Configuration manual
for Profibus-module

PROFIBUS-DP interface

**Read the configuration manual prior to assembly,
starting installation and handling!
Keep for future reference**

Manufacturer / publisher
Johannes Hubner
Fabrik elektrischer Maschinen GmbH
Siemensstraße 7
35394 Giessen

Germany
Phone: +49 641 7969 0
Fax: +49 641 73645
E-Mail: info@huebner-giessen.com
                                    www.huebner-giessen.com

Trademarks
PROFIBUS™, **PROFINET™** and **PROFIsafe™**, as well as the relevant logos, are registered trademarks of PROFIBUS Nutzerorganisation e.V. (PNO), **SIMATIC** is a registered trademark of SIEMENS AG. Brand names and product names are trademarks or registered trademarks of their respective owner. Protected trademarks bearing a ™ or ® symbol are not always depicted as such in the manual. However, the statutory rights of the respective owners remain unaffected.

Change reservation

The manual has been drawn up with the utmost care and attention. Nevertheless, we cannot exclude the possibility of errors in form and content.

All rights, subject to errors and changes due to technical improvements reserved.

Font styles

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

`Courier-New` font displays text, which is visible on the screen and software/software menu selections.

Content

1 General Information

These configuration-manual contain the following topics:
- Basic safety instructions with declaration of the intended use
- Characteristics
- Parameterization
- Error causes and remedies

This configuration-manual is supplementary to other documentation, such as operating and assembly instructions, product data sheets, dimension drawings, connection diagrams, brochures etc.

1.1 Applicability

This configuration manual apply exclusively for the following measuring system series with *PROFIBUS-DP* interface.

The products are labelled with affixed nameplates and are components of a system.
The following documentation therefore also applies:
- operator's operating instructions specific to the system
- the "Operating and Assembly Instructions UOC40 respectively USC42".
- this configuration-manual.

2 Basic safety instructions

2.1 Explanation of symbols and notes

Warnings are indicated by symbols in these configuration manual. The warnings are introduced by signal words that express the scope of the hazard.
The warnings must be strictly heeded; you must act prudently to prevent accidents, personal injury, and property damage.

DANGER!
Means that death or serious injury will occur if the required precautions are not met.

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!
Indicates a possibly dangerous situation that can result in material damage if it is not avoided.

NOTES!
Indicates important information or features and application tips for the product used.

NOTES!
Means that appropriate ESD-protective measures are to be considered according to EN 61340-5-1 supplementary sheet 1.

NOTES!
Do not use a hammer or similar tool when installing the device due to the risk of damage occurring to the bearings or coupling!

2.2 Warranty and liability

In principle the "General Terms and Conditions" of Johannes Hubner - Fabrik elektrischer Maschinen GmbH apply. These are available to the operator with the Order Confirmation or when the contract is concluded at the latest. Warranty and liability claims in the case of personal injury or damage to property are excluded if they result from one or more of the following causes:

● Non-observance of these operating and assembly instructions
● Non-intended use of the measuring system
● Improper assembly, installation, start-up and programming of the measuring system
● Work carried out incorrectly on the measuring system
● Operation of the measuring system with technical defects
● Mechanical or electrical modifications to the measuring systems undertaken autonomously
● Repairs carried out autonomously
● Third party interference and Acts of God
● Deployment of non-qualified personnel
● Opening of the measuring system or conversions on it

2.3 Organizational measures

● The operating and assembly instructions must always be kept ready-to-hand at the place of use of the measuring system.
● In addition to the operating and assembly instructions, generally valid legal and other binding regulations on accident prevention and environmental protection must be observed and communicated.
● The respective applicable national, local and system-specific provisions and requirements must be observed and communicated.
● The operator is obliged to inform personnel on special operating features and requirements.
● Prior to commencing work, personnel working with the measuring system must have read and understood the chapter 2 "Basic safety instructions".
● The nameplate and any prohibition or instruction symbols applied on the measuring system must always be maintained in a legible state.
● Do not undertake any mechanical or electrical modifications to the measuring system, except for those expressly described in this operating and assembly instructions.
● Repairs may only be undertaken by the manufacturer or a center or person authorized by the manufacturer.

2.4 Personnel selection and qualification; basic obligations

● All work on the measuring system must only be carried out by qualified personnel.
Qualified personnel includes persons, who, through their training, experience and instruction, as well as their knowledge of the relevant standards, provisions, accident prevention regulations and operating conditions, have been authorized by the persons responsible for the system to carry out the required work and are able to recognize and avoid potential hazards. They are capable of identifying and avoiding potential hazards.
● The definition of "qualified personnel" also includes an understanding of the standards VDE 0105-100 and IEC 364 (source: e.g. Beuth Verlag GmbH, VDE-Verlag GmbH).
● The responsibility for assembly, installation, commissioning and operation must be clearly defined. The obligation exists to provide supervision for trainee personnel.

3 Installation and commissioning

3.1 User manual

The module can be used as a multiturn or singleturn absolute encoder. It can be configured to the profiles CLASS 1 (Huebner 1.0), with parameterization of the count direction, or CLASS 2 (Huebner 2.0), with the additional setting of the resolution in units/turn and the total measuring range.

The profiles Huebner 2.1 and Huebner 2.2 are also available. These enable the following additional functions:

-         Expanded scaling function
-         Setting of code sequence (count direction), preset and automatic scaling (teach-in) during online operation in commissioning mode.
-         Limit switch function
-         Velocity/speed output

These functions shift a portion of the computing effort from the Profibus® master to the absolute encoder, thus reducing the load on the system as a whole. However, if these extra functions are not needed, then it makes sense to keep the parameterization simple, by using a CLASS 1 or CLASS 2 profile.

3.2 Profibus for the absolute encoder

The module behaves like a multiturn encoder that has been designed to operate with Profibus®. It can be configured and parameterized to the following profiles, as a multiturn or singleturn encoder:

Absolute encoder profile	Parameterization options
HUEBNER 1.0 Single / Multiturn (CLASS 1)	Count direction (code sequence)
HUEBNER 2.0 Single / Multiturn (CLASS 2)	Count direction (code sequence) Switch HUEBNER 2.0 functions on/off Switch scaling functions on/off Resolution in units/revolution Total measuring range

HUEBNER 2.1 Single / Multiturn	As for HUEBNER 2.0, additionally with:
	 Required no. of measuring units,
	 Required resolution in units per
	       - revolution
	       - max. total measuring range
	       - physical pulses
	 Switch commissioning mode on/off
	 Use preset value in online operation
	 Change count direction (code sequence) in online operation
	 Determine gearing factor (scaling)
	 Switch lower limit switch on/off
	 Lower limit switch (position)
	 Switch upper limit switch on/off
	 Upper limit switch (position)

HUEBNER 2:2 Single / Multiturn	As for HUEBNER 2.1, with additional velocity/speed output

Note:
The encoder can be operated in HUEBNER 1.0, HUEBNER 2.0, HUEBNER 2.1 or HUEBNER 2.2, regardless of whether a CLASS 1 or CLASS 2 master has been selected.

3.3 Joining the encoder to the Profibus

After the encoder has been installed and the electrical connections have been made, it is joined to the Profibus system. The following is an example, using the COM PROFIBUS V 5.0 installation software with an IM308C Profibus-DP master.

First of all, the manufacturer-specific bitmap files (*.bmp, *.dib) are copied to the bitmaps directory, and the GSD file is copied to the GSD directory of the COM PROFIBUS software. Next, start the COM PROFIBUS installation software. In the FILE menu, create a new configuration file in the menu item NEW, or use the menu item OPEN to call up an existing configuration file. The GSD file is now read in, using the menu item READ GSD FILES.
In the selection list, under DP Master, select the type IM308C, and under DP Slave / Encoder, select the HUEBNER encoder AMP1212, and place them in the bus graphic in the right window with a double click.
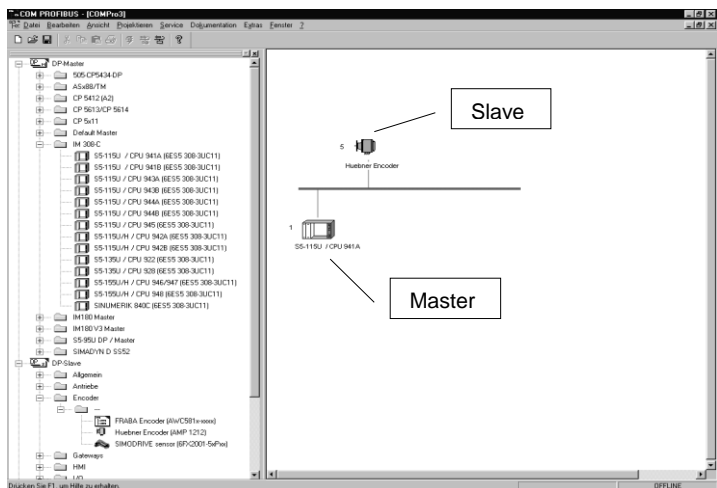
By selecting the menu item CONFIGURE / DP SLAVE CONFIGURE, or by clicking with the mouse pointer on the encoder icon, you can access the *Slave properties* window. The bus address of the encoder must be entered here, to match the setting of the address selector switches in the terminal box of the encoder.
Then continue with the *Configure* menu.

3.4 Configuring the encoder
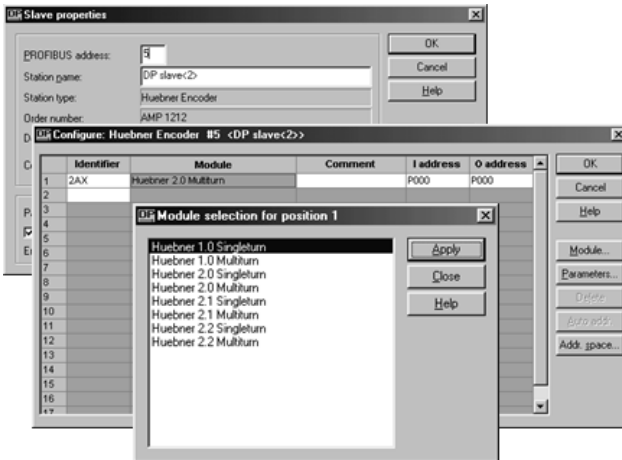
Now select the profile for the encoder operation. The input and output address are then assigned, and the parameterization can be carried out. This function can be called up by the PARAMETERS button in the CONFIGURE window, and provides a clear and simple way of setting the parameters.

Parameterization through other windows has to be performed in hexadecimal format, an operation which demands precise knowledge of the significance of the individual bits and bytes.

3.5 Parameterizing the encoder
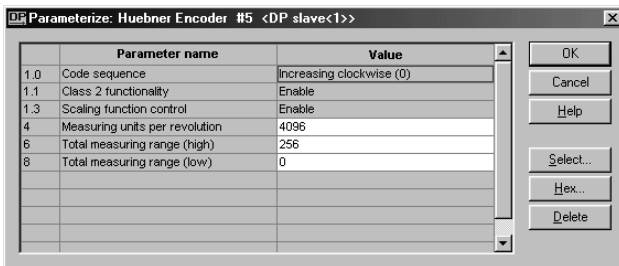
In this example, the PARAMETERIZE window shows the options for setting the parameters for an absolute encoder that has been configured for HUEBNER 2.0.

Note:

If Class 2 functionality is switched off, then the encoder operates in the HUEBNER 1.0 mode. The only option available is to change the count direction (code sequence). The resolution in units per revolution can have any value from 1 to 4096, and this determines the size of the unit. The total measuring range defines the measurement path length as the number of revolutions with the given resolution (units per revolution) until the zero position is reached again.

NOTE!
Total measuring range = units per revolution x number of revolutions
The number of revolutions must have a value 2^n, where n can be from 0 to 12

If this is not taken into account, the encoder will detect a parameter error. This is indicated on the cover of the terminal box. The red LED lights continuously, while the green one blinks.

NOTE!
To activate the parameterization of Measuring units per revolution, Class 2 functionality and the scaling function must be switched on. The preset value then has to be reset in the normal operating mode, since it is referred to the scaled value.

3.6 Parameterization in hex code

octet 9
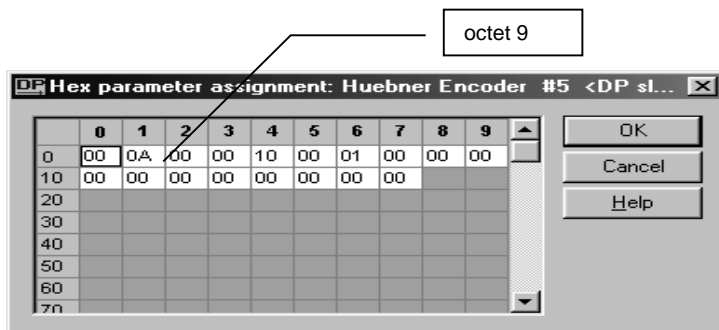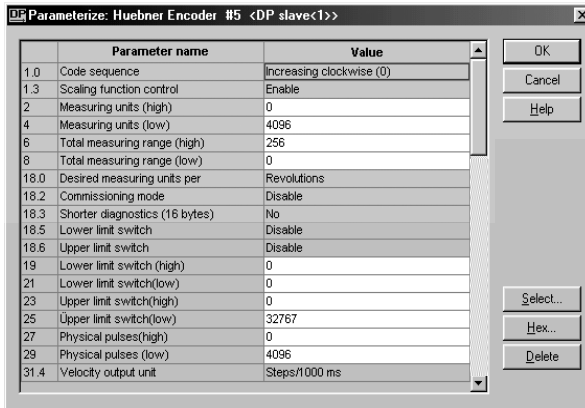
It is also possible to carry out the parameterization in the *Hex parameter assignment* window. However, this is an awkward operation, requiring precise knowledge of the functions of the individual bits and bytes.

3.7 Operating the encoder in the Huebner 2.1 and Huebner 2.2 profiles

Compared with the standard profiles, these two profiles offer several additional functions which can be parameterized through COM Profibus®, as is explained below.

The SCALING FUNCTION must be activated as a precondition for using these additional functions.

3.8 Desired measuring units per …

Compared with the HUEBNER 2.0 (CLASS 2) profile, three different scaling options are available.

Required resolution: units per:
- revolution
- max. total measuring range
- physical pulse

3.8.1 Desired measuring units per revolution

Here you can define the number of units that the encoder produces per revolution. In addition, the total possible path length for measurement, and thus the number of revolutions, is defined in the fields for the total measuring range.

Example:

The required value is 8 units per revolution. The total measuring range should cover 8 revolutions, or repeat after 8 revolutions. This requires

8 x 8 = 64

units. So 8 units must be entered for DESIRED MEASURING UNITS, and 64 units for TOTAL MEASURING RANGE.

> **!**
>
> **CAUTION!**
> The number of revolutions must have a value of 2^n.
> If this is not observed ambiguous position values will occur, since the transition from the maximum encoder position to the 0 position value will happen at various encoder positions.

3.8.2 Desired measuring units per maximum total measuring range

For this type of scaling, the maximum possible measuring range of the encoder is divided into a definite number of units. This number is then entered in the fields for DESIRED MEASURING UNITS per.

Example:

The entire measuring range of the encoder is to be divided into 16384 units.

16384 / 4096 = 4 units per revolution

The number of units that are required must be smaller than the number for the total measuring range.

This type of scaling is also used in commissioning mode, for automatic scaling (teach-in).

3.8.3 Desired measuring units per physical pulse

This setting is always referred to the division of the code disk into 4096 pulse intervals. The number that is entered in the entry fields for MEASURING UNITS is the number of parts into which the value entered for PHYSICAL PULSES is to be divided.

Example:

Physical measurement pulses = 2048, required number of measuring units = 64

$$2048 / 64 = 32$$

So the required measurement unit has a length of 32 physical intervals.

> **!**
>
> **CAUTION!**
> This value must divide into the total measuring range 2^n times. If this is not observed, ambiguous position values will occur, since the transition from the maximum encoder position to the zero position (0) will happen at various encoder positions.

3.9 Commissioning mode

If this mode is activated, then the following functions are available in online operation:

> changing the count direction (code sequence)
>
> setting the preset value
>
> automatic scaling (teach-in)

These values are set from the Profibus master, by manipulating the status bit in the DDLM_DATA_EXCHANGE mode. A detailed description is included in a later section.

3.10 Limit switches

Two software limit switches are available, which can be activated through the fields UPPER LIMIT SWITCH and LOWER LIMIT SWITCH. The required positions for the limit switches are referred to the total measuring range that has been selected. They must not lie outside this range, and are entered in the fields UPPER LIMIT SWITCH (HIGH/LOW) and LOWER LIMIT SWITCH (HIGH/LOW).

As long as the encoder is positioned between the two switch positions, the corresponding status bit (bit 27) is set to LOW. If the position goes outside the limits, i.e. above the upper position or below the lower position, the bit is set to HIGH.

3.11 Velocity/speed output

This function can only be used with the HUEBNER 2.2 encoder profile. The following options are available for the output:

> units per 1000 milliseconds
>
> units per 100 milliseconds
>
> units per 10 milliseconds
>
> revolutions per minute

4 Data transfer modes for Profibus

Three data transfer modes are needed for operating the encoder on a Profibus®:

When the system is started up, the data that are required for configuration and parameterization are transferred in the **DDLM_SET_PRM** mode from the master to the encoder (attached as a slave). 16 to 39 bytes (octets) are necessary for this operation, depending on the encoder profile.

In the **DDLM_Data_Exchange** mode, the master requests data from the encoder outputs. If the encoder is configured for Huebner 2.1 or Hübner 2.2, then some parameters can be altered in online operation.

In the **DDLM_Slave_Diag** mode, the master requests diagnostic data from the encoder.

Normally, the configuration and parameterization in the DDLM_Set_Prm mode when the system is started up, and the subsequent operation in the DDLM_DATA_EXCHANGE mode are performed automatically.

The settings for the necessary functions are defined beforehand in the selection menus in the windows of the Profibus system (COMProfibus).

However, in some cases it is necessary to know the relevant commands, so that parameters can also be altered manually.

4.1 Configuring and parameterizing the encoder

The following shows which bits can be set in the DDLM_SET_PRM mode. Octets 1-8 contain Profibus-specific data, and should not be altered.

4.1.1 DDLM_Set_Prm - Mode for Class 1 and Class 2

Octet	Parameter	Bit – No.	
	Count direction (code sequence)	0	right = 0, left = 1
	Class 2 functionality	1	off = 0, on = 1
	Commissioning diagnostics	2	not used for AMP1212
	Scaling function	3	off = 0, on = 1
9	Reserved	4	---
	Reserved	5	---
	optional for Hübner 2.1 and 2.2	6	not for Class 1 and Class 2
	Reserved	7	
10 - 13	Resolution: units per revolution	2^{31} - 2^0	max. 4096
14 - 17	Total measuring range	2^{31} - 2^0	max. 4096 x 4096

In Class 1 operation, only the count direction (code sequence) bit can be altered.

4.1.1.1 Class 2 functionality (Octet 9.1)

This bit can be set to 0, to switch over to Class1 operation.

4.1.1.2 Scaling function control (octet 9.3)

If this bit is cleared, the encoder has a resolution of 4096 units per revolution, and a total measuring range of 4096 x 4096 units (corresponding to 4096 revolutions). If bit 3 = 1, then it is possible to make a scaling of the units per revolution and the total measuring range.

4.1.1.3 Resolution: units per revolution (octet 10 – 13)

This value must not be larger than 4096, otherwise the output code will be ambiguous.

4.1.1.4 Total measuring range (octet 14 – 17)

The value that is set here must be an exact multiple of the resolution (in units per revolution), whereby the multiplying factor is the number of revolutions, and can only have a value 2^n (where $1 < n < 12$).

> **!** **CAUTION!**
> **Total measuring range = units per revolution x number of revolutions and number of revolutions = 2^n**

If any other value is used for the number of revolutions, then jumps will occur at the transition from the maximum encoder position to position 0 , resulting in ambiguous position data.

4.1.2 DDLM_SET_PRM mode for HUEBNER 2.1 and HUEBNER 2.2

The user profiles HUEBNER 2.1 and HUEBNER 2.2 are an extensions of the CLASS 2 profile. They provide additional functions that can be applied by the user. Unused functions can be switched off. This makes it possible to use online parameterization in the DDLM_DATA_EXCHANGE mode to set the code sequence (count direction), the preset value, and to determine the gearing factor. Furthermore, HUEBNER 2.2 allows the output of a velocity/speed value.

Bits and bytes for parameterization of HÜBNER 2.1 and HÜBNER 2.2

Octet	Parameter	Bit – Nr.	
	Count direction (code sequence)	0	right = 0, left = 1
	Class 2 functionality	1	off = 0, on = 1
	Commissioning diagnostics	2	---
	Scaling function control	3	off = 0, on = 1
9	Reserved	4	---
	Reserved	5	---
	HUEBNER 2.1 and 2.2	6	off = 0, on = 1
	Reserved	7	
10-13	Units per xxx	$2^{31} - 2^0$	see Octet 26 / bit1+0
14-17	Total measuring range		
18-25	Reserved for encoder profile		
	Measuring units	1 + 0	00H per revolution 01H per total measuring range 10H physical pulse intervals
	Commissioning mode	2	off = 0, on = 1
	Shorter diagnostics	3	off = 0, on = 1
26	Reserved	4	---
	Lower limit switch active	5	off = 0, on = 1
	Upper limit switch active	6	off = 0, on = 1
	Octet 27 – 39 active	7	off = 0, on = 1
27-30	Lower limit switch	$2^{31} - 2^0$	
31-34	Upper limit switch	$2^{31} - 2^0$	
35-38	Physical pulses	$2^{31} - 2^0$	
	Reserved	0	---

	Singleturn/Multiturn	1	single-turn = 0, multi-turn = 1
	Reserved	2	---
39	Reserved	3	---
	Velocity/speed dimension unit	5 + 4	00H units/second 01H units/100 msec 01H units/10 msec 11H rpm
	Reserved	6	---
	Reserved	7	---

4.1.2.1 HUEBNER 2.1 and 2.2 (octet 9.6)

This bit is used to enable the other encoder functions which are available in this profile (in octet 26).

4.1.2.2 Measuring units per xxx (octet 10 – 13) + required measuring units (octet 26.0 and 26.1)

The bits for the desired measuring units (octet 26.0 and 26.1) can be used to store a value in octet 10 – 13 that refers to the following ranges:

measuring units per revolution

measuring units, referred to the total measuring range

physical pulses

For measuring units per revolution (octet 26.0 and 26.1, 00H)

which   This entry refers to one revolution of the encoder, and defines the number of units into
the   this single revolution is divided. Values up to 4096 can be entered. Taken together with
the   value for resolution referred to total measuring, as stored in octet 14 – 17, this defines
          measuring range of the encoder, (see also under Total measuring range)

For measuring units referred to the total measuring range (octet 26.0 and 26.1, 00H)

          This entry defines the number of measuring units over 4096 revolutions, so it is referred
to the   total measuring range of the encoder.

For physical pulses (i.e. physical measuring intervals) (octet 26.0 and 26.1, 00H)

          The resolution is the same as the code disk, with 4096 intervals. Depending on the
value for the total measuring range, the number of revolutions is a number of 2n with 1 < n < 12
(see   also under Total measuring range). In this mode it is possible to scale the measuring
range   that is defined.

          To do this, the number of units into which the total measuring range is to be divided is
entered   in the octets 35 to 39. In addition to the direct entry, the scaling can also be determined
by the   teach-in method.

4.1.2.3 Commissioning mode (octet 26.2)

This switch is used to set a special status in the DDLM_SET_PRM mode, where (in a system that is ready for operation) the preset value and other parameters are transferred to the encoder, and stored there in non-volatile memory. A gearing factor can also be determined in this mode. The parameters that are established in this way should be recorded, so that they can be transferred to the encoder when the bus system is started up again in DDLM_SET_PARA mode and the commissioning mode is switched off.

4.1.2.4 Shorter diagnostics (octet 26.4)

Many (mostly older) Profibus masters cannot read in all the diagnostics bytes from the encoder. (Refer to the documentation for the master which is used.) If this bit is set, then only 16 diagnostics bytes are transferred.

4.1.2.5 Octet 27 – 39 active (octet 26.7)

When this bit is set, access is enabled to octets 27 to 39.

This enables the functions: upper and lower limit switches, scaling through physical pulses, Singleturn/Multiturn, and the dimension for the velocity/speed (only for HUEBNER 2.2).

4.1.2.6 Lower / upper software limit switches (octet 26.5 and 26.6) and (octet 27 – 34)

Setting these bits activates the lower software limit switch (octet 26.5) and the upper limit switch (octet 26.6). The position values which are required are stored in octet 27 – 30 (for the lower limit) and octet 31 – 34 (for the upper limit). This function can only be used for programming the classes HUEBNER 2.1 and 2.2.

4.1.2.7 Physical measurement pulses (octet 35 – 38)

The number of physical measuring pulses (intervals) is stored in this octet. It is the divisor for the total measuring range, and is therefore used for the scaling of the encoder.

4.1.2.8 Singleturn / Multiturn (octet 39.1)

This bit (which is normally set by the selection of the encoder class) can be used to select the encoder type.

4.1.2.9 Dimensional unit for velocity/speed (octet 39, 5+4)

If the class HUEBNER 2.2 is selected, then it is possible to output the velocity/speed. Bits 5 and 4 of octet 39 can be used to set the following types of output:

00H	units/second
01H	units/100 milliseconds
10H	units/10 milliseconds
11H	rpm

4.2 Commissioning mode

The commissioning mode is a special feature of normal operation for the encoder classes HUEBNER 2.1 and 2.2. In addition to the preset value and code sequence (count direction), which can also both be altered in normal operation, it is possible to perform a scaling in online operation, through the teach-in method. This just requires manipulating a bit in the status for the DDLM_Data_Exchange mode. To do this, the data are transferred in each cycle as four 8-bit words, as below:

Status $+2^{24}$	$2^{23} - 2^{16}$	$2^{15} - 2^{8}$	$2^{7} - 2^{0}$

Transfer of the data within a DDLM_Data_Exchange cycle

The status bits are interpreted as follows:

Bit 25	0 = encoder not ready	1 = encoder ready
Bit 26	0 = commissioning mode	1 = normal mode

Bit 27	0 = software limit switch
	    min. < process value < max.
		1 = software limit switch
		    min. > process value > max.

Bit 28	0 = clockwise
	    (looking at end of shaft)
		1 = counter-clockwise
		    (looking at end of shaft)

Bit 31	0 = normal mode	1 = set preset value

4.2.1 Accept preset value

The preset value can be taken from the encoder position, both in normal mode and in commissioning mode. The acceptance is made regardless of whether or not bit 26 is set.

	Status bits							Data bits
	31	30	29	28	27	26	25	24 - 0
M->S	1	0	0	0	0	x	0	process value is transferred as the preset value
S->M	1	0	0	0	0	X	0	new process value is transferred
M->S	0	0	0	0	0	X	0	reset to the commissioning mode
S->M	0	0	0	0	0	x	0	new process value is output
M = Master, S = Slave								

4.2.2 Set count direction (code sequence)

In commissioning mode, the count direction can be reversed online, by using bit 28. After changing over, the encoder sends back the present direction to the master. A 0 means that the count direction is clockwise (looking at the shaft end), a 1 means it is counter-clockwise (anti-clockwise).

		Status bits					Data bits	
	31	30	29	28	27	26	25	24 – 1	0
M->S	0	0	0	**1**	0	0	0	bit 28 switches the direction from 0 to 1 or the reverse	
S->M	0	0	0	**0/1**	0/1	0	1	acknowledge new direction in bit 0	1/0
M->S	0	0	0	**0**	0	0	0	end changeover for bit 28 = 0	
S->M	0	0	0	**0/1**	0/1	0	1	continue output of process value	
M = Master, S = Slave									

NOTE!
After setting the direction, the preset value has to be set again.

4.2.3 Scaling the encoder with the teach-in method

This method provides an automatic scaling of the encoder. After starting the procedure, the system moves over a defined path. Then the system is stopped, and the number of units into which the path is to be divided is entered. The motion path must not be longer than 2047 revolutions.

4.2.3.1 Start scaling

		Status bits						Data bits
	31	30	29	28	27	26	25	24 – 1
M->S	0	**1**	0	0	0	0	0	bit 30 = 1 = start scaling
S->M	0	**1**	0	0/1	0/1	0	1	acknowledge through bit 30 =1
M->S	0	**0**	0	0	0	0	0	rest the previous scaling
S->M	0	**1**	0	0/1	0/1	0	1	output of process value, with scaling factor 1
M = Master, S = Slave								

After using this function, the gearing factor is set to 1 and the zero offset (preset) is cancelled.

The system must now traverse the path that was defined previously. The motion path is displayed through the process value, without scaling.

4.2.3.2 Stop scaling

		Status bits						Data bits
	31	30	29	28	27	26	25	24 – 1
M->S	0	**0**	1	0	0	0	0	transfer the number of units for dividing the path
S->M	0	**1**	1	0/1	0/1	0	1	new total measuring range (should be recorded)
M->S	0	**0**	0	0	0	0	0	end scaling
S->M	0	**0**	0	0/1	0/1	0	1	scaled process value is output
M = Master, S = Slave								

With scaling, both positive and negative directions of rotation are taken into account, as well as traversing the zero point.

The following must be considered for scaling:

> **The number of units that is required must not exceed the physical resolution (pulses) of the motion path.**

> **Bit 28 must be set correctly for the count direction. If necessary, it must be set again after using this function.**

Since the preset value is cancelled when scaling is started, it must be set again in a subsequent operation.

The scaling is stored in non-volatile memory in the encoder. In order to be able to carry on using the scaling values if the encoder is replaced, it is a good idea to transfer the total measuring range to the Profibus master. There it is entered in the field Measuring units, and the switch Desired measuring units per xxx is set to MAXIMUM TOTAL MEASURING RANGE.

5 Diagnostic messages

The DDLM_Slave_Diag mode makes it possible for the master to call up diagnostic data from the encoder. The number of octets is 57, except for the shorter diagnostics, where the number of diagnostics bytes is limited to 16.

The diagnostic messages which are supported by the HÜBNER absolute encoder are listed below. The diagnostic data are given out in accordance with the rules of the Profibus Profile for encoders, PNO Order No. 3.062.

Octet	Parameter	Bit – No.			Class
1–3	Station status (see Profibus® standards)				1
4	Diagnostics master add				1
5–6	PNO number	15-0	PNO number of the encoder		1
7	Extended diagnostics header		number of diagnostic bytes		1
8	Alarm message	4	memory error (EEPROM)	1 = error	1
9	Operating mode	0 1 2 3	direction of rotation Class 2 functionality diagnostics routine scaling function	0 = CW, 1 = CCW 0 = off, 1 = on 0 = off, 1 = on 0 = off, 1 = on	1
10	Encoder type	1	Singleturn/Multiturn	single-turn = 0 multi-turn = 1	1
11–14	Resolution per revolution (hardware)	0-23	single-turn resolution	4096 (10 00 H)	1
15–16	Number of revolutions (hardware)	0-23	multi-turn resolution	4096 (10 00 H)	1
20–21	Warning messages	20/4	operating time warning after 10^5 hours	0 = no, 1 = yes	2
24–25	Profile version	15-8 7-0	revision number index		2
26–27	Software version	15-8 7-0	revision number index		2

28–31	Operating time	23-0	is incremented every 6 minutes, while the supply voltage is applied		2
32–35	Zero point shift	23-0	preset value		2
40–43	Parameterized resolution per revolution	23-0	only if the value Resolution per revolution was entered		2
44–47	Parameterized total measuring range	23-0	parameter setting, or calculated by scaling		2
48-57	Serial number		bytes, filled with 2AH at present		2

6 Faults

6.1 Fault table absolute part

Faults	Possible cause	Remedy
Moisture in the terminal box cover	Soiled gasket or seal surfaces of terminal box cover	Clean gasket of terminal box cover and seal surfaces
	Damaged gasket of terminal box cover	Replace gasket of terminal box cover
	Cable gland/blanking plug not tightened	Tighten cable gland/blanking plug
	Unsuitable cable for cable gland	Use suitable cable and cable glands

6.2 LED display for error and status messages

Two LEDs (one red, one green) are built into the cover of the terminal box, and are visible through a window. They are used to indicate errors and the momentary status of the encoder. Each one of the LEDs can have the state; OFF, BLINKING or ON. This allows 9 possible combinations, of which 6 are used as follows:

LED display in the terminal box cover		
Red LED	**Green LED**	**Error indication / encoder status**
off	off	no supply voltage
on	blinking	Parameter and/or configuration error. (e.g., data length too large, total resolution too high).
on	off	Encoder has not received data for a longer period from Master
blinking	on	Encoder is ready for operation but is not addressed by the master. Possible cause: Wrong address setting.
off	blinking	Commissioning mode in data exchange mode
off	on	Normal operation mode data exchange mode