ifm electronic

CE

Device manual
Profibus encoder
efector 400

RM30xx
RN30xx

Contents

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1 Preliminary note

1.1 Symbols used

►	Instruction
>	Reaction, result
[…]	Designation of keys, buttons or indications
→	Cross-reference

☐! Important note
Non-compliance can result in malfunction or interference.

☐ⓘ Information
Supplementary note
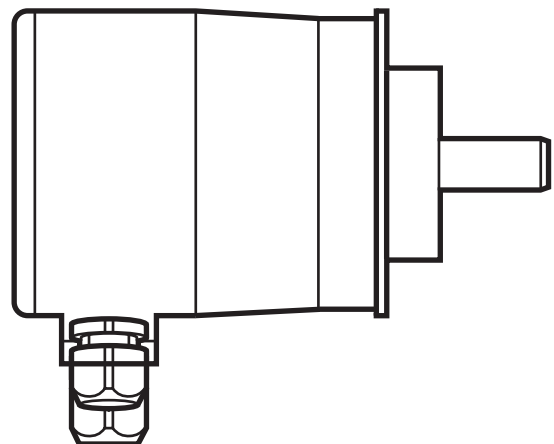
1.2 Warning signs used

NOTE
Warning of damage to property.

1.3 Notes on this document

This document applies to encoders of the following type:

RM30xx and RN30xx with Profibus interface

It is part of the device and contains information about the correct handling of the product.

This document is intended for qualified electricians. These specialists are people who are qualified by their training and their experience to recognise and to avoid possible hazards that may be caused during operation of the device.

► Read this document before using the device.

► Keep this document during the service life of the device.

► Observe these operating instructions.

► Adhere to the warning notes.

2 Safety instructions

Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the unit. Only the signals indicated in the technical data or on the device label may be supplied to the connections or wires.

3 General information

3.1 1.2 Profibus technology

Profibus is a manufacturer-independent, open fieldbus standard determined by the international standards EN 50170 and EN 50254.
There are 3 versions: DP, FMS and PA.
ifm encoders support the DP version and are designed for common baud rates up to 12 Mbaud.

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Besides manufacturer-specific functions the devices support the classes 1 and 2 to the encoder profile. This device profile can be ordered from the Profibus user organisation indicating the order number 3.062.

Here you can also get further information about PROFIBUS (functionality, manufacturers, products) as well as standards and profiles → www.profibus. com.

4 Functions and features

The encoder converts rotary movements into digital numerical values. Each revolution and each angular position of the revolutions is provided as a numerical value. These values allow angular movements to be measured and positions and number of revolutions to be determined.

> Products from ifm electronic gmbh are usually individual components of larger installations. These applications require tests of the entire installation and do not only depend on the specification of these components. The notes in this manual apply only to the product from ifm electronic and not to the entire installation. If the product is used in a non-intended way, this will be at your own risk.

5 Electrical connection

▶ Disconnect power.
▶ Connect the device according to the indications on the type label.

5.1 Connection of the signal and supply cables

	Terminal	Description
Power Supply (diagram)	B (left)	Signal cable B Incoming bus cable
	A (left)	Signal cable A Incoming bus cable
	-	0 V
	+	10...30 V
	B (right)	Signal cable B Outgoing bus cable
	A (right)	Signal cable A Outgoing bus cable
	-	0 V
	+	10...30 V

6 Installation

▶ Disconnect power.

▶ Ensure that the machine stands still.

▶ The drive must not be started during installation.

▶ Do not hit the shaft; do not use a file or similar tool on the shaft. Risk of destruction!

This product is a precision measuring device. Therefore it has to be handled with care by trained staff. The following warnings apply to influences outside the limit values indicated in the product data sheet.

Damage to the product can be caused by:

● electrostatic discharge while touching the electronics

● too high forces on the shaft

● humidity and chemical liquids (do not connect any cables oriented upwards)

● extreme temperatures

● too high vibrations and shocks

● short circuit or too high an operating voltage

● impact, shock or any other physical forces

7 Installation

The encoder is connected via the terminal cap. It is connected to the encoder via a 15-pole D-Sub-connector and can be removed by loosening the 2 screws on the back of the device. Bus and supply cables are inserted in the cab via cable glands and connected via screw terminals.

7.1 Settings in the terminal cap

7.1.1 Participant address

The Profibus participant address is set via decimal rotary switches in the terminal cap. The positional value (x 10 or x 1) is indicated on the switch. Possible addresses are between 1 and 99; each address must only occur in the system once.
The device address is read when the voltage supply of the encoder is applied; a change of address by the master [Set_Slave_Add] is not supported.

Connection and setting of addressing

1: Supply $+U_B$ / - GND
2: Bus IN
3: Bus OUT
4: Addressing
5: Setting terminating resistor
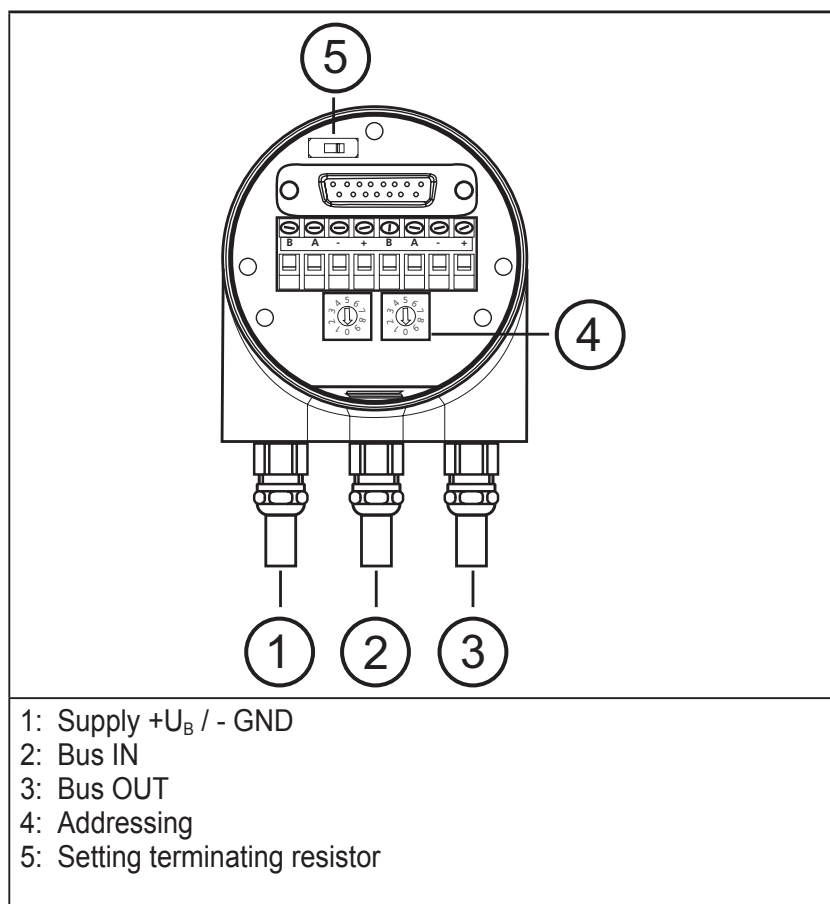
7.1.2 Bus termination

If the encoder is installed as an end device, the terminal resistor integrated in the device must be activated. This is done via the slide switch in the terminal cap (5).

When the terminal resistor is activated, the next bus (Bus Out) is decoupled.

The bus is only correctly connected if the encoder is installed on the terminal cap. If the encoder has to be replaced during operation, the use of a separate active bus termination is recommended.

After the address has been set in the hardware and, if applicable, the terminating resistor has been activated, the encoder can be put into operation.

8 Device configuration

Encoders with Profibus interface can be configured and parameterised according to the requirements of the user.

In this respect the GSD file of the device is loaded into the projection tool. Various encoder classes can be selected for the projection. Parameters and functionalities of the device that can be set depend on the selected encoder class. ifm encoders of the RM30xx and RN30xx series support all encoder classes described below.

Therefore the functionality is not restricted from the hardware side and is only determined by the user. ifm encoders do not only provide the encoder classes "Class 1" and "Class 2" described in the encoder profile but also encoder classes with manufacturer-specific functions.

When configuring the device, configuration and parameter data are defined by selecting the encoder class. This data saved in the Profibus master is transferred once to the encoder when the system starts up (configuration and parameterising phase – "DDLM_Set_Prm"). It is not possible to change configuration or parameters during operation.

After the configuration and parameter data has been received, the encoder goes into normal operation (cyclic data exchange – "DDLM_Data_Exchange mode") in which, for example, the position value is transferred. The length and format of the data exchanged are also defined when configuring the device by selecting the appropriate encoder class.

9 Encoder classes

9.1 Class 1 and Class 2

The encoder classes Class 1 and Class 2 are the versions according to the encoder profile defined by the encoder working group in the Profibus user organisation (available from PNO indicating order no. 3.062).

9.2 Parameter setting

The following table gives an overview of the parameters that can be set according to the encoder profile and of the arrangement in the parameter setting telegram. Parameters are set using input masks in the projection tool.

Octet (= byte) no.	Parameters	Bit no.	Details
1...8	Profibus standard parameters		
9	Direction of rotation	0	→ Chapter 9.2.1
	Class 2 functionality	1	→ Chapter 9.2.2
	Commissioning diagnostics	2	→ Chapter 9.2.3
	Scaling function	3	→ Chapter 9.2.4
	Reserved	4	
	Reserved	5	
	Not used for Class 1 and Class 2	6	
		7	
10...13	Measuring steps / revolution		→ Chapter 9.2.5
14...17	Total resolution		→ Chapter 9.2.6
18...25	Reserved (to encoder profile)		
26...	Not used for Class 1 and Class 2		

Rotational direction

The direction of rotation defines the counting direction of the process actual value output when the shaft rotates clockwise (CW) or counter-clockwise (CCW). The counting direction is defined by bit 0 in octet 9.

Octet 9 bit 0	Direction of rotation when viewing the shaft	Direction of rotation
0	Clockwise (CW)	Rising
1	Counter-clockwise (CCW)	Rising

9.2.1 Class 2 functionality

Class 2 encoders can be limited to the functionality of Class 1; the possibility of parameter setting is disabled. To use the function of Class 2 encoders, bit 1 is set in octet 9.

Octet 9 bit 1	Class 2 functionality
0	Disabled
1	Enabled

9.2.2 Commissioning diagnostics

This function is of no meaning for the ifm encoder.

9.2.3 Scaling function

The scaling function enables parameter setting of the resolution per revolution and the selected total resolution. It should always be enabled if you want to use the functions of Class 2 (or the manufacturer-specific classes).

Octet 9 bit 3	Scaling function
0	Disabled
1	Enabled

9.2.4 Measuring steps per revolution

This parameter is used to assign a requested number of steps referred to one revolution to the encoder.
If the value of the parameter exceeds the actual physical basic resolution of the encoder, the output value no longer proceeds by one step.
For encoders as of the B1 generation a parameter fault is displayed in this case; the device does not change to the cyclic data transfer.
For high-resolution encoders it may be required to split the value into high word and low word, depending on the projection tool.

Octet	10	11	12	13
Bit	31...24	23...16	15...8	7...0
Data	2^{31} to $2^{2}4$	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Requested number of measuring steps per revolution			

9.2.5 Total resolution

Octet	14	15	16	17
Bit	31...24	23...16	15...8	7...0
Data	2^{31} to $2^{2}4$	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Selected total resolution in measuring steps			

This parameter enables the user to adapt the measuring range of the device. The encoder counts up to the configured total resolution and then it starts again at 0.

Example
Selected: 100 steps per revolution, total resolution 12800, then the encoder starts again at zero after 128 revolutions and counts again up to 12799.
With many projection tools it may be required to split the value into high word and low word.

When the [Total measuring range] parameter is entered, use the following formula:

total resolution < measuring steps per revolution x number of revolutions (physical)

ℹ️ If this is not observed, the device indicates a parameter fault and does not go into the cyclic data exchange.

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ℹ️ The internal software routine is only effective during operation.

9.3 Data exchange during normal operation

The DDLM_Data_Exchange mode is the normal status during system operation. On request, the encoder sends current position values to the master. Conversely, the encoder can also receive cyclic data (e.g. the preset value with Class 2 encoders).

9.3.1 Transfer of the process actual value

The current position value of the multiturn encoder is transferred as a 32-bit value (double word) to the master.

Word	Word 1		Word 0
Function	Process actual value		
Bit	31...30	29...16	15...0
	0	X	X

9.3.2 Preset function

The preset function enables adaptation of the encoder zero point to the mechanical zero point of the system.

► Set the encoder actual value to the requested preset value.

> The requested zero point drift is calculated by the device and stored in an EEPROM (non-volatile) which takes less than 40 ms.

The preset value is activated in the peripheral output double word by setting bit 31 (adopted with rising edge). Setting is made automatically after transfer of the scaling parameters, i.e. the preset value refers to the scaled actual value.

			Data bits
Bit 4	**31**	**30**	**29...0**
Master → encoder	1	0	Transfer of the requested value (= preset value)
Encoder → master	0	0	New = requested process actual value is transferred
Master → encoder	0	0	Reset bit 31 - normal mode
Encoder → master	0	0	New = requested process actual value is transferred

Only set the preset while the encoder shaft is at standstill. If the shaft moves during this time, shifts are possible since runtimes occur via the bus when the preset value is set.

Note on the singleturn version
The process can be transferred to the singleturn version – here bit 15 is used to activate the preset value. With high-resolution singleturn encoders (16 bits) no preset values > 32767 (15 bits) can be set in Class 2 (MSB is used to activate the preset value). If this function is requested, one of the manufacturer-specific ifm classes has to be selected (transfer here also in 32-bit format for the singleturn).

10 Profibus encoder profile Class 2

Parameter setting telegram

Octet (= byte) no.	Parameters	Bit no.	Details
1...8	Profibus standard parameter		
9	Direction of rotation	0	→ Chapter 9.2.1
	Class 2 functionality	1	→ Chapter 9.2.2
	Commissioning diagnostics	2	→ Chapter 9.2.3
	Scaling function	3	→ Chapter 9.2.4
	Reserved	4	
	Reserved	5	
	Activate manufacturer-specific parameters (octet 26)	6	→ Chapter 10.1.1
	Reserved	7	
10...13	Measuring steps / revolution (Reference: octet 26 bits 0 and 1)		→ Chapter 10.1.2
14...17	Total resolution		→ Chapter 9.2.6
18...25	Reserved		
26	Reference to the requested measuring steps	0 1	→ Chapter 10.1.3
	Activate set-up mode	2	→ Chapter 10.1.4
	Reduced diagnosis	3	→ Chapter 10.1.5
	Reserved	4	
	Activate lower software limit switch	5	→ Chapter 10.1.6
	Activate upper software limit switch	6	→ Chapter 10.1.6
	Activate parameters as from octet 27	7	→ Chapter 10.1.1
27...30	Lower limit switch		→ Chapter 10.1.6
31...34	Upper limit switch		→ Chapter 10.1.6
35...38	Physical measuring steps		→ Chapter 10.1.7
39	Reserved	0	
	Encoder (singleturn or multiturn)	1	→ Chapter 10.1.8
	Reserved	2	
	Reserved	3	
	Selection of the measuring unit to provide the value of velocity	4 5	→ Chapter 10.1.9
	Reserved	6	
	Reserved	7	

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10.1 Parameters

The manufacturer-specific parameters are described below. The parameters to the encoder profile (also supported) are described in chapter 9.

10.1.1 Activation of the manufacturer-specific parameters

The manufacturer-specific parameter byte 26 is activated via bit 6 in octet 9. The manufacturer-specific bytes 27...39 are activated in byte 26.

Octet 9 bit 6	Octet 26
0	Deactivated
1	Activated

Octet 26 bit 7	Octet 27...29
0	Deactivated
1	Activated

10.1.2 Requested measuring steps

The device can be programmed with the [Desired measuring units] parameter so that any number of measuring steps referred to

- – one revolution
- – the entire measuring range
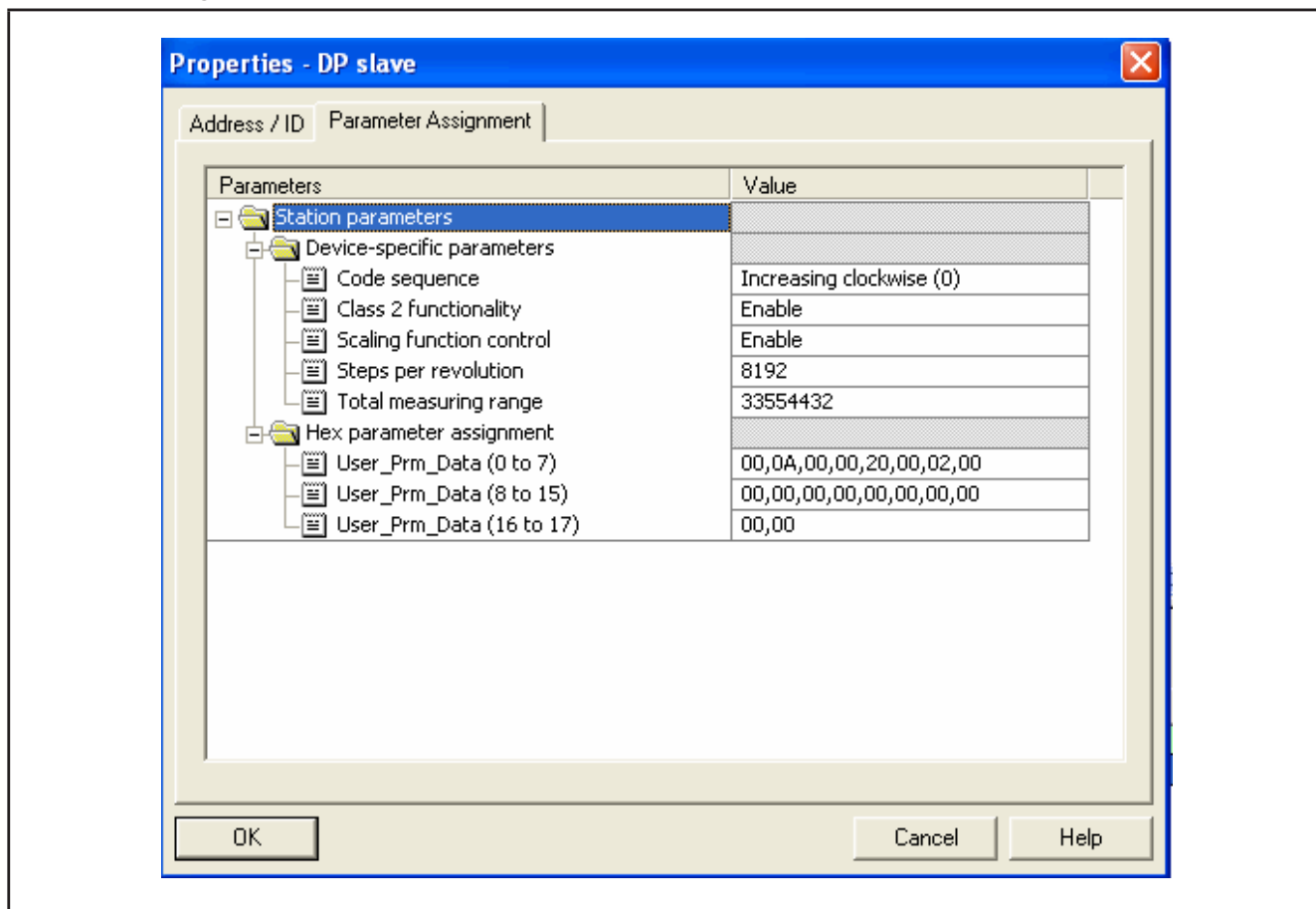- – any part of the measuring range

can be implemented.

Octet	10	11	12	13
Bit	31...24	23...16	15...8	7...0
Data	2^{31} to 2^{24}	2^{23} to 2^{16}	2^{15} to 2^{8}	2^{7} to 2^{0}
	Required number of measuring steps			

10.1.3 Required resolution

Parameter selection of

- – resolution per revolution
- – or max. total resolution
- – code sequence
- – Class 2 functionality
- – scaling function

Selection required resolution

Resolution per revolution
The position value is scaled so that it increases by the number of the required measuring steps during one revolution.
In addition the [Total mesuring range] parameter is evaluated via which the measuring range can be adapted (→ chapter 9.2.5)

Resolution per max. total resolution
The requested measuring steps entered refer to the total measuring range.
The device provides the configured number of measuring steps via the total (physical) number of revolutions.

Resolution per physical measuring steps
The requested number of steps refers to the data entered via the [Physical impulses] parameter (→ chapter 10.1.7).
This is the numerical value that is read from the coded disc inside the encoder (e.g. 4096 steps per revolution for the standard 12-bit version).
This option allows free setting of gearbox factors.

Reference	Octet 26 bit 0	Octet 26 bit 1
Per revolution	0	0
Per max. total resolution	1	0
Per physical measuring steps (= steps indicated in octets 35-38)	0	1

10.1.4 Activate set-up mode

Bit 2 in octet 26 is a switch for the set-up mode.

In this mode other parameters besides the preset value can be transferred to the encoder.

With activated mode a teach operation can be carried out; the gearbox factor can be directly determined in the system.

In this mode (green LED flashing) the direction of rotation and scaling set during projection are ignored and the values saved in the internal EEPROM are used.

The device can be operated permanently in the set-up mode.

Recommendation:
Transfer the parameters determined in the set-up mode and then use the device in normal mode (which enables a replacement of the device without having to repeat the teach operation).

Octet 26 bit 2	Set-up mode
0	Off
1	On

10.1.5 Reduced diagnosis

With older Profibus masters the full number of diagnostic bytes (standard diagnosis: 57 bytes) may lead to problems. .

With the RM30xx and RN30xx devices it is possible to reduce the number of the diagnostic bytes provided by the encoder to 16. If the device class "Class 1" is selected, only 16 diagnostic bytes are provided in general.

Octet 26 bit 3	Diagnostic data length
0	Standard = 57 bytes
1	Reduced = 16 bytes

10.1.6 Software limit switch

2 positions can be programmed. If they are exceeded or not reached, the encoder sets bit 27 in the 31-bit process actual value to "1".

Between the two positions the bit is set to "0". Both limit switch values can be set to any value via parameter setting but they must not exceed the value of the [Total measuring range] parameter. The limit switches are activated via bit 5 or 6 in octet 26.

With many projection tools it may be required to split the values into high word and low word.

Octet	27	28	29	30	31	32	33	34
Bit	31...24	23...16	15...8	7...0	31...24	23...16	15...8	7...0
Data	$2^{31}...2^{24}$	$2^{23}...2^{16}$	$2^{15}...2^{8}$	$2^{7}...2^{0}$	$2^{31}...2^{24}$	$2^{23}...2^{16}$	$2^{15}...2^{8}$	$2^{7}...2^{0}$
	Lower limit switch in measuring steps (referred to scaled value)							

Octet 26 bit 5	Lower limit switch
0	Off
1	On

Octet 26 bit 6	Upper limit switch
0	Off
1	On

10.1.7 Physical measuring steps

Octet	35	36	37	38
Bit	31...24	23...16	15...8	7...0
Data	$2^{31}...2^{24}$	$2^{23}...2^{16}$	$2^{15}...2^8$	$2^7...2^0$
	Physical measuring steps			

This parameter is evaluated by the device if the option [Physical impulses] was selected as reference to the requested measuring steps. By means of the physical measuring steps a gearbox factor can be freely set. Here it is defined how many measuring steps (requested measuring steps) are to be provided on a defined sub-measuring range. This option is useful if "odd" scaling factors are to be entered.

Example

The encoder is to provide 400 steps over 3 revolutions.

With the reference [Desired measuring units per revolution] this number of steps cannot be set (the [Desired measuring units] parameter should contain the value 133.333; however only integers can be entered).

Remedy

The physical measuring steps are selected as reference for the requested measuring steps.

The number of the physical measuring steps over the requested measuring range is determined on the basis of the actual (physical) resolution of the device (type label). For this absolute encoder with 12-bit standard resolution this would in this case be

4096 steps/revolution x 3 revolutions = 12288 steps

This value is now entered as [Physical impulses] parameter; the actually required number of steps of 400 is entered at [Desired measuring units]. The encoder now provides 400 steps over a measuring range of 12288 physical steps (i.e. 3 revolutions).

Note: With many projection tools it may be required to split the value into high word and low word.

10.1.8 Encoder type

The type of encoder (singleturn or multiturn) is defined in bit 1 of octet 39. This is done automatically when the encoder class is selected. The user only has to consider this parameter if parameters are set directly in the hexadecimal code.

Octet 39 bit 1	Type
0	Singleturn
1	Multiturn

10.1.9 Unit of measurement velocity

The unit for the velocity value to be provided (class ifm 2.2) can be set via this parameter.

Unit	Bit 4	Bit 5
Steps / second	0	0
Steps / 100ms	1	0
Steps/10ms	0	1
Revolutions / minute	1	1

10.2 Data exchange during normal operation

The process actual value is in general transferred as a 32-bit word (double word) with the manufacturer-specific encoder classes ifm 2.1 and ifm 2.2. In addition to the 25 bits that are provided for the position value 7 other bits are used as status bits. In the (peripheral) output double word the master sends the preset value and in addition the control bits to the encoder.

For encoders of this type more than 25-bit absolute position data may be available. The position values < 25 bits are not supported in the ifm classes; the more significant bits are overwritten by status bits.
If the ifm classes are to be used with encoders whose physical resolution exceeds 25 bits, the user must ensure that the physical position value is scaled to a (max.) output value < 33554432 (via parameter setting). If absolute values > 25 bits are required, Class 2 has to be selected.

An additional (peripheral) input word of the current velocity value is transferred with device class ifm 2.2.

Identifica-tion	F1 hex				D0 hex	
Encoder → master	Status + position actual value				Velocity	
	Status + 2^{24}	2^{23} - 2^{16}	2^{15} - 2^{8}	2^{7} - 2^{0}	2^{15} - 2^{8}	2^{7} - 2^{0}
Master → encoder	Preset value + control bits					
	Control + 2^{24}	2^{23} - 2^{16}	2^{15} - 2^{8}	2^{7} - 2^{0}		

The status bits in the input double word have the following meaning

Bit	Meaning		
28	Rotational direction	0 = increasing clockwise (seen on the shaft)	1 = increasing counter-clockwise (seen on the shaft)
27	Software Limit switch	0 = lower limit switch ≤ actual value ≤ upper limit switch	1 = actual value > upper limit switch or actual value < lower limit switch
26	Operating mode	0 = set-up mode	1 = normal mode
25	Readiness for operation	0 = encoder not ready for operation	1 = encoder ready for operation

10.3 Set-up mode

If the encoder is switched to the set-up mode via parameter setting, the gearbox factors can be determined directly in the system via a teach operation.

The set-up mode is signalled by the encoder via a flashing green LED in the terminal cap and via bit 26 in the input double word (set to 0).

In the set-up mode the parameters set during projection (direction of rotation, scaling) are ignored and the values saved in the internal EEPROM are used. If the direction of rotation and gearbox factor are changed during the set-up mode, the new values are stored in the EEPROM.

Process during the set-up mode

► Install the device in the system.

► Enable the set-up mode via parameter setting.

► Adapt the direction of rotation (if required).

► Move the system to the starting position.

► Transmit the start command for the teach operation to the encoder.

► Move the system to the end position.

► Transfer the requested number of steps to the encoder with the "stop teach operation" command.

► Set the preset value.

► Transfer the values determined during the teach operation to the projection (parameters).

► Disable the set-up mode during parameter setting.

10.3.1 Set the direction of rotation

The direction of rotation cannot be changed online in the set-up mode. The current direction of rotation is displayed via bit 28 in the input double value (0: increasing/ 1: decreasing clockwise). The direction of rotation can be changed via bit 28 in the output double word.

	Status bits							Data bits	
Bit	31	30	29	28	27	26	25	24...1	0
Master → encoder	0	0	0	**1**	0	0	0	Select the direction of rotation via bit 28	
Encoder → master	0	0	0	**0/1**	0	0	1	The encoder acknowledges the new direction of rotation in bit 0 and bit 28	0/1
Master → encoder	0	0	0	**0**	0	0	0	The selection is terminated by resetting bit 28	
Encoder → master	0	0	0	**0/1**	X	0	1	Output of the process actual value with changed direction of rotation	

The set direction of rotation is saved in the EEPROM non-volatilely.

10.4 Start teach operation

► Move the system to the starting position.

► Transmit the start command for the teach operation to the encoder.

> The device starts the measurement to determine the gearbox factor internally.

	Status bits							Data bits
Bit	31	30	29	28	27	26	25	24...0
Master → encoder	0	**1**	0	0	0	0	0	Start of the teach operation by setting bit 30
Encoder → master	0	**1**	0	X	X	0	1	Encoder acknowledges the start of the teach operation by setting bit 30
Master → encoder	0	**0**	0	0	0	0	0	Reset bit 30
Encoder → master	0	**1**	0	X	X	0	1	Output of the non-processed actual value (gearbox factor = 1, preset not active)

10.4.1 Stop teach operation

► Transfer the requested number of steps to the encoder with the "stop teach operation" command.

► Do not exceed the physical resolution (e.g. 20000 steps on a quarter of a revolution).

Positive and negative direction of rotation and if the zero point is possible exceeded is considered automatically. The measuring distance covered must not be longer than half the measuring range of the encoder (i.e. max. 2047 revolutions for the multiturn encoder with 4096 revolutions, max. 8191 revolutions for the 14-bit multiturn).

As response to the "stop teach operation" command the encoder transmits the total resolution calculated by the device.

► Write down the value and accept it later for the normal operation of the system in projection / parameter setting.

After this process the device works with the new scaling factor which is stored in the EEPROM non-volatilely.

	Status bits							Data bits
Bit	31	30	29	28	27	26	25	24...0
Master → encoder	0	0	**1**	0	0	0	0	Number of the requested steps over the measuring range covered
Encoder → master	0	1	**1**	X	X	0	1	Transfer of the total resolution for the new gearbox factor
Master → encoder	0	0	**0**	0	0	0	0	Reset bit 29
Encoder → master	0	1	**0**	X	X	0	1	Output actual value (included in the new gearbox factor)

Encoder replacement without a new teach operation

► Transfer the total resolution determined by the encoder to the projection.

Enter the total resolution determined during the teach operation into the parameter field [Desired measuring units] (→ 10.1.2) and then set the switch to [Max. total measuring range] → 10.1.3).

During the new configuration make sure that the direction of rotation is entered correctly - the setting in the set-up mode must also be observed during parameter setting. Then the set-up mode can be disabled via parameter setting; the encoder is now used in "normal operation".

10.4.2 Preset value

The preset value is set according to the procedure described in chapter 9.3.2. Only difference: Setting of the preset value with the manufacturer-specific classes ifm 2.1 and ifm 2.2 is confirmed via a status bit.

	Status bits							Data bits
Bit	31	30	29	28	27	26	25	24...0
Master → encoder	**1**	0	**0**	0	0	0	0	Tranfer of the requested value (= preset value)
Encoder → master	**1**	0	**0**	0	0	0	1	New = requested process actual value is transferred
Master → encoder	0	0	**0**	0	0	0	0	Reset bit 31 - normal mode
Encoder → master	0	0	**0**	0	0	0	1	New = requested process actual value is transferred

11 Diagnostic messages

11.1 Overview

In the DDLM_Slave_Diag operating mode, diagnostic data is transferred from the encoder to the master on request. The number of the diagnostic bytes is 57. Exception: Reduced diagnosis. The diagnostic data is output according to the definitions of the Profibus standard (octets 1-6) or according to the encoder profile (starting with octet 7).

Diagnostic function	Data type	Diagnosis Octet number	Encoder class
Station status 1 (see: Profibus standard)	Octet	1	1
Station status 2 (see: Profibus standard)	Octet	2	1
Station status 3 (see: Profibus standard)	Octet	3	1
Diagnostic master address	Octet	4	1
PNO ID number	Octet	5.6	1
Extended diagnostic header	Octet string	7	1
Alarms	Octet string	8	1
Operating status	Octet string	9	1
Encoder type	Octet string	10	1
Resolution per revolution (hardware)	Unsigned 32	11...14	1
Number of revolutions (hardware)	Unsigned 16	15.16	1
Other alarm messages	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
Zero point shift	Unsigned 32	32...35	2
Manufacturer specific: Offset value	Unsigned 32	36...39	2
Configured resolution per revolution	Unsigned 32	40...43	2
Configured total resolution	Unsigned 32	44...47	2
Serial number	ASCII string	48...57	2

11.2 Supported diagnostic messages

The individual diagnostic inputs are described in detail below.

11.2.1 Extended diagnostic header

Diagnostic byte 7 contains the length of the extended diagnosis (including the diagnostic header).

11.2.2 Memory error

Via bit 4 in diagnostic by 8 it is indicated if a memory error has occurred.

In this case memory error means that the EEPROM of the encoder does no longer function reliably and non-volatile storage (e.g. of the zero point shift) is no longer ensured.

Bit	Definition	0	1
4	Memory error (Fault in EEPROM)	No	Yes

11.2.3 Operating status

The operating parameters set via parameter setting can be enquired via diagnostic byte 9.

Bit	Definition	0	1
0	Rotational direction	CW	CCW
1	Class 2 functionality	Off	On
2	Diagnosis routine	Off	On
3	Scaling function	Off	On

11.2.4 Encoder type

The design of the encoder can be enquired via diagnostic byte 10.

Byte 10	Definition
0	Singleturn encoder
1	Multiturn encoder

11.2.5 Singleturn resolution

The physical resolution per revolution of the encoder is stored in the diagnostic bytes 11...14.

11.2.6 Number of revolutions

The physical number of the distinguishable revolutions per encoder can be enquired via the two diagnostic bytes 15 and 16. The standard values for singleturn is 1 and 4096 (or 16384) for multiturn.

11.2.7 Operating time alarm

The warning message for exceeding the operating time is indicated in bit 4 of diagnostic byte 21. The bit is set after 10^5 hours.

11.2.8 Profile version

The profile version of the encoder is stored in the diagnostic bytes 24 and 25.

Bytes	24	25
Bit	15...8	7...0
Data	$2^7...2^0$	$2^7...2^0$
	Revision no.	Index

11.2.9 Software version

The software version of the encoder is stored in the diagnostic bytes 26 and 27.

Octet	26	27
Bit	15...8	7...0
Data	$2^7...2^0$	$2^7...2^0$
	Revision no.	Index

11.2.10 Operating time

The operating time of the device is recorded in the diagnostic bytes 28...31. While the supply voltage is applied, the value (Operating time) is stored again in the encoder in steps of 0.1 every 6 minutes.

11.2.11 Zero point shift

The zero point shift is provided in the diagnostic bytes 32...35.

11.2.12 Configured resolution

The configured resolution per revolution of the encoder is stored in the diagnostic bytes 40...43. This value is only valid if the gearbox factor was calculated in the parameter mask via the setting [Resolution per revolution].

11.2.13 Configured total resolution

The configured or calculated total resolution is stored in diagnostic bytes 44...47.

11.2.14 Serial number

According to the encoder profile, diagnostic bytes 48...57 are intended for a serial number. At the moment the serial number is not stored in the device; the bytes are pre-assigned with 2A hex.

12 LED indicators

UK

12.1 Legend

☀	LED on / lit	The terminal cap has two LEDs that optically represent the bus status on the encoder.
✹	LED flashes	The red LED is used to display errors; the green LED to display the status of the encoder. Each LED has three states: off, on, flashing. Seven of the nine possible combinations are used to display a certain state.
○	LED off	Should there be problems during start-up of the device, the status of the LEDs is to be checked; it often gives information about the cause of the fault.

Colour	Status / frequency	Colour	Status / frequency	Description
Red	○	Green	○	No voltage supply
	☀ (red)		☀ (green)	The encoder is operational but has not received any configuration data after the voltage was applied. Possible causes: Address incorrectly set; bus cables incorrectly connected.
	☀ (red)		✹ (green)	Parameter setting or configuration fault. The encoder receives configuration or parameter setting data of an incorrect size or inconsistent data. Possible cause: e.g. total resolution is set too high
	✹ (red)		☀ (green)	The encoder is operational but is not addressed by the master (e.g. incorrect address is addressed).
	☀ (red)		○	The encoder does not receive any data for a longer time (approx. 40 s) (e.g. data line interrupted)
	○		☀ (green)	Normal operation in the data exchange mode
	○		✹ (green)	Set-up in the data exchange mode

13 Configuring with STEP7

In the following chapter the configuration of the ifm encoder with the configuration tool Hardware manager STEP 7 is shown as an exemple.

In the example the STEP 7 version 5.4 SP4 and the CPU 315-2PN/DP are used.

13.1 Installation and import of the GSD file

Prior to initial configuration of the system in the hardware configurator of the software, the GSD files of the encoder must be imported into the software.

Start the software and proceed as follows to import the above GSx files:

► Open new or existing project.

► Open hardware configurator

Copy the required GSx file via menu item [Options] → [Install GSD File...].
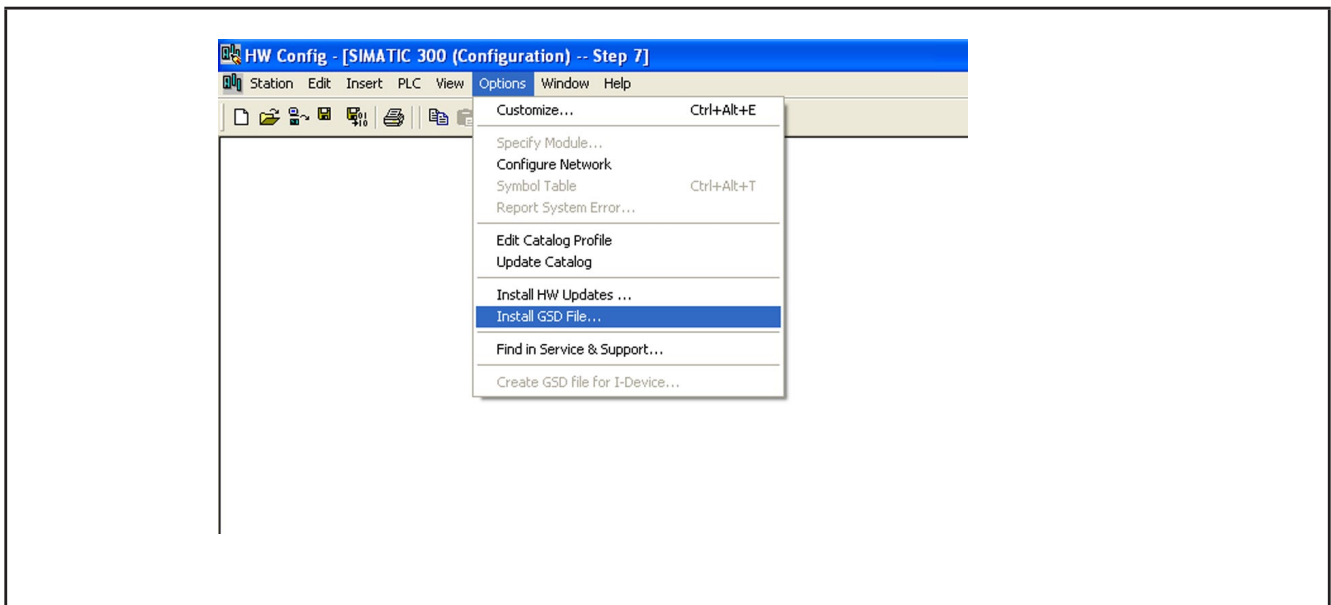
Importing a GSD file

The GSD file is supplied by ifm (free of charge on www.ifm.com).

In order to display the encoder as a bitmap in STEP7 the file will be installed automatically with the GSD file – both files must be in the same directory. The main software release number in the GSD file and the firmware must be the same, e.g. 4.xx.

► Select the GSD file from the according source directory.
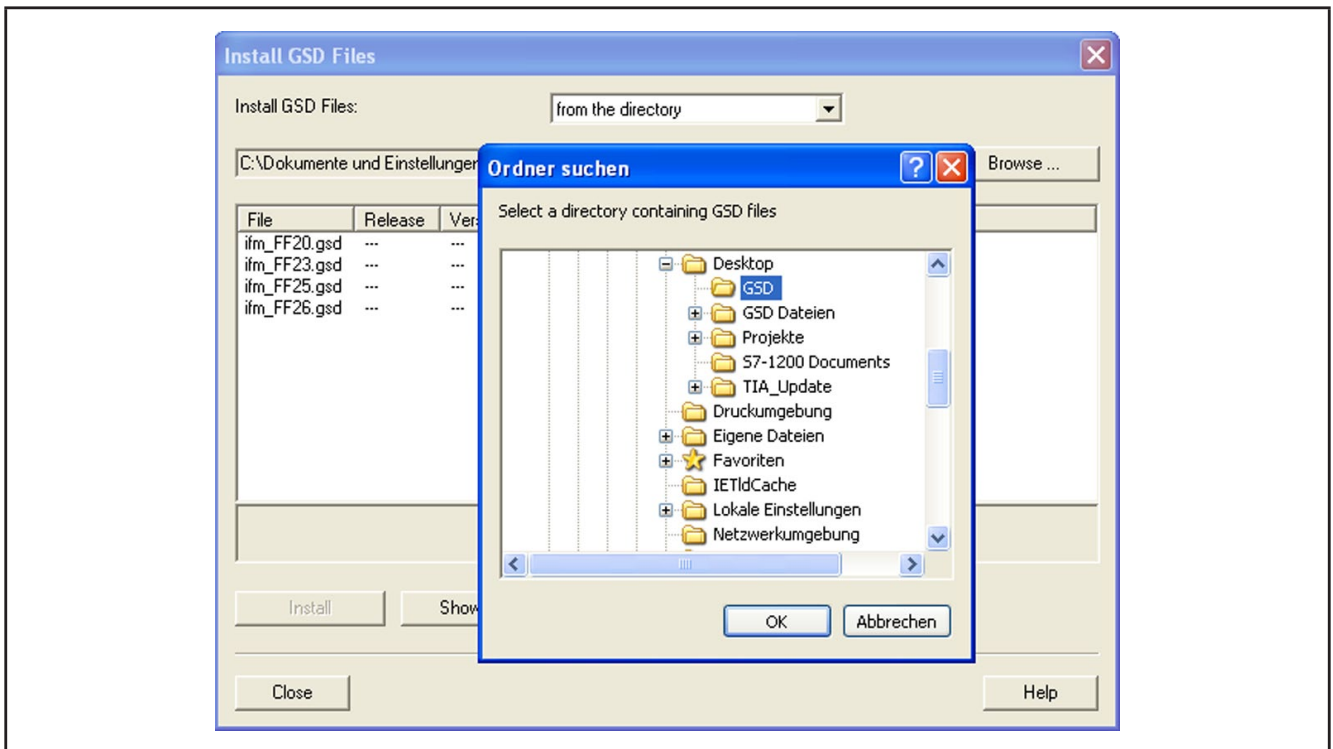
Selecting the GSD file from the directory

After correct import and an update of the hardware catalogue via [Options]
→ [Update Catalog] the modules will be displayed as separate entries in the
hardware catalogue.

> The exact configuration procedure can be found in the operating manual which is supplied together
> with the software.

13.2 Adding an encoder to a STEP7 project

To add an encoder to a project, the absolute encoder can be selected from the hardware catalogue and added to the network. The requested device is coupled to the bus by drag&drop (or double-click on the module with marked bus).

When the device has been added, the participant address of the slave device is entered. It must correspond with the address set in the terminal cap.
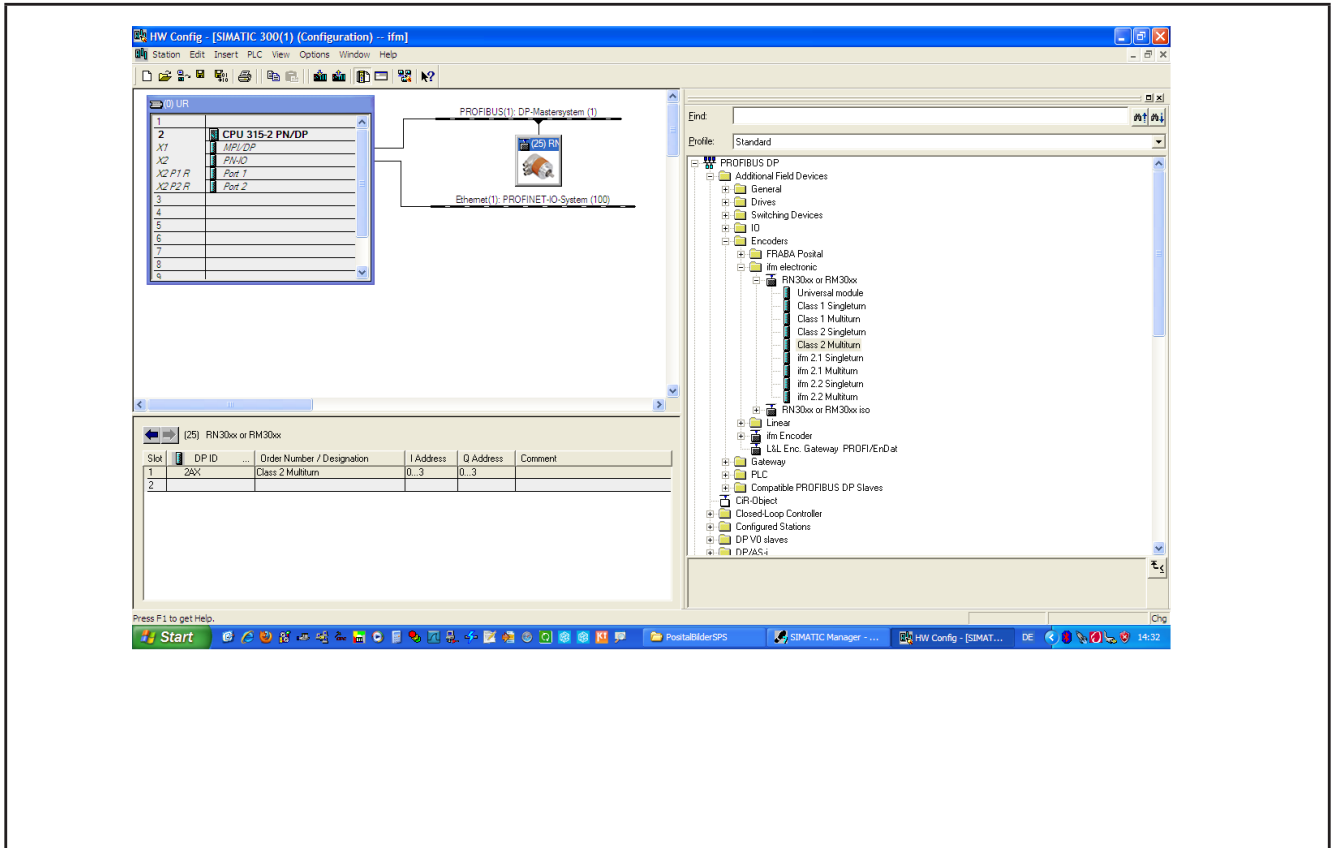

Adding an encoder to a STEP7 project

13.3 Parameter setting

Mark the encoder to be configured in projection and then doubleclick on location 1 (table in the lower area of the station window). The dialogue window [Properties DP slave] appears. Here the default address of the device can be changed (if requested).

► Select [Parameter Assignment] in the tab to enter the parameters.
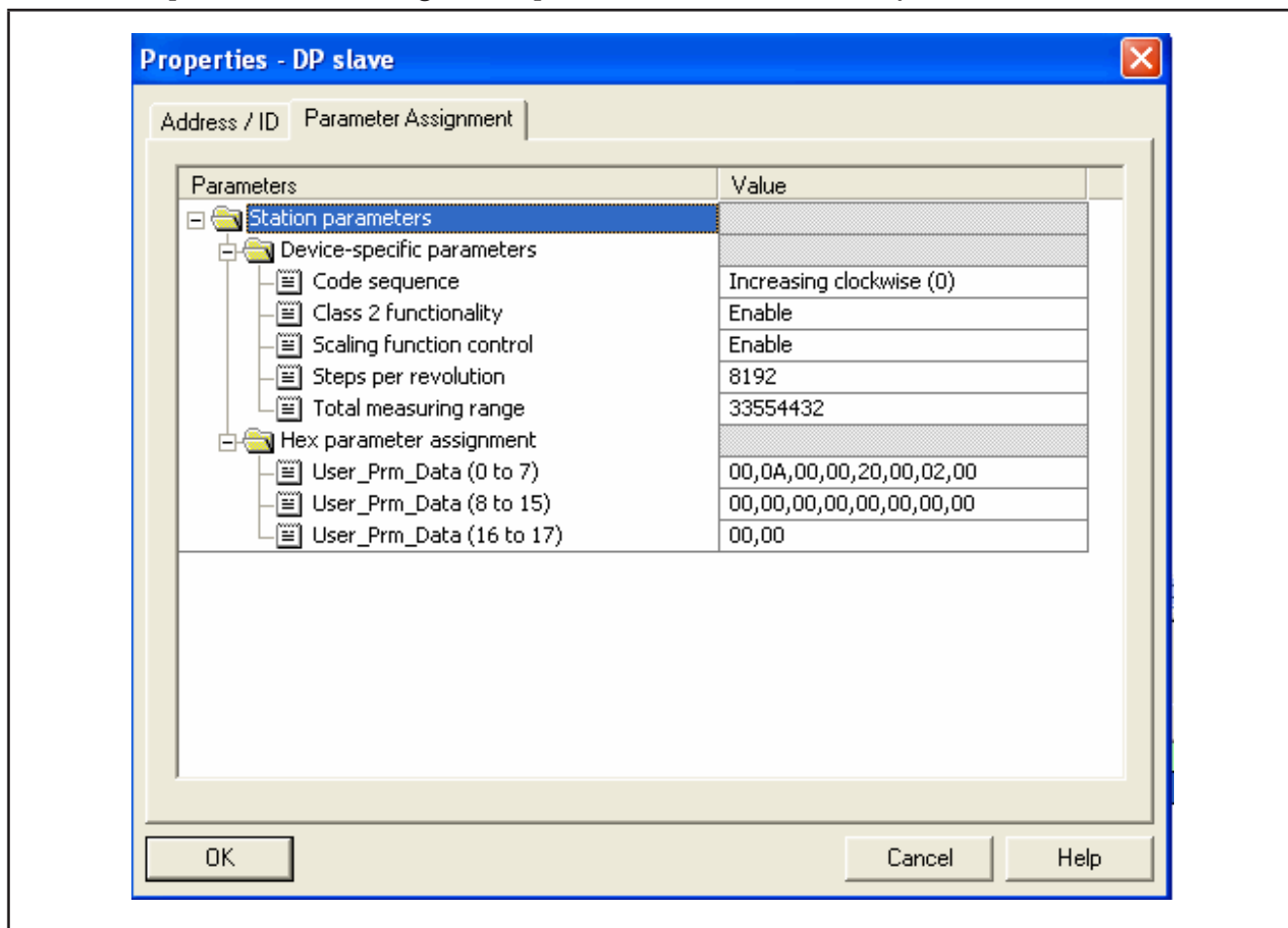
Parameter setting of the encoder