communication protocol

The measuring systems 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 station, module and channel-specific diagnosis.

5 Installation / Preparation for commissioning

5.1 PROFIBUS – interface

5.1.1 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 in the measuring system connector hood.

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 with the PROFIBUS specification for the following copper data wire parameters:

Parameter	**Cable type A**
Wave impedance in Ω	135...165 at a frequency of 3...20 MHz
Operating capacitance (pF/m)	30
Loop resistance (Ω/km)	≤ 110
Wire diameter (mm)	> 0.64
Wire cross-section (mm²)	> 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:

Baud rate (kbits/s)	9.6	19.2	93.75	187.5	500	1500	12000
Range / Segment	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 power current carrying cables if at all possible. At data speed ≥ 1.5 Mbit, drop lines should be avoided under all circumstances.

The measuring system connector hood offers the possibility of connecting the inward and outward data cables directly to the removable connector hood. This avoids drop lines and the bus connector can be connected to and disconnected from the bus at any time without interruption of data traffic.

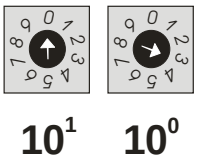
The PROFIBUS guidelines and other applicable standards and guidelines are to be observed to insure safe and stable operation!

In particular, the applicable EMC directive and the shielding and grounding guidelines must be observed!

5.1.2 Bus termination

If the measuring system is the last slave in the PROFIBUS segment, the bus is to be terminated with the termination switch = ON. In this state, the subsequent PROFIBUS is decoupled.	

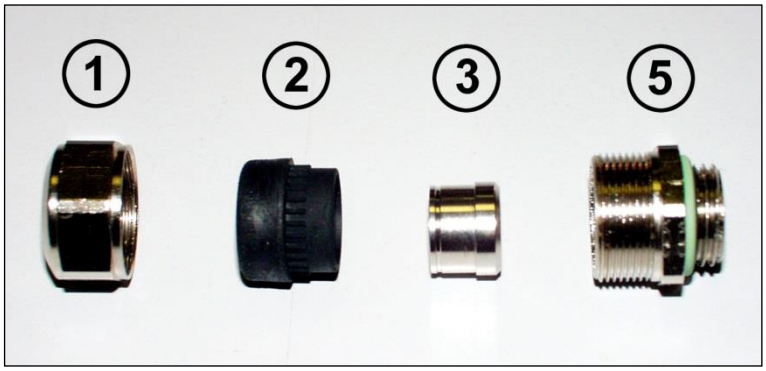
5.1.3 Bus address

Valid PROFIBUS addresses: 3 - 99 10^0: Setting the 1st position 10^1: Setting the 10th position The device does not start up with an invalid station address, LEDs = OFF.	

5.2 Shield cover

The shield cover is connected with a special EMC cable gland, whereby the cable shielding is fitted on the inside.

Cable gland assembly, variant A



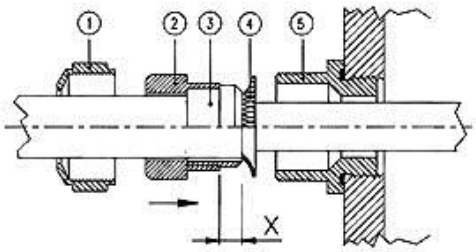
Pos. 1 Nut

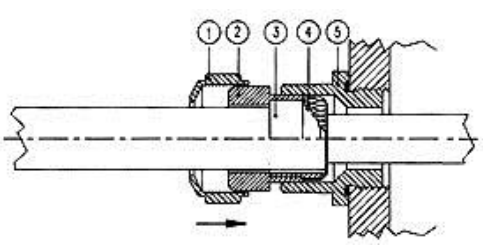
Pos. 2 Seal

Pos. 3 Contact bush

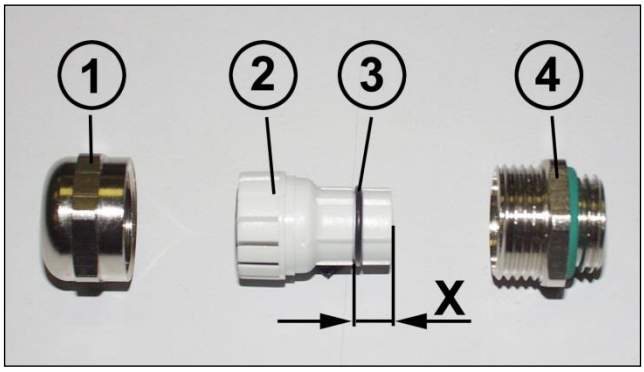
Pos. 5 Screw socket

1. Cut shield braid / shield foil back to ***dimension "X"***.
2. Slide the nut (1) and seal / contact bush (2) + (3) over the cable.
3. Bend the shield braining / shield foil to 90° (4).
4. Slide seal / contact bush (2) + (3) up to the shield braining / shield foil.
5. Assemble screw socket (5) on the housing.
6. Push seal / contact bush (2) + (3) flush into the screw socket (5).
7. Screw the nut (1) to the screw socket (5).



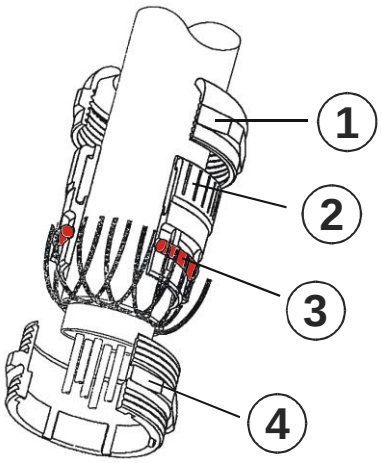


Cable gland assembly, variant B



Pos. 1 Nut
Pos. 2 Clamping ring
Pos. 3 Inner O-ring
Pos. 4 Screw socket

1. Cut shield braid / shield foil back to dimension ***"X" + 2mm***.
2. Slide the nut (1) and clamping ring (2) over the cable.
3. Bend the shield braining / shield foil to approx. 90°.
4. Push clamping ring (2) up to the shield braid / shield foil and wrap the braiding back around the clamping ring (2), such that the braiding goes around the inner O-ring (3), and is not above the cylindrical part or the torque supports.
5. Assemble screw socket (4) on the housing.
6. Insert the clamping ring (2) in the screw socket (4) such that the torque supports fit in the slots in the screw socket (4).
7. Screw the nut (1) to the screw socket (4).



6 Commissioning

6.1 Requirements for start-up on IM-308-C

In order to start up the measuring system on an IM-308-C, the following minimum requirements must be met:

- COM-ET-200 for Windows Version 2.0 or higher.
- IM-308-C Edition 3 or higher.
- Device master file for COM-ET-200 for Windows.

6.2 Requirements for start-up on SIMATIC-S7

In order to start up the measuring system on a programmable controller of the SIMATIC S7 type, the following minimum requirements must be met:

- STEP-7 for Windows Version 2.1 Edition 4 or higher. The Version 2.1 basic package supplied by Siemens does not support the parameterization function via input masks !
- SIMATIC S7-300 or S7-400 with PROFIBUS-DP interface.
- Device master file for COM-ET-200 for Windows.

6.3 Device Master File (GSD)

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, GSD 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 GSD file is a component of the measuring system and has the file name ***„TRM2AAAC.GSD“***

The measuring system also includes two bitmap files with the names ***"TRAAACMN.BMP"*** and ***"TRAAACMS.BMP"***, which show the measuring system in normal operation as well as with a fault.

Download:

- www.tr-electronic.de/f/TR-ELA-ID-MUL-0004

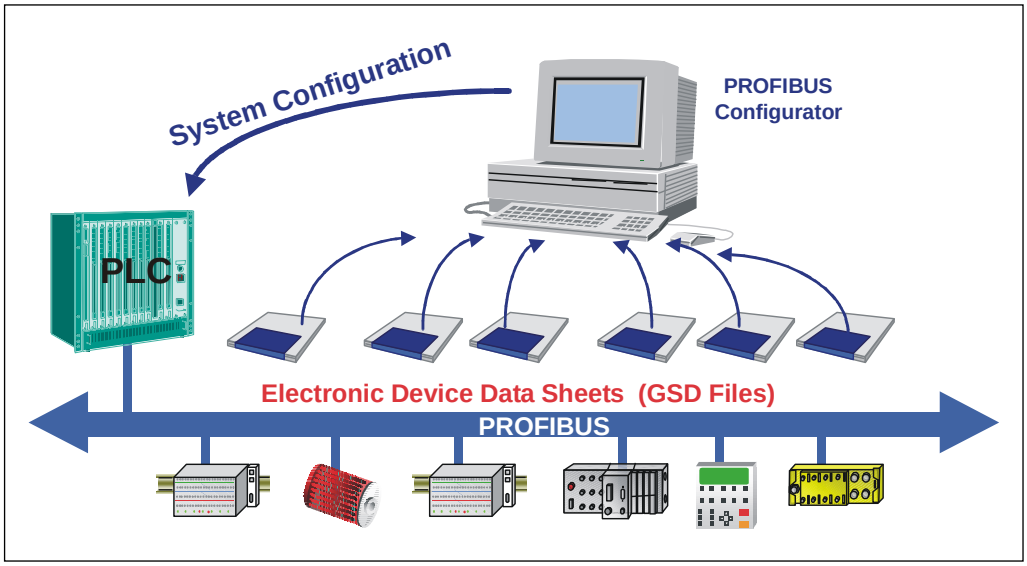


Figure 1: GSD for the configuration

6.4 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 AAAC (hex). This number is reserved and is stored at the PNO.

6.5 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 adjustment function can be performed.

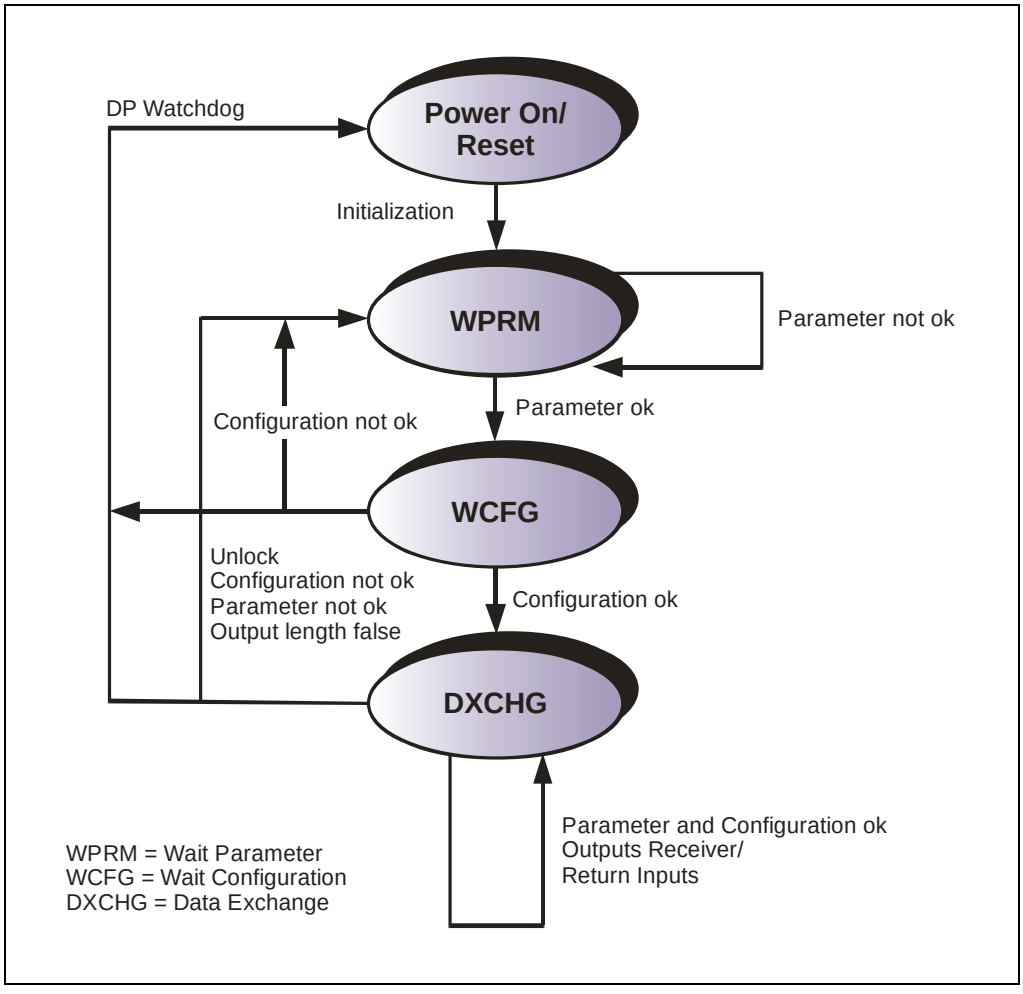


Figure 2: DP slave initialization

6.6 Bus status display

The measuring system has two LEDs in the connection hood. A red LED (Bus Fail) to display faults and a green LED (Bus Run) to display status information.
When the measuring system starts up, both LEDs flash briefly. The display then depends on the operational state.

● = ON
○ = OFF
◉ = 1 Hz
◉ = 10 Hz

LED, green	*Bus Run*
●	Ready for operation
○	Supply absent, hardware error
◉	Parameterization or configuration error

LED, red	*Bus Fail*
○	No error, bus in cycle
◉	Measuring system is not addressed by the master, no data exchange
●	Measuring system in Data Exchange, but no magnet was detected.

Corresponding measures in case of an error see chapter “Troubleshooting and diagnosis options”, page 41.

7 Parameterization and configuration

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 nominal configuration.

The configuration described as follows contains configuration and parameter data coded in their bit and byte positions. This information is e.g. only of significance in troubleshooting or with bus master systems for which this information has to be entered manually.

Modern configuration tools provide an equivalent graphic interface for this purpose. Here the bit and byte positions are automatically managed in the "background". The configuration example on page 37 illustrates this again.

Configuration

The definition of the I/O length, I/O data type etc. takes place automatically for most bus masters. This information only has to be entered manually for a few bus masters.

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 configurations, the identifier to be entered is preset dependent on the required nominal 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 **nominal configuration** (max. 1) and the **number of the additional magnets** (max. 11).

Structure of the configuration byte (compact format):

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Length of the I/O data:	0-15 for 1 to 16 bytes or words	
Type of I/O data:	00 = empty, 10 = output,	01 = input, 11 = input/output
Format:	0 = BYTE,	1 = WORD
Consistency:	0 = Consistency about one byte or word 1 = Consistency about the complete module	

7.1 Overview

Configuration	*Operating parameters*	**-Length*	*Features*
PNO Class 1 ***Page 22***	- Code sequence	16 bit IN	- No measuring system scaling, the measuring system has the base resolution according to the nameplate - 16 byte diagnosis data - Code sequence
PNO Class 1 ***Page 23***	- Code sequence	32 bit IN	
PNO Class 2 ***Page 24***	- Code sequence - Class 2 functionality - Scaling function - Total measuring range	16 bit IN 16 bit OUT	- Measuring system scaling is possible - Preset adjustment via the bus - Code sequence
PNO Class 2 ***Page 26***	- Code sequence - Class 2 functionality - Scaling function - Total measuring range	32 bit IN 32 bit OUT	
TR-extended 32 Bit ***Page 28***	- Code sequence - Class 2 functionality - Scaling function - Total measuring range - Preset value	32 bit IN 32 bit OUT	- Measuring system scaling possible - Preset adjustment via the bus - Code sequence - Preselection of the values for the external Preset inputs, depends on the type of measuring system
Additional magnet 16 Bit ***Page 31***	-	16 bit IN	- Module for 1 additional magnet, 16 bit data length, max. 11 modules can be projected. Not combinably with module “Additional magnet 32 bit”.
Additional magnet 32 Bit ***Page 32***	-	32 bit IN	- Module for 1 additional magnet, 32 bit data length, max. 11 modules can be projected. Not combinably with module “Additional magnet 16 bit”.

***** from the bus master perspective

7.2 PNO CLASS 1 16 bits

Data exchange

DDLM_Data_Exchange
Input word IWx

Byte	***1***	***2***
Bit	15 – 8	7 – 0
Data	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	Data_Exchange – Position data	

Configuration data

see note on page 20

Device Class 1: ***0xD0*** (1 word input data for position value, consistent)

DDLM_Chk_Cfg

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

Overview of operating parameters

see note on page 20

DDLM_Set_Prm

Byte	***9***
Bit	7 – 0
Data	$2^{7} – 2^{0}$

Bit	***Definition***	***= 0 (DEFAULT)***	***= 1***	***Page***
0	Code sequence	increasing position values to the rod end	decreasing position values to the rod end	34

7.3 PNO CLASS 1 32 bits

Data exchange

DDLM_Data_Exchange

Input double word IDx

Byte	***1***	***2***	***3***	***4***
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 – Position data			

Configuration data

see note on page 20

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

DDLM_Chk_Cfg

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

Overview of operating parameters

see note on page 20

DDLM_Set_Prm

Byte	***9***
Bit	7 – 0
Data	$2^{7} – 2^{0}$

Bit	***Definition***	***= 0 (DEFAULT)***	***= 1***	***Page***
0	Code sequence	increasing position values to the rod end	decreasing position values to the rod end	34

7.4 PNO CLASS 2 16 bits

Data exchange

DDLM_Data_Exchange

Input word IWx

Byte	***1***	***2***
Bit	15 – 8	7 – 0
Data	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	Data_Exchange – Position data	

Format for preset adjustment value (description of the function see page 33)

Output word OWx

Byte	***1***		***2***
Bit	15	14 – 8	7 – 0
Data	0 / 1	$2^{14} – 2^{8}$	$2^{7} – 2^{0}$
	Preset execution	Preset adjustment value	

Configuration data

see note on page 20

Device Class 2: ***0xF0*** (1 word input data for position value, consistent /
1 word output data for preset adjustment, consistent)

DDLM_Chk_Cfg

Byte	***1***			
Bit	7	6	5 – 4	3 – 0
Data	1	1	11	0
	F			***0***
	Consistency	Word format	Input data	Length code

Bit coded operating parameters

DDLM_Set_Prm

Byte	9
Bit	7 – 0
Data	$2^7 – 2^0$

x = default setting

Bit	Definition	= 0		= 1		Page
0	Code sequence	increasing position values to the rod end	X	decreasing position values to the rod end		34
1	Class 2 Functionality	no		yes	X	34
2	unused	-		-		
3	Scaling function	switched off	X	switched on		34

Associated operating parameters for scaling

Description see page 34, 35

DDLM_Set_Prm

unsigned32

Byte	10	11	12	13
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^8$	$2^7 – 2^0$
Default (dec.)	0			
	Steps per revolution, unused			

DDLM_Set_Prm

unsigned32

Byte	14	15	16	17
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^8$	$2^7 – 2^0$
	hi		lo	
	0x00	0x01	0x86	0xA0
Default (dec.)	100 000			
	Total measuring range, hi/lo			

7.5 PNO CLASS 2 32 bits

Data exchange

DDLM_Data_Exchange

Input double word IDx

Byte	***1***	***2***	***3***	***4***
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 – Position data			

Format for preset adjustment value (description of the function see page 33)

Output double word ODx

Byte	***1***		***2***	***3***	***4***
Bit	31	30 – 24	23 – 16	15 – 8	7 – 0
Data	0 / 1	$2^{30} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	Preset execution	Preset adjustment value			

Configuration data

see note on page 20

Device Class 2: ***0xF1*** (1 double word input data for position value, consistent / 1 double word output data for preset adjustment, consistent)

DDLM_Chk_Cfg

Byte	***1***			
Bit	7	6	5 – 4	3 – 0
Data	1	1	11	1
	F			***1***
	Consistency	Word format	Input data	Length code

see note on page 20

Bit coded operating parameters

DDLM_Set_Prm

Byte	9
Bit	7 – 0
Data	$2^7 – 2^0$

x = default setting

Bit	Definition	= 0		= 1		Page
0	Code sequence	increasing position values to the rod end	X	decreasing position values to the rod end		34
1	Class 2 Functionality	no		yes	X	34
2	unused	-		-		
3	Scaling function	switched off	X	switched on		34

Associated operating parameters for scaling

Description see page 34, 35

DDLM_Set_Prm

unsigned32

Byte	10	11	12	13
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^8$	$2^7 – 2^0$
Default (dec.)	0			
	Steps per revolution, unused			

DDLM_Set_Prm

unsigned32

Byte	14	15	16	17
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^8$	$2^7 – 2^0$
	hi		lo	
	0x00	0x01	0x86	0xA0
Default (dec.)	100 000			
	Total measuring range, hi/lo			

7.6 TR-extended 32 Bit

Data exchange

DDLM_Data_Exchange

Input double word IDx

Byte	***1***	***2***	***3***	***4***
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 – Position data			

Format for preset adjustment value (description of the function see page 33)

Output double word ODx

Byte	***1***		***2***	***3***	***4***
Bit	31	30 – 24	23 – 16	15 – 8	7 – 0
Data	0 / 1	$2^{30} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	Preset execution	Preset adjustment value			

Configuration data

see note on page 20

TR-extended: ***0xF1*** (1 double word input data for position value, consistent / 1 double word output data for preset adjustment, consistent)

DDLM_Chk_Cfg

Byte	***1***			
Bit	7	6	5 – 4	3 – 0
Data	1	1	11	1
	F			***1***
	Consistency	Word format	Input data	Length code

Overview of operating parameters

see note on page 20

Parameter	Data type	Byte	Format	Description
Code sequence	bit	9	page 29	page 34
Class 2 functionality	bit	9	page 29	page 34
Scaling function	bit	9	page 29	page 34
Total measuring range, hi/lo	unsigned32	14 – 17	page 30	page 35
Preset 1 value, hi/lo	unsigned32	18 – 21	page 30	page 35

Bit coded operating parameters

DDLM_Set_Prm

Byte	9
Bit	7 – 0
Data	2^7 – 2^0

x = default setting

Bit	Definition	= 0		= 1		Page
0	Code sequence	increasing position values to the rod end	X	decreasing position values to the rod end		34
1	Class 2 functionality	no		yes	X	34
2	unused	-		-		
3	Scaling function	switched off	X	switched on		34

Associated operating parameters for scaling

Description see page 34, 35

DDLM_Set_Prm

unsigned32

Byte	***10***	***11***	***12***	***13***
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
Default (dec.)	0			
	Steps per revolution, unused			

DDLM_Set_Prm

unsigned32

Byte	***14***	***15***	***16***	***17***
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	hi		lo	
	0x00	0x01	0x86	0xA0
Default (dec.)	100 000			
	Total measuring range, hi/lo			

Operating parameter Preset 1 value, hi/lo

Description see page 35

DDLM_Set_Prm

unsigned32

Byte	***18***	***19***	***20***	***21***
Bit	31 – 24	23 – 16	15 – 8	7 – 0
Data	$2^{31} – 2^{24}$	$2^{23} – 2^{16}$	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	hi		lo	
	0x00	0x00	0x00	0x01
Default (dec.)	1			
	Preset 1 value, hi/lo			

7.7 Additional magnet 16 Bit

This module can be used only in connection with the nominal configurations

- CLASS 1 - 16-Bit or
- CLASS 2 - 16-Bit

Only one nominal configuration may be projected, these takes over the processing of the position data for the 1st magnet. For each further magnet in each case an "Additional magnet 16 Bit" - module must be projected.

Data exchange

DDLM_Data_Exchange
Input word IWx

Byte	***1***	***2***
Bit	15 – 8	7 – 0
Data	$2^{15} – 2^{8}$	$2^{7} – 2^{0}$
	Data_Exchange – Position data Additional magnet 1 - 11	

Configuration data

see note on page 20

Additional magnet 16 Bit: ***0xD0*** (1 word input data for position value, consistent)

DDLM_Chk_Cfg

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

7.8 Additional magnet 32 Bit

This module can be used only in connection with the nominal configurations

- CLASS 1 - 32-Bit,
- CLASS 2 - 32-Bit or
- TR-extended 32 Bit

Only one nominal configuration may be projected, these takes over the processing of the position data for the 1st magnet. For each further magnet in each case an "Additional magnet 32 Bit" - module must be projected.

Data exchange

DDLM_Data_Exchange
Input double word IDx

Byte	***1***	***2***	***3***	***4***
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 – Position data Additional magnet 1 - 11			

Configuration data

see note on page 20

Additional magnet 32 Bit: ***0xD1*** (1 double word input data for position value, consistent)

DDLM_Chk_Cfg

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

7.9 Preset adjustment function

⚠ WARNING

NOTICE

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

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

Availability							
PNO CLASS1 16 + 32		PNO CLASS2 16 + 32	X	TR-extended	X		
not supported!		page 24 + 26		page 28			

In order that the preset adjustment function can be used in PNO CLASS 2 configurations, the operating parameter "Class 2 functionality" must be switched on!

The measuring system can be adjusted to an arbitrary position value in the range 0 to measurement length in steps via the PROFIBUS.
This is achieved by setting the highest value output data bit
(2^{31} for PNO CLASS 2-32 bit configuration and TR-extended, or 2^{15} for the PNO CLASS 2-16 bit configuration).
The positions of the additional magnets are also shifted.

The preset adjustment value sent in the data bytes with the rising flank of the bit ***"preset execution"*** is adopted as the position value. The adjustment refers to the position of the first magnet.

There is no acknowledgement of the process via the inputs in CLASS 2 mode.

lower limit	0
upper limit CLASS 2 16 Bit	programmed total measuring length in increments, within ≤ 32 768
upper limit CLASS 2 32 Bit / TR-extended	programmed total measuring length in increments, within ≤ 16 777 216

7.10 Description of the operating parameters

The adjusted parameters are valid for the selected nominal configuration and all additional magnets.

7.10.1 Code sequence

Availability							
PNO CLASS1 16 + 32	X	PNO CLASS2 16 + 32	X	TR-extended	X		
page 22 + 23		page 24 + 26		page 28			

The code sequence defines whether increasing or decreasing position values are output from the measuring system if the magnet is slided towards the end of the rod.

7.10.2 Class 2 Functionality

Availability							
PNO CLASS1 16 + 32		PNO CLASS2 16 + 32	X	TR-extended	X		
not supported!		page 24 + 26		page 28			

Defines the functional scope of the measuring system. Class 2 switched off means only Class 1 functions are active in the measuring system; it does not scale the position value and is not adjustable. The diagnosis data are limited to 16 byte.

7.10.3 Scaling function

Availability							
PNO CLASS1 16 + 32		PNO CLASS2 16 + 32	X	TR-extended	X		
not supported!		page 24 + 26		page 28			

Defines whether the position is scaled according to the parameter "Total measuring range".

If Class 2 is switched off, the position value cannot be scaled or adjusted.

If the scaling parameters are activated with the ***Scaling function***, the physical resolution of the measuring system can be changed. The position value output is binary decoded and is calculated with a zero point correction and the code sequence set.

7.10.4 Total measuring range, hi/lo

Defines the ***Total number of steps*** of the measuring system related to the measuring length and corresponds to the resolution.

lower limit	1 step
upper limit PNO CLASS 2 16 Bit	65 536 steps
upper limit PNO CLASS 2 32 Bit / TR-extended	16 777 216 steps (24 bit)
default	**100 000**

Standard value:
The given measuring length on the rating plate multiplied with 100 corresponding to the resolution of 0.01 mm or multiplied with 200 corresponding to the resolution of 0.005 mm

$$\text{Measuring length in steps} = \frac{\text{Measuring length}}{\text{Resolution in mm}}$$

7.10.5 Preset 1 value, hi/lo

⚠ WARNING

NOTICE

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

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

Availability							
PNO CLASS1 16 + 32		PNO CLASS2 16 + 32		TR-extended	X		
not supported!		not supported!		page 28			

Defines the position value to which the 1st magnet of the measuring system is adjusted with the leading edge of the external preset input. To suppress interference, however, the preset is only carried out if the preset signal is present without interruption during the entire response time of 30 ms. A re-execution of the preset is not possible until the input signal has been reset again and a filter time of 30 ms has been waited.

lower limit	0
upper limit CLASS 2 16 Bit	programmed total measuring length in increments, within ≤ 65 536
upper limit CLASS 2 32 Bit / TR-extended	programmed total measuring length in increments, within ≤ 16 777 216
default	**1**

7.10.6 Input of parameters with data format 32 bits

The Profibus standard provides the data format "UNSIGNED32" for the definition of 32 bits of parameter data in the device master file. This data format isn't supported by all configuration programs for profibus master. These programs clip the more significant word of the parameter. In order to allow inputs despite this, these parameters are split up into single words.
Illogically enough, the input in the input masks also has to be made in decimal form.

This affects the following parameters:

- Total measuring range [units]
- Preset 1 value

In the meantime, we recommend the following procedure for entering measuring lengths in increments larger than 16 bits:

1. Convert the desired measuring length in increments to a hexadecimal figure using a calculator and store this figure.
2. Convert only the four less significant tetrads (figures) back to decimal format separately. This gives you the input 'Total measuring range [units] lo'
3. Convert only the remaining more significant tetrads (figures) back to decimal format separately. This gives you the input 'Total measuring range [units] hi'

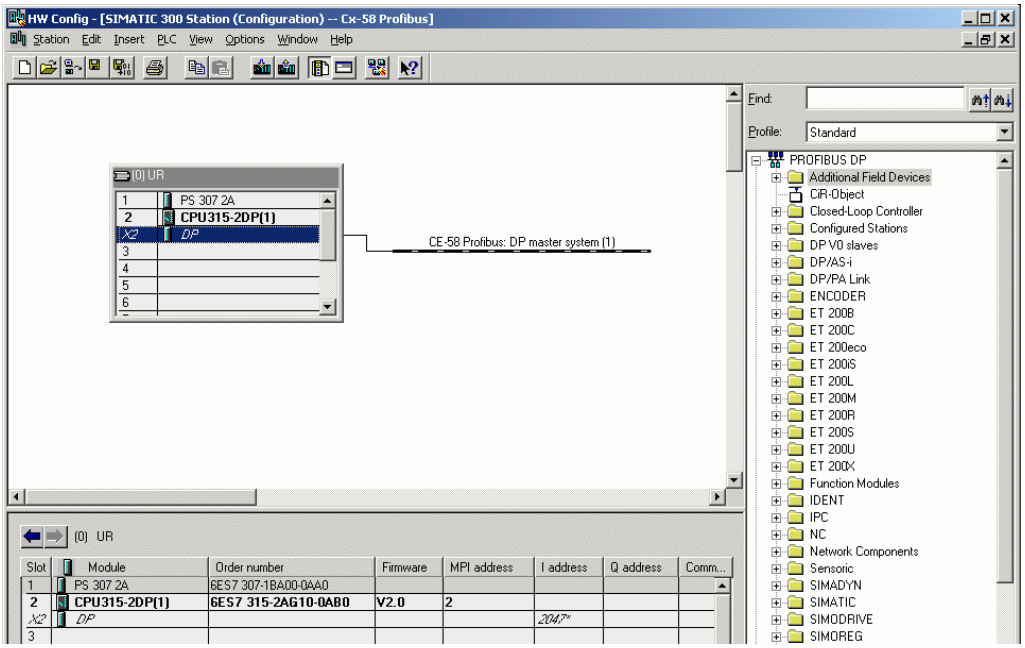
Example:

Total measuring length in increments:	10 500 000 (D)	
converted to hexadecimals:	A0 37A0 (H)	
results in four less significant tetrads:	37A0 (H)	
and remaining more significant tetrads:	A0 (H)	
Total measuring range [units] lo:	14240 (D)	(=37A0 (H) !)
Total measuring range [units] hi:	160 (D)	(=A0 (H) !)

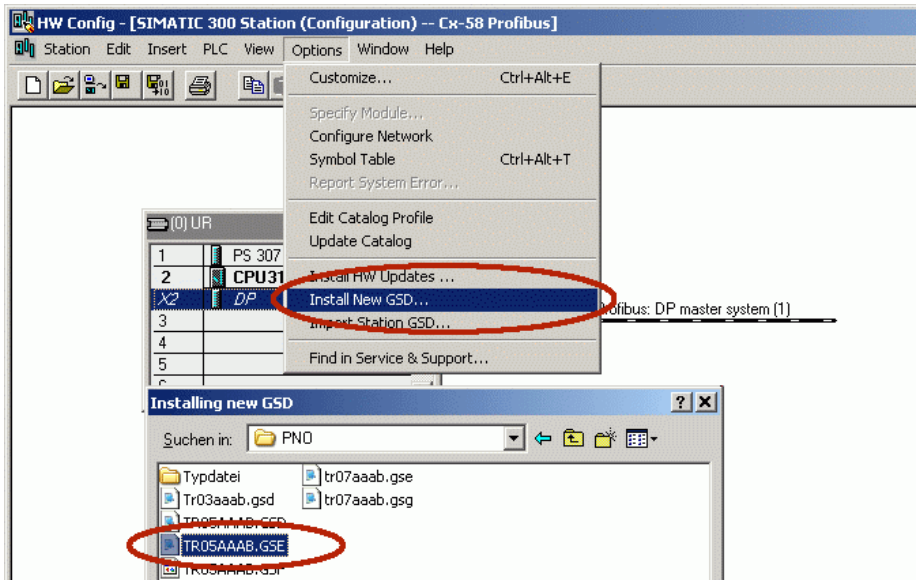
7.11 Configuration example, SIMATIC® Manager V5.3

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.

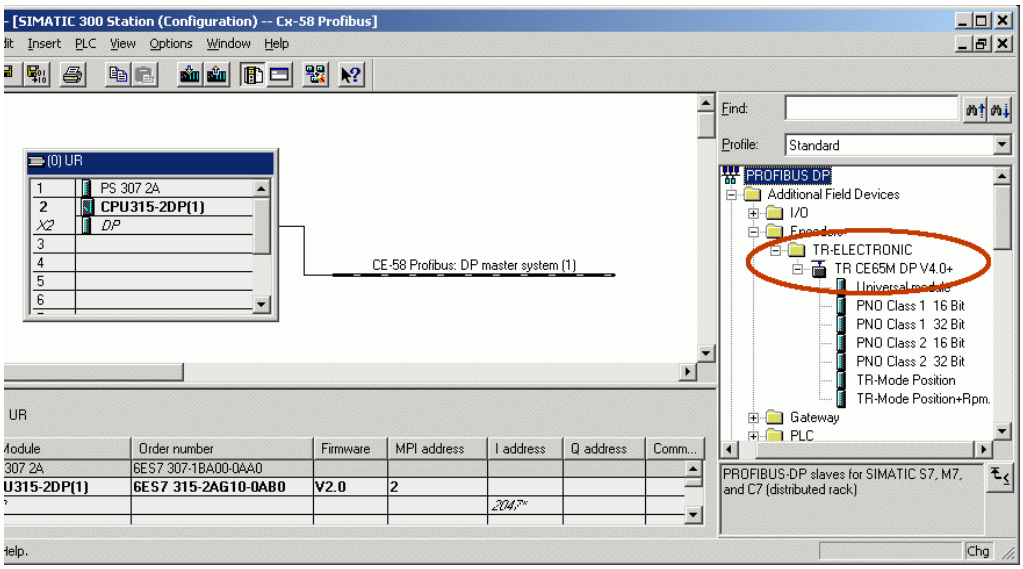
File names and entries in the following masks are to be regarded only as examples of the procedure.



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



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



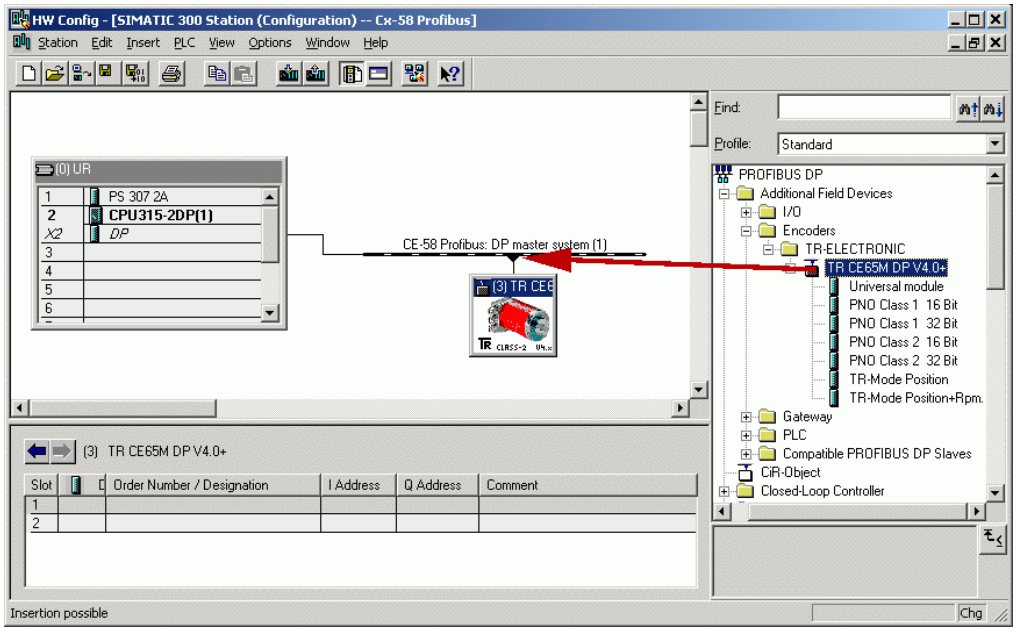
The entry for the GSD file TRM2AAAC.GSD is:***"TR LA/LP X12 Multisensor"***

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

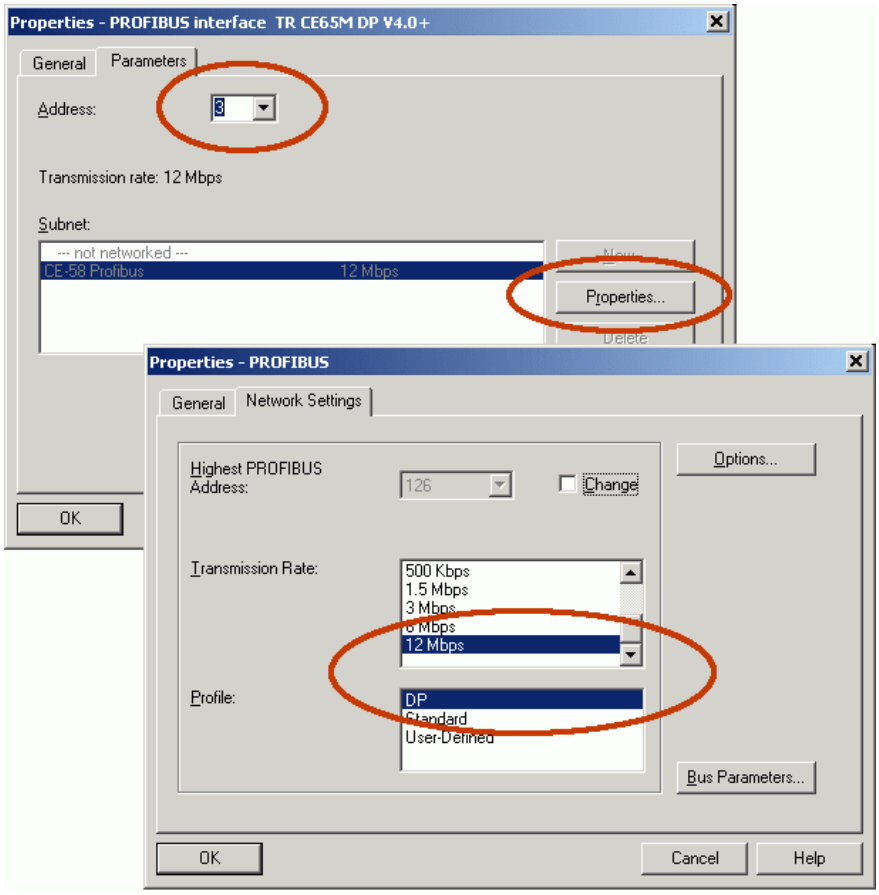
- PNO Class 1 16 bit, see page 22
- PNO Class 1 32 bit, see page 23
- PNO Class 2 16 bit, see page 24
- PNO Class 2 32 bit, see page 26
- TR-extended 32 bit, see page 28
- Additional magnet 16 bit, see page 31
- Additional magnet 32 bit, see page 32

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

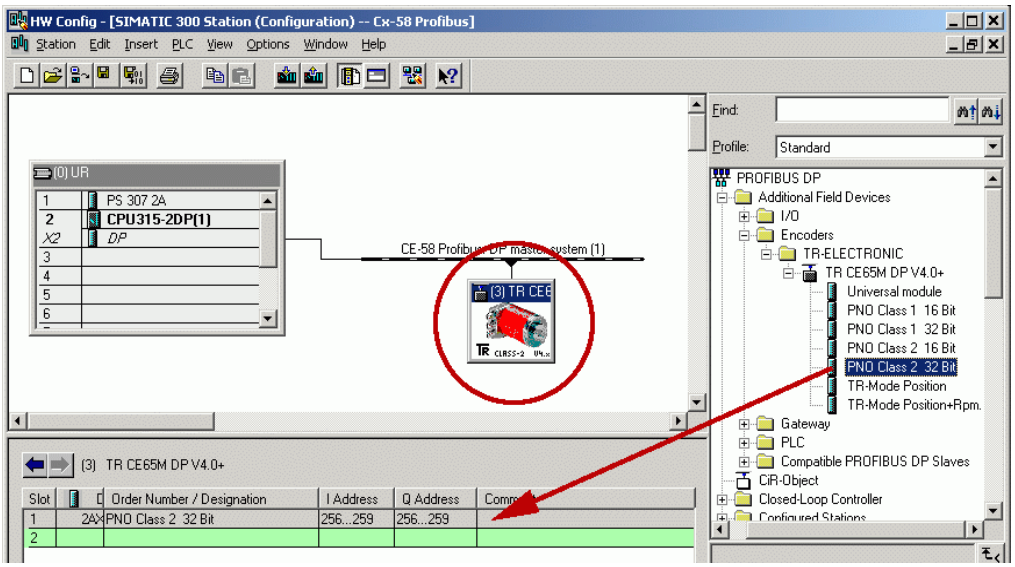
Connect measuring system to the master system (drag&drop):



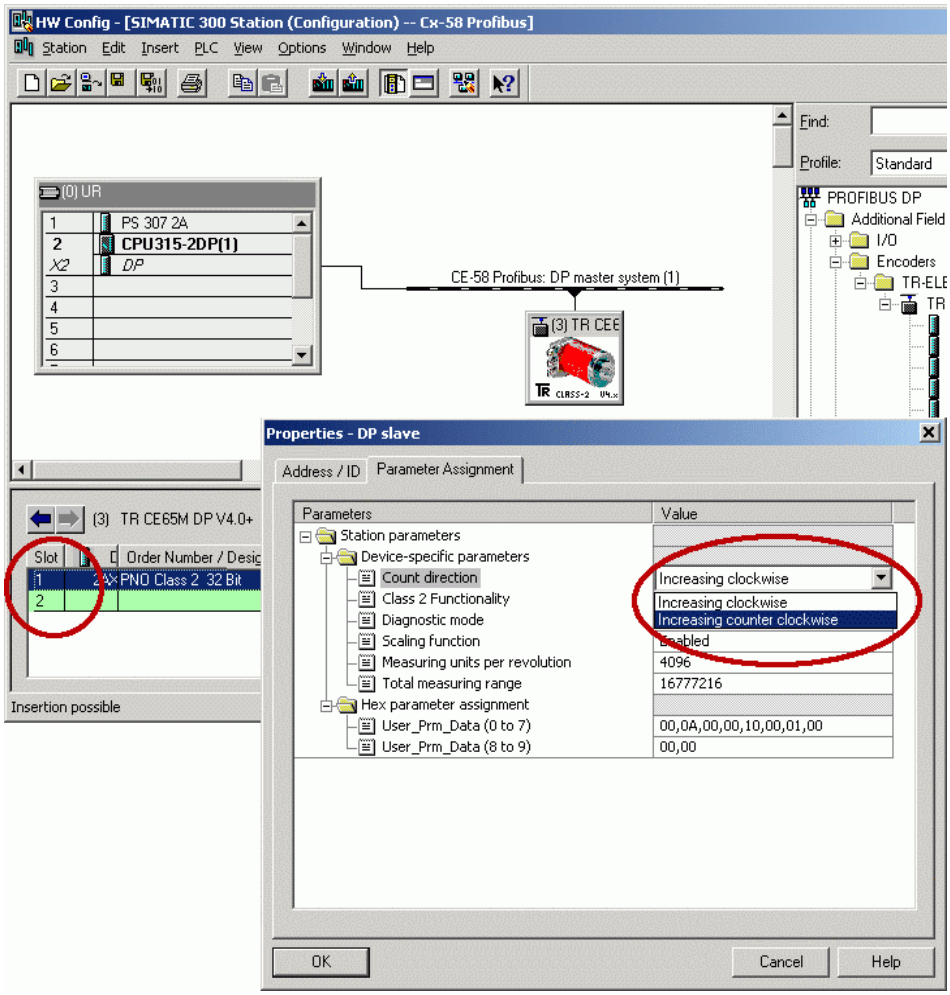
Once the measuring system is connected to the master system, the network settings can be undertaken --> *Object Properties...* --> *PROFIBUS...* button):



Transfer the required configuration from the catalogue to the slot (drag&drop). The measuring system symbol must be active.



Perform parameterization with a double click on the slot number:



8 Troubleshooting and diagnosis options

8.1 Optical displays, LEDs

Statuses of the green LED (Bus Run)

Green LED	*Cause*	*Remedy*
Off	Voltage supply absent	Check voltage supply wiring
	Station address incorrectly set	Set station address (valid values 3-99 !)
	Bus hood not correctly connected and screwed on	Check bus hood for correct fitting
	Bus hood defective	Replace bus hood
	Hardware fault, measuring system defective	Replace measuring system
10 Hz	– Parameter or configuration error. The measuring system is running at the bus.	Check parameterization and configuration, see chap. 7 from page 20
On	Measuring system ready for operation	

Statuses of the red LED (Bus Fail)

Red LED	*Cause*	*Remedy*
Off	No error, bus in cycle	
1 Hz	Measuring system has not been addressed by the master, no Data Exchange	Check station address set. Check projection and operating status of the PROFIBUS master. Check connection to the master.
On	Measuring system in Data Exchange, but no magnet was detected.	Slide magnet into measuring range.

8.2 Use of the PROFIBUS diagnosis

In a PROFIBUS system, the PROFIBUS masters provides the so-called host system, e.g. a PLC-CPU, with process data. If there is no slave on the bus or it is no longer accessible, or the slave reports a fault itself, the master must notify the host system of the fault in one form or another. There are several possibilities here, whose evaluation is solely decided by the application in the host system.
Generally a host system is not stopped by the failure of just one component on the bus, but must react to the failure in an appropriate way in accordance with the safety regulations. Normally the master firstly provides the host system with a summary diagnosis, which the host system reads cyclically from the master, and through which the user is informed of the state of the individual clients on the bus. If a client is reported defective in the summary diagnosis, the host can request further data from the master (slave diagnosis), which then allows a detailed evaluation of the reasons for the fault. The reports obtained in this way can be generated from the master if the affected slave fails to respond to the master's polling or they may come directly from the slave if it reports a fault itself. The generation or reading of a diagnosis report between the master and slave takes place automatically and does not need to be programmed by the user.
Besides the standard diagnosis information, depending on the nominal configuration, the measuring system can also provide an extended diagnosis report according to CLASS 1 or CLASS 2 of the profile for encoders from the PROFIBUS User Organization.

8.2.1 Standard diagnosis

The DP standard diagnosis is structured as follows. The perspective is always as viewed from the master to the slave.

	Byte no.	***Significance***	
Standard diagnosis	byte 1	station status 1	
	byte 2	station status 2	
	byte 3	station status 3	general part
	byte 4	master address	
	byte 5	manufacturer's identifier HI byte	
	byte 6	manufacturer's identifier LO byte	
Extended diagnosis	byte 7	length (in bytes) of the extended diagnosis including this byte	
	byte 8 to byte 241 (max)	further device-specific diagnosis	device-specific extensions

8.2.1.1 Station status 1

Standard diagnosis byte 1	bit 7	Master_Lock	Slave has been parameterized from another master (bit is set by the master)
	bit 6	Parameter_Fault	The parameter telegram last sent has been rejected by the slave
	bit 5	Invalid_Slave_Response	Is 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 an extended diagnosis report from the slave is waiting
	bit 2	Slave_Cfg_Chk_Fault	The configuration identifier(s) sent from the master has (have) been 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 projected, but is not available on the bus

8.2.1.2 Station status 2

Standard diagnosis byte 2	bit 7	Deactivated	Slave was removed from the poll list from the master
	bit 6	Reserved	
	bit 5	Sync_Mode	Is set by the slave after receipt of the SYNC command
	bit 4	Freeze_Mode	Is set by the slave after receipt of the FREEZE command
	bit 3	WD_On	The response monitoring of the slave 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 reconfigured.

8.2.1.3 Station status 3

Standard diagnosis byte 3	bit 7	Ext_Diag_Overflow	Overrun for extended diagnosis
	bit 6-0	Reserved	

8.2.1.4 Master address

Standard diagnosis byte 4

The slave enters the station address of the master into this byte, after the master has sent a valid parameterization telegram. To ensure correct function on the PROFIBUS it is imperative that, in the case of simultaneous access of several masters, their configuration and parameterization information exactly matches.

8.2.1.5 Manufacturer's identifier

Standard diagnosis byte 5 + 6

The slave enters the manufacture's ID number into the bytes. This is unique for each device type and is reserved and stored by the PNO. The ID number of the encoder is AAAC(h).

8.2.1.6 Length (in bytes) of the extended diagnosis

Standard diagnosis byte 7

If further diagnosis informations are available, the slave enters the number of bytes at this location, which follow in addition to the standard diagnosis.

8.2.2 Extended diagnosis

The measuring system also provides a DP standard extended diagnosis report in accordance with the PNO profile for encoders. This report is of varying size dependent on the nominal configuration selected. In the "TR-extended" configuration, the diagnosis report corresponds to PNO Class 2.
The following pages present an overview of the diagnosis information to be obtained. The individual measuring system options actually supported can be read from the respective device.

	Byte no.	***Significance***	***Class***
Extended diagnosis	byte 7	Length (in byte) of the extended diagnosis	1/2/TR
	byte 8	Alarms	1/2/TR
	byte 9	Operating status	1/2/TR
	byte 10	Encoder type	1/2/TR
	byte 11-14	Encoder resolution in steps per revolution (rotational) Encoder resolution in measurement steps (linear)	1/2/TR
	byte 15-16	Number of resolvable revolutions	1/2/TR
	byte 17	Additional alarms	2/TR
	byte 18-19	Alarms supported	2/TR
	byte 20-21	Warnings	2/TR
	byte 22-23	Warnings supported	2/TR
	byte 24-25	Profile version	2/TR
	byte 26-27	Software version (firmware)	2/TR
	byte 28-31	Operating hours counter	2/TR
	byte 32-35	Offset value	2/TR
	byte 36-39	Manufacturer's offset value	2/TR
	byte 40-43	Number of steps per revolution	2/TR
	byte 44-47	Total measuring range in steps	2/TR
	byte 48-57	Serial number	2/TR
	byte 58-59	reserved	Optional
	byte 60-63	Manufacturer's diagnoses	Optional

8.2.2.1 Alarms

	Bit	***Significance***	***= 0***	***= 1***
Extended diagnosis, byte 8	bit 0	Position error	No	Yes
	bit 1	Voltage supply faulty	No	Yes
	bit 2	Current load too large	No	Yes
	bit 3	Diagnosis	OK	error
	bit 4	Memory error	No	Yes
	bit 5	not used		
	bit 6	not used		
	bit 7	not used		

8.2.2.2 Operating status

Extended diagnosis, byte 9

Bit	*Significance*	*= 0*	*= 1*
bit 0	Count direction	increasing --> rod end	decreasing --> rod end
bit 1	Class 2 Functions	no, not supported	yes
bit 2	Diagnosis	no, not supported	yes
bit 3	Scaling function status	no, not supported	yes
bit 4	not used		
bit 5	not used		
bit 6	not used		
bit 7	Used configuration	PNO configuration	TR configuration

8.2.2.3 Encoder type

Extended diagnosis, byte 10

Code	*Significance*
07	Linear absolute encoder

for further codes see encoder profile

8.2.2.4 Measuring step

Extended diagnosis, bytes 11-14

The diagnostic bytes indicate the measuring step which is output by the measuring system. The measuring step is given in nm (0.001µm) as an unsigned 32 value. Example: a measuring step of 1 µm gives a value of 0x000003E8.

8.2.2.5 Number of resolvable revolutions

Extended diagnosis, bytes 15-16

Not relevant for linear measuring systems, fixed to 0x0001.

8.2.2.6 Additional alarms

Byte 17 is reserved for additional alarms, however no further alarms are implemented.

Extended diagnosis, byte 17

Bit	*Significance*	*= 0*	*= 1*
bit 0-7	reserved		

8.2.2.7 Alarms supported

Extended diagnosis, bytes 18-19

Bit	*Significance*	*= 0*	*= 1*
bit 0	* Position error	not supported	supported
bit 1	Supply voltage monitoring	not supported	supported
bit 2	Monitoring current load	not supported	supported
bit 3	Diagnosis routine	not supported	supported
bit 4	Memory error	not supported	supported
bit 5-15	Not used		

* is supported

8.2.2.8 Warnings

Extended diagnosis, bytes 20-21

Bit	*Significance*	*= 0*	*= 1*
bit 0	Frequency exceeded	no	yes
bit 1	Perm. temperature exceeded	no	yes
bit 2	Light control reserve	not achieved	achieved
bit 3	CPU watchdog status	OK	reset performed
bit 4	Operating time warning	no	yes
bit 5-15	Battery charge	OK	too low

8.2.2.9 Warnings supported

Extended diagnosis, bytes 22-23

Bit	*Significance*	*= 0*	*= 1*
bit 0	Frequency exceeded	not supported	supported
bit 1	Perm. temperature exceeded	not supported	supported
bit 2	Light control reserve	not supported	supported
bit 3	CPU watchdog status	not supported	supported
bit 4	Operating time warning	not supported	supported
bit 5-15	reserved		

8.2.2.10 Profile version

The diagnosis bytes 24-25 show the version (1.1) of the profile for PNO encoders supported by the encoder. Decoding is performed on the basis of the revision number and revision index: 1.10 corresponds to 0000 0001 0001 0000 or 0110h

Extended diagnosis, bytes 24-25

byte 24	Revision number
byte 25	Revision index

8.2.2.11 Software version

The diagnosis bytes 26-27 show the internal software version of the encoder. Decoding is performed on the basis of the revision number and revision index (e.g. 1.40 corresponds to 0000 0001 0100 0000 or 0140 (hex))

Extended diagnosis, bytes 26-27

byte 26	Revision number
byte 27	Revision index

8.2.2.12 Operating hours counter

Extended diagnosis, bytes 28-31

The diagnosis bytes represent an operating hours counter, which is incremented by one digit every 6 minutes. The measurement unit is therefore 0.1 hours.
If the function is not supported, the operating hours counter is set to the maximum value FFFFFFFF (hex).
The encoders count the operating hours. In order to keep the bus load low, a diagnosis telegram with the latest counter reading is sent, but only after each parameterization or if a error has to be reported, however not if everything is working correctly and only the counter has changed. The state of the last parameterization is therefore always shown in the online diagnosis.

8.2.2.13 Offset value

Extended diagnosis, bytes 32-35

The diagnosis bytes show the offset value to the absolute position of the scan, which is calculated when carrying out the preset function.

8.2.2.14 Manufacturer's offset value

Extended diagnosis, bytes 36-39

The diagnosis bytes show an additional offset value to the absolute position of the scan, which is calculated when carrying out the preset function.

8.2.2.15 Number of steps per revolution

Extended diagnosis, bytes 40-43

Indicates the projected measurement length in encoder steps.

8.2.2.16 Total measuring range

Extended diagnosis, bytes 44-47

The diagnosis bytes show the projected measurement length in encoder steps.

8.2.2.17 Serial number

Extended diagnosis, bytes 48-57

The diagnosis bytes show the serial number of the encoder. If this function is not supported, asterisks ********** (hex code 0x2A) are displayed.

8.2.2.18 Manufacturer's diagnoses

The measuring system does not support further manufacturer's diagnoses.

Important information

*According to the PNO encoder profile, an encoder must set the bits **'Ext.diag'** (extended diagnostic information available) and **'Stat.diag'** (static error) in the event of an internal error being detected in the station status. This means that, in case of error, the encoder stops providing position data and is removed from the process image by the PROFIBUS master until the error bits are reset. If no magnet is detected the magnet must be slided into the measuring range. It is not possible for the user to acknowledge the error via the PROFIBUS.*

*At present only the alarm **"position data error"** is supported in the profile.*
Warnings, specified in the profile, aren't available and will be set to the default values prescribed by the profile. These functions can be supported on request, however.

8.3 Other faults

Fault	***Cause***	***Remedy***
Position skips of the measuring system	Strong vibrations	Vibrations, impacts and shocks, e.g. on presses, are dampened with "shock modules". If the error recurs despite these measures, the measuring system must be replaced.
	Electrical faults EMC	Perhaps isolated flanges made of plastic help against electrical faults, as well as cables with twisted pair wires for data and supply. Shielding and wire routing must be performed according to the PROFIBUS construction guidelines.
The PROFIBUS runs if the measuring system is not connected, but leads to faults if the bus hood is plugged onto the measuring system.	PROFIBUS Data A and Data B switched	Check all connections and lines associated with the wiring of the measuring system.