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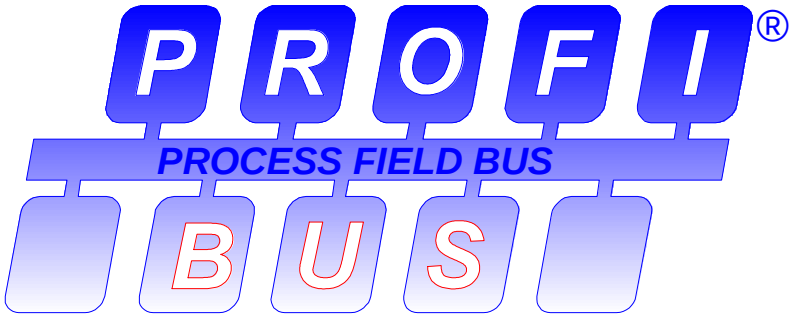

PROFIBUS

PROFIBUS - Profile for Encoders

PROFIBUS PROFILE, Order No. 3.062

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PROFIBUS Profile for Encoders

Published by:
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Haid-und-Neu-Str. 7
D-76131 Karlsruhe

Phone: ++ 721 / 96 58 590
Fax: ++ 721 / 96 58 589
http://www.profibus.com

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1. Introduction

This profile describes the functionality of Encoders connected to PROFIBUS-DP. The operating functions are divided in two device classes:
Class 1, the Mandatory class with a basic range of functions that all PROFIBUS-DP Encoders must support. The class 1 Encoder can optionally support selected class 2 functions, these functions must however be implemented according to this specification. The PDU size for the mandatory functions is limited to 16 bytes to support early DP implementations.
Class 2, where the Encoder must support all class 1 functions and all functions defined in class 2.
In addition to the two classes there are reserved parameter and diagnostic areas for manufacturer specific functions. This functionality is not covered by this specification.
The output position value from the Encoder is presented in binary format.

2. Definitions

2.1 References

European Fieldbus Standard EN 50170, Volume 2, PROFIBUS
Series DIN 19 245 Part 1 - 4, PROFIBUS

2.2 Abbreviations

DP	PROFIBUS-DP
DDLM	Direct Data Link Mapper, the interface between the PROFIBUS-DP functions and the Encoder software.
PDU	Protocol Data Unit
PNO	PROFIBUS Nutzerorganisation e.V.
PI	PROFIBUS International

2.3 Encoder Classification

Two device classes are defined in this profile, one Mandatory class (class 1) and one class with Optional functions (class 2).

2.3.1 Device class 1

This class is Mandatory for PROFIBUS-DP Encoders, **all functions defined in this class must be supported by the Encoder**. Class 2 functions can optionally be supported by the class 1 Encoder, these functions must however be implemented according to this specification. Interoperability is in this case only guaranteed for the class 1 functions, not for the optional class 2 functions.

2.3.2 Device class 2

In this class all optional Encoder functions are defined. The class 2 Encoder must support **all class 1 and all class 2 functions**.

3. Data Exchange function

3.1 Position value

The Encoder input data are only used for the position value with a mandatory length of 32 bits, optionally the Encoder supports a position value length of 16 bits. The value is right aligned in the data field.

3.2 Preset function

The preset function supports adaptation of the Encoder zero point to the mechanical zero point of the system. The preset function sets the actual position of the Encoder to the preset value. The preset value is written to the Encoder as output data in the Data_Exchange function. The preset function is used after the scaling function which means that the preset value is given in the current measuring units.
The MSB of the preset value controls the preset function in the following way:
Normal operating mode: MSB = 0 (bit 31, optionally bit 15)
The Encoder will make no change in preset value.
Preset mode: **MSB = 1 (bit 31**, optionally bit 15)
With the MSB = 1 the Encoder accepts the transferred value (bit 0 - 30) as a preset value in binary code. The Encoder reads the current position value and calculates an offset value from the preset value and the read position value. The position value is shifted with the calculated offset value. When the output position value equals the preset value the preset mode is ended and the MSB can be set to zero by the master. The offset value can be read with the diagnostic function and is securely stored in case of voltage breakdown and reloaded at each start-up.
NOTE! The preset function should only be used at Encoder standstill.

DDLM_Data_Exchange

Mandatory configuration:

Octet	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 - 32 bits			

Configuration data:
- Device class 1: D1hex (2 words of input data, consistency)
- Device class 2: F1hex (2 words of input data, 2 words of output data for preset value, consistency)

Preset value format:

Octet	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 control	**Preset Value - max 31 bits**			

Optional configuration:

Octet	1	2
Bit	**15 - 8**	**7 - 0**
Data	2^{15} - 2^{8}	2^{7} - 2^{0}
	Data_Exchange - 16 bits	

Configuration data:
- Device class 1: D0hex (1 word of input data, consistency)
- Device class 2: F0hex (1 word of input data, 1 word of output data for preset value, consistency)

4. Operating parameters

Table 1: Parameter overview

Parameter	Data type	Parameter octet number	Device class
Code sequence	bit	9	1
Commissioning diagnostic control	bit	9	optional
Class 2 functionality enable	bit	9	2
Scaling function control	bit	9	2
Measuring units per revolution	unsigned 32	10 - 13	2
Total measuring range in measuring units	unsigned 32	14 - 17	2
Reserved for future use		18 • • 25	2
Manufacturer specific functions		26...	optional

4.1 Class 1 parameters

All class 1 parameters except the commissioning diagnostics must be supported by the class 1 Encoder.

4.1.1 Code sequence

The code sequence defines whether increasing position values are output when the Encoder shaft rotates clockwise or counterclockwise (viewed from the shaft side). The code sequence is set with the code sequence bit in the operating parameters.
The default setting of the code sequence is clockwise rotation (0).

4.1.2 Commissioning diagnostics (optional)

With the commissioning diagnostic function it is possible to check the Encoder components responsible for position detection at Encoder standstill (such as illumination, photovoltaic cells and triggers). In conjunction with the position alarms, this enables an extensive check of the correctness of the position values. The commissioning diagnostics is initiated by the commissioning bit in the operating parameters. If errors are detected it will be announced by the commissioning diagnostic alarm bit in the diagnostic function (see Alarms). The commissioning diagnostic function is optional. To find out if the Encoder supports commissioning diagnostics the ”Operating status” should be read with the diagnostic function and the commissioning diagnostic bit checked.

4.1.3 Class 2 functionality enable/disable

This bit enables/disables the device class 2 functionality. The default setting is disabled (0) which means that a DP-Master must set this bit to be able to use the class 2 functions. To find out if the Encoder supports the full class 2 functionality the ”Operating status” should be read with the diagnostic function and the class 2 functionality bit checked. When the class 2 functionality is disabled the Encoder performs exactly like a class 1 Encoder.
NOTE! If a class 1 Encoder uses optional class 2 functions the class 2 functionality bit must be set by the master to enable these functions.

4.2 Class 2 parameters

The class 2 parameters use the DDLM_Set_Prm function up to octet 17. Octet 18 to 25 are reserved for future class 2 parameters.

4.2.1 Scaling function

With the scaling function the Encoder internal numerical value is converted in software to change the physical resolution of the Encoder.
The parameters ”Measuring units per revolution” and ”Total measuring range in measuring units” are the scaling parameters set by the parameter function when the scaling function control bit is set. When the scaling function control bit is set to zero the scaling function is disabled.
The data type for both parameters is unsigned 32 with a value range from 1 to 2^{32} limited by the Encoder resolution. For a 25 bit Encoder with a singleturn resolution of 13 bits the permissible value for the ”Measuring units per revolution” is between 1 and 2^{13} (8192) and for the ”Total measuring range in measuring units” the permissible value is between 1 and 2^{25} (33 554 432).
The default setting is: Measuring units per revolution = Singleturn resolution.
Total measuring range in measuring units = Singleturn resolutions*Number of distinguishable revolutions.

DDLM_Set_Prm

Octet	**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}**
	Measuring units per revolution			

DDLM_Set_Prm

Octet	**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}**
	Total measuring range in measuring units			

4.3 Operating parameter definitions

This section defines each bit for the DP-Encoder operating parameters previously described.

DDLM_Set_Prm

Octet	**9**
Bit	**7 - 0**
Data	**2^7 - 2^0**
	Operating Parameters

Bit	**Definition**	**= 0**	**= 1**
0	Code Sequence	Increasing position values with clockwise rotation (viewed from shaft side)	Increasing position values with counter clockwise rotation (viewed from shaft side)
1	Class 2 functionality	Disable	Enable
2	Commissioning diagnostics (optional)	No	Yes, Perform commissioning
3	Scaling function control	Disable scaling function	Enable scaling function and set scaling parameters to the values sent in this message
4	*Reserved for future use*		
5			
6	*Reserved for the Encoder manufacturer*		
7			

5. Diagnostic information

The diagnostic information contains the diagnostics specified in the DP specification (octet 1 to 6) and device related Encoder diagnostic information specified below.

Table 2: Extended diagnostic overview

Diagnostic function	**Data type**	**Diagnostic octet number**	**Device class**
Extended diagnostic header	Octet string	7	1
Alarms	Octet string	8	1
Operating status	Octet string	9	1
Encoder type	Octet string	10	1
Singleturn resolution (rotary), Measuring step (linear)	Unsigned 32	11 - 14	1
Number of distinguishable revolutions	Unsigned 16	15,16	1
Additional alarms	Octet string	17	2
Supported alarms	Octet string	18,19	2
Warnings	Octet string	20,21	2
Supported warnings	Octet string	22,23	2
Profile version	Octet string	24,25	2
Software version	Octet string	26,27	2
Operating time	Unsigned 32	28 - 31	2
Offset value	Signed 32	32 - 35	2
Manufacturer offset value	Signed 32	36 - 39	2
Measuring units per revolution	Unsigned 32	40 - 43	2
Total measuring range in measuring units	Unsigned 32	44 - 47	2
Serial number	ASCII string	48 - 57	2
Reserved for future use		58, 59	2
Manufacturer specific diagnostics		60 - 63	Optional

5.1 Class 1 diagnostics

The length of the class 1 diagnostic information is limited to 16 bytes, being compatible with early DP implementations.

5.1.1 Diagnostic header

The header byte specifies the length of the Encoder diagnostics including the header byte. The format of the length value is hexadecimal. For the DP-Encoder class 1 the length of the Encoder specific diagnostics is 10 bytes (0A hex). NOTE! Octets 7.... are for user diagnostics, the lower octets are specified in the DP standard and is not mentioned in this specification.

DDLM_Slave_Diag

Octet	**7**		
Bit	**7**	**6**	**5 - 0**
Data	**0**	**0**	**xxh**
	Fixed to 00 to indicate device related diagnostics		**Length incl. header**
	Extended diagnostic header		

5.1.2 Alarms

An alarm is set if a malfunction in the Encoder could lead to incorrect position values. Octet 8 in the diagnostic function (DDLM_Slave_Diag) shows the status of the alarms. Additional alarms for device class 2 is added in diagnostic octet 17.
If an alarm occurs, then the Ext_Diag bit and the Stat_Diag bit in the Diagnostic function is set to logical high until the alarm is cleared and the Encoder is able to provide an accurate position value. Alarms are cleared when the functionality is within the specification and the position value is correct.
Not every Encoder supports every alarm. For class 2 Encoders, refer to the diagnostic information ”supported alarms” (see section 5.2.2) for information on the support of individual bits.

DDLM_Slave_Diag

Octet	**8**
Bit	**7 - 0**
	ALARMS

Bit	**Definition**	**= 0**	**= 1**
0	Position error	No	Yes
1	Supply Voltage error	No	Yes
2	Current too high	No	Yes
3	Commissioning diagnostics	OK	Error
4	Memory error	No	Yes
5	*Currently not assigned*		
6			
7			

5.1.3 Operating status

Octet 9 in the diagnostic function gives information on Encoder internal parameters.
The class 2 Encoder sets the class 2 functionality bit to indicate to the DP-Master that device class 2 is fully supported. The DP-Master must set the class 2 functionality bit in the parameter message (DDLM_Set_Prm) to enable the class 2 functionality.
The scaling function status bit is set when the scaling function is enabled and the Encoder resolution controlled by the scaling parameters.

DDLM_Slave_Diag

Octet	**9**
Bit	**7 - 0**
	Operating Status

Bit	**Definition**	**= 0**	**= 1**
0	Code Sequence status	Increasing position values with clockwise rotation (viewed from shaft side)	Increasing position values with counter clockwise rotation (viewed from shaft side)
1	Class 2 functionality	No, not supported	Yes
2	Commissioning diagnostics	No, not supported	Yes
3	Scaling function status	Disabled	Enabled
4	*Currently not assigned*		
5			
6			
7			

5.1.4 Encoder type

The Encoder type can be read in Octet 10 of the diagnostic function. The Encoder type is given with a hex code from 0 to FF.

DDLM_Slave_Diag

Octet	**10**
Code	**0 - FF**
	Encoder Type

Code	**Definition**
00	Singleturn absolute rotary Encoder
01	Multiturn absolute rotary Encoder
02	Singleturn absolute rotary Encoder with electronic turncount
03	Incremental rotary Encoder
04	Incremental rotary Encoder with battery buffer
05	Incremental linear Encoder
06	Incremental linear Encoder with battery buffer
07	Absolute linear Encoder
08	Absolute linear Encoder with cyclical coding
09	*Currently not assigned*
•	
•	
•	
FF	

5.1.5 Singleturn resolution or Measuring step

The singleturn resolution in the diagnostic function has different contents depending on the Encoder type.

5.1.5.1 Rotary or angle Encoders

For rotary or angle Encoders the diagnostic octet 11 to 14 gives the number of measuring steps per revolution that are output for the absolute singleturn position value. The maximum singleturn resolution is 2^{32}.

DDLM_Slave_Diag

Octet	**11**	**12**	**13**	**14**
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}**
	Singleturn resolution			

5.1.5.2 Linear Encoders

For linear Encoders the diagnostic octet 11 to 14 indicates the measuring step that is output by the Encoder. 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 000003E8h.

DDLM_Slave_Diag

Octet	**11**	**12**	**13**	**14**
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}**
	Measuring step			

5.1.6 Number of distinguishable revolutions

The number of distinguishable revolutions that the Encoder can output is given in octet 15 and 16 of the diagnostic function. For a Multiturn Encoder the number of distinguishable revolutions and the Singleturn resolution gives the measuring range according to the formula below. The maximum number of distinguishable revolutions is 65536 (16 bits).
Measuring range=Number of distinguishable revolutions * Singleturn resolution

DDLM_Slave_Diag

Octet	**15**	**16**
Bit	**15 - 8**	**7 - 0**
	Number of distinguishable revolutions	

5.2 Class 2 diagnostics

For the DP-Encoder class 2 the length of the Encoder specific diagnostics including the extended diagnostic header is 51 bytes (33 hex).
The DDLM_Slave_Diag memory area up to octet 99 is reserved for future class 2 diagnostics.

5.2.1 Additional alarms

Diagnostic octet 17 gives additional alarms for device class 2.

DDLM_Slave_Diag

Octet	**17**
Bit	**7 - 0**
	Additional alarms

Bit	**Definition**	**= 0**	**= 1**
0	*Currently not assigned*		
•			
•			
•			
7			

5.2.2 Supported alarms

Information on supported alarms can be read in the diagnostic octets 18 and 19.

DDLM_Slave_Diag

Octet	**18**	**19**
Bit	**15 - 8**	**7 - 0**
	Supported alarms	

Bit	**Definition**	**= 0**	**= 1**
0	Position error	Not supported	Supported
1	Supply Voltage error	Not supported	Supported
2	Current too high	Not supported	Supported
3	Commissioning diagnostics	Not supported	Supported
4	Memory error	Not supported	Supported
5	*Currently not assigned*		
•			
•			
•			
15			

5.2.3 Warnings

Warnings indicate that tolerances for certain internal parameters of the Encoder have been exceeded. In contrast to alarms warnings do not imply incorrect position values.
Octet 20 and 21 of the diagnostic function shows the status of the warnings. If a warning occurs, then the Ext_Diag bit in the Diagnostic function is set to logical high until the warning is cleared.
All warnings are cleared after the diagnostic message is read from the Encoder, but if the tolerances still are exceeded the warning will again be set. For the operating time limit warning (bit 4) the warning is only set again after a power-ON sequence.
Not every Encoder supports every warning. Refer to the diagnostic information "supported warnings" (see section 5.2.4) for information on the support of individual bits.

DDLM_Slave_Diag

Octet	**20**	**21**
Bit	**15 - 8**	**7 - 0**
	WARNINGS	

Bit	**Definition**	**= 0**	**= 1**
0	Frequency exceeded	No	Yes
1	Temperature exceeded	No	Yes
2	Light control reserve	Not reached	Reached
3	CPU Watchdog status	OK	Reset generated
4	Operating time limit warning	No	Yes
5	Battery charge	OK	Too low
6	Reference point	Reached	Not reached
7	*Currently not assigned*		
•			
•			
•			
15			

5.2.4 Supported warnings

Information on supported warnings can be read in the diagnostic octets 22, 23.

DDLM_Slave_Diag

Octet	**22**	**23**
Bit	**15 - 8**	**7 - 0**
	Supported warnings	

Bit	**Definition**	**= 0**	**= 1**
0	Frequency warning	Not supported	Supported
1	Temperature warning	Not supported	Supported
2	Light control reserve warning	Not supported	Supported
3	CPU Watchdog status	Not supported	Supported
4	Operating time limit warning	Not supported	Supported
5	Battery charge warning	Not supported	Supported
6	Reference point warning	Not supported	Supported
7	*Currently not assigned*		
•			
•			
•			
15			

5.2.5 Profile version

Octet 24 and 25 of the diagnostic function gives the DP Encoder profile version implemented in the Encoder. The octets is combined to a revision number and an index.
Example:
Profile version: 1.40

Octet nr:	24	25
Binary Code:	00000001	01000000
Hex:	1	40

DDLM_Slave_Diag

Octet	**24**	**25**
Bit	**15 - 8**	**7 - 0**
Data	**2^7 - 2^0**	**2^7 - 2^0**
	Revision number	**Index**
	Profile version	

5.2.6 Encoder software version

Octet 26 and 27 of the DDLM_Slave_Diag function gives the Encoder software version. The octets is combined to a revision number and an index.
Example:
Software version: 1.40

Octet nr:	26	27
Binary Code:	00000001	01000000
Hex:	1	40

DDLM_Slave_Diag

Octet	**26**	**27**
Bit	**15 - 8**	**7 - 0**
Data	**2^7 - 2^0**	**2^7 - 2^0**
	Revision number	**Index**
	Software version	

5.2.7 Operating time

The operating time monitor stores the operating time for the Encoder in operating hours. The operating time is stored every 6 minutes in the Encoder non volatile memory as long as the Encoder is power supplied. The operating time value is presented in 0.1 hours as an unsigned 32 binary value of the function DDLM_Slave_Diag.
If the operating time function is not used the operating time value is set to the maximum value (FFFFFFFF hex) by the Encoder manufacturer.
A maximum operating time limit can be set by the Encoder manufacturer, when this limit is exceeded an operating time limit warning bit is set.

DDLM_Slave_Diag

Octet	**28**	**29**	**30**	**31**
Bit	**31 - 24**	**23 - 16**	**15 - 8**	**7 - 0**
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^{8}$	$2^{7} - 2^{0}$
	Operating Time			

5.2.8 Offset value

The offset value is calculated in the preset function and shifts the position value with the calculated value. The offset value is stored and can be read from the Encoder in the diagnostic octet 32 to 35. The data type for the offset value is signed binary 32 with an offset value range equal to the measuring range of the Encoder. The preset function is used after the scaling function which means that the offset value is given according to the current measuring resolution.
NOTE! If an offset value is used it must be added to the offset value of the Encoder manufacturer to get the offset value from the physical zero point of the Encoder disk.

DDLM_Slave_Diag

Octet	**32**	**33**	**34**	**35**
Bit	**31 - 24**	**23 - 16**	**15 - 8**	**7 - 0**
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^{8}$	$2^{7} - 2^{0}$
	Offset Value			

5.2.9 Offset value of the Encoder manufacturer

The Manufacturer offset value indicates the Encoder offset set by the Encoder manufacturer . This value gives information on the shift of the zero point in number of positions from the physical zero point of the Encoder disk. The data type for the offset value is signed binary 32 with an offset value range equal to the measuring range of the Encoder. The Manufacturer offset value is given in number of steps according to the basic resolution of the Encoder and is located in write protected memory area only changeable by the Encoder manufacturer.

DDLM_Slave_Diag

Octet	**36**	**37**	**38**	**39**
Bit	**31 - 24**	**23 - 16**	**15 - 8**	**7 - 0**
Data	$2^{31} - 2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^{8}$	$2^{7} - 2^{0}$
	Manufacturer Offset Value			

5.2.10 Scaling parameter settings

The Scaling parameters are set in the DDLM_Set_Prm function, the parameters are stored and can be read from the Encoder in octet 40 to 47 of the diagnostic function. The parameters ”Measuring units per revolution” and ”Total measuring range in measuring units” sets the desired Encoder resolution.
The Scaling function status bit in the Operating status indicates if the Scaling function is enabled or disabled.

Default values of the Encoder manufacturer:

Measuring units per revolution = Singleturn resolution

Total measuring range in measuring units = Singleturn resolution * Number of distinguishable revolutions

The data type for both values is unsigned 32.

DDLM_Slave_Diag

Octet	**40**	**41**	**42**	**43**
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}
	Measuring units per revolution			

DDLM_Slave_Diag

Octet	**44**	**45**	**46**	**47**
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}
	Total measuring range in measuring units			

5.2.11 Encoder serial number

Octet 48 to 57 in the diagnostic function gives the Encoder serial number as an ASCII string of ten characters. If the serial number is not used the ASCII string will contain only stars (**********), hexcode 2A.

DDLM_Slave_Diag

Octets	**48 - 57**
Bit	**79 - 0**
Data	**ASCII**
	Serial number

6. Configuration function

The configuration function allows the DP-Master to send the configuration data to the DP-Encoder for checking. The main purpose is to define the number of bytes used for the Data_Exchange function.

Encoder Mandatory configuration data:
- Device class 1: D1hex (2 words of input data, consistency)
- Device class 2: F1hex (2 words of input data, 2 words of output data for preset value, consistency)

Encoder Optional configuration data:
- Device class 1: D0hex (1 word of input data, consistency)
- Device class 2: F0hex (1 word of input data, 1 word of output data for preset value, consistency)

Configuration example:

DDLM_Chk_Cfg

Octet	**1**			
Bit	**7**	**6**	**5, 4**	**3 - 0**
Data	**1**	**1**	**01**	**1**
	Consistency	**Word format**	**Input data**	**Length code**
	Mandatory configuration - Device class 1			

7. Physical layer

According to EN50 170 Vol. 2.

7.1 Connectors

Two connectors are available for the DP Encoder:
- 9 pin D-sub connector with pin assignment as defined in EN 50 170 Vol. 2.
- Interconnectron 12 Pin female with pin assignment as in table below. The arrangement is numbered clockwise (seen from connection side).

Table 3: Pin assignment for Interconnectron 12 pin.

Pin No.	Signal	Meaning
1	DGND	Data Ground (M5V)
2	RXD/TXD-N	Receive/Transmit-Data-Negative (A)
3	Reserved	
4	RXD/TXD-P	Receive/Transmit-Data-Positive (B)
5	Reserved	
6	VP	+5V output (P5V)
7	+EV	Supply Voltage + (P24)
8	0V	Supply Voltage - (M24)
9	Reserved	
10	Reserved	
11	Reserved	
12	RTS *)	Transmit request

External shield is on housing of coupling or flange socket.

*) Signal is optional

7.2 Built-in-T-Coupling

Following clamps have to be assigned for an integrated T-coupling in the Encoder.

Supply Voltage +	(P24)
Supply Voltage -	(M24)
Receive/Transmit-Data-Negative	(A)
Receive/Transmit-Data-Positive	(B)
Receive/Transmit-Data-Negative	(A)
Receive/Transmit-Data-Positive	(B)

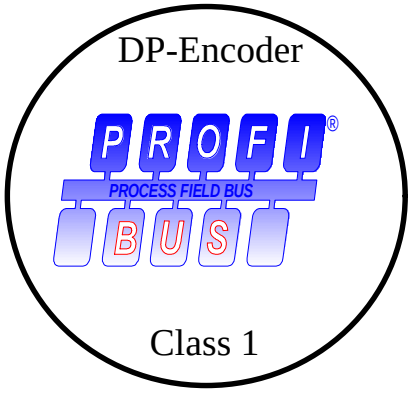
Additionally, a two-line-switch must be integrated to enable the termination of the bus line.

8. Encoder identification

This part of the specification defines the identification of the DP Encoder.

8.1 Confirmation to the profile

A label must be placed on the DP Encoder stating conformity to the profile and the supported device class. The label must include the PNO logotype.
Below is an example of a label for a class 1 Encoder.



8.2 GSD file extensions

The following GSD file extensions are used for the DP Encoder.

Name	Value
DP_Encoder_class:	1 / 2
DP_Encoder_profile_version:	x.x
DP_Encoder_manufacturer_specific_functions:	True / False

Appendix A, Encoder function overview

The Encoder profile comprises functions for powerful diagnostics and for parameterization of the position value. Table A.1 and A.2 gives an overview of the Class 1 and Class 2 Encoder specific data, implemented as application specific data in the communication functions.

Table A.1: Encoder specific data class 1, Mandatory for all DP Encoders

Function	**Octet nr**	**Data type**	**Name**
Data_Exchange	1 - 4	Unsigned 32 *)	Position value (input)
Data_Exchange	1 - 4	Unsigned 32 *)	Preset value (output)
RD_Inp	1 - 4	Unsigned 32 *)	Position value
Slave_Diag	7	Octet string	External diagnostic header
Slave_Diag	8	Octet string	Alarms
Slave_Diag	9	Octet string	Operating status
Slave_Diag	10	Octet string	Encoder type
Slave_Diag	11 - 14	Unsigned 32	Singleturn resolution or Measuring step
Slave_Diag	15,16	Unsigned 16	Number of distinguishable revolutions
Set_Prm	9	Octet string	Operating parameters

*) Optionally unsigned 16

Table A.2: Encoder specific data class 2, Optional functionality

Function	**Octet nr**	**Data type**	**Name**
Slave_Diag	17	Octet string	Additional alarms
Slave_Diag	18,19	Octet string	Supported alarms
Slave_Diag	20,21	Octet string	Warnings
Slave_Diag	22,23	Octet string	Supported warnings
Slave_Diag	24,25	Octet string	Profile version
Slave_Diag	26,27	Octet string	Software version
Slave_Diag	28 - 31	Unsigned 32	Operating Time
Slave_Diag	32 - 35	Signed 32	Offset Value
Slave_Diag	36 - 39	Signed 32	Manufacturer Offset Value
Slave_Diag	40 - 43	Unsigned 32	Measuring units per revolution
Slave_Diag	44 - 47	Unsigned 32	Total measuring range in measuring units
Slave_Diag	48 - 57	ASCII string	Serial number
Set_Prm	10 - 13	Unsigned 32	Measuring units per revolution
Set_Prm	14 - 17	Unsigned 32	Total measuring range in measuring units

PROFIBUS Nutzerorganisation e.V.
Haid-und-Neu-Str. 7
D-76131 Karlsruhe

Phone: ++ 721 / 96 58 590
Fax: ++ 721 / 96 58 589
PROFIBUS_International@compuserve.com
http://www.profibus.com