POSITAL

IXARC ABSOLUTE ROTARY ENCODER

PROFIsafe over PROFINET

User Manual

Translation of the Original Instructions

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GENERAL SECURITY ADVISE

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

Please Note

Electrical equipment should be serviced only by qualified trained personnel. No responsibility is assumed by FRABA B.V. for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

Relate Note

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1. Safety Instructions

1.1 Scope

This user manual is valid exclusively for the following absolute encoders with PROFINET interface:
PROFIsafe on PROFINET

1.2 Documentation

The following documents must be observed:

- The owner's system-specific operating instructions
- This user manual on CD, also on website as dowload
- Data sheet number MCS-EI on CD, also on website as dowload
- The connection assignment enclosed with the device
- Assembly instructions enclosed with the device

1.3 Proper Use

POSITAL's IXARC absolute encoders are used to measure angular positions and make their measured value available in the form of an electrical output signal. As part of a system, they have to be connected to the downstream electronics and must only be used for this purpose.

1.4 Commissioning

- The relevant device may only be set up and operated in combination with this and the documentation specified under point 1.2.
- Protect the device against mechanical damage during installation and operation.
- Device commissioning and operation may only be undertaken by a specialist electrician.
- Do not operate the device outside of the limit values specified in the data sheet.
- Check all electrical connections before commissioning the system.

2. General information

Encoder type MCS-EI is an electromagnetic rotary encoder with a PROFINET interface and PROFIsafe protocol. Thanks to additional internal monitoring measures, it is suitable for use in safety-technical applications up to SIL2 or PLd.

In addition to a safe position signal, the MCS-EI also supplies a safe speed signal. It offers the same parameterisation and diagnostic options as the standard PROFINET rotary encoders.

The PROFINET interface according to IEC 61158 / 61784 or PNO specifications, order Nos. 2.712 and 2.722 version 2.2, and the PROFIsafe protocol according to "PROFIsafe – Profile for Safety Technology on PROFIBUS DP and PROFINET IO", order Nos. 3.092 and 3.192 version 2.4, are integrated. PROFIsafe V2 mode is supported.

The specifications can be obtained from the profibus user organisation (www.profibus.com).

3. Installation

3.1 General Information

- During installation, observe the profinet assembly guideline PNO order No.: 8.071
- Use only certified profinet cables, connectors and switches (see "PROFINET Cabling and Interconnection Technology" PNO order No.: 2.252 and "Installation Guideline PROFINET Part 2: Network Components" PNO order No.: 2.252 p2)
- Hubs are not permissible.
- The cable length between two subscribers may be max. 100 m.
- POSITAL's MCS-EI absolute encoder possesses an integrated switch. This not only enables tree and star topologies but also the linear topology.
- Media redundancy protocol support enables the establishment of a redundant ring.
- The setting of addresses, the baud rate or terminating resistors on the device is not necessary.

3.2 Electrical Connection

Absolute encoders have separate connectors for the supply and the PROFINET system. Port 1 or port 2 are optionally available for the PROFINET connection. Due to the integrated switch, it is irrelevant which port is used.

Connection	Designation	Connector type
PROFINET	Port 1	M12x4 D-coded socket
PROFINET	Port 2	M12x4 D-coded socket
Voltage supply	24 VDC	M12x4 A-coded pins

Refer to data sheet for connector assignment and ordering information.

View of the rear side of the encoder

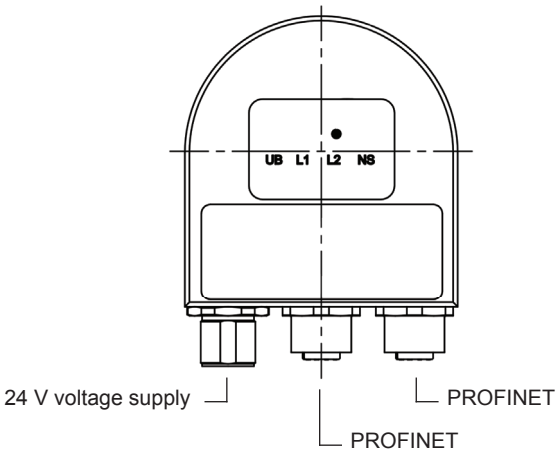


Fig.: 1

3.3 Status LEDs

Four LEDs are housed in the absolute encoder's connecting cap. These have the following meaning:

UB (VS)	Link 1 (L1)	Link 2 (L2)	Status (NS)	Description
green	green	green	green/red	
on				Operating voltage available
	on			Network connection established
		on		Network connection established
			green	Data exchange, device in operation and OK
			green flashing	Network connection o.k. but no connection to a PROFINET controler
			red, slow flashing	Firmware download mode
			red flashing	Impermissible parameter or preset value, velocity to high or wrong modul
			Fast red flashing	Device error
			red	Connection to the PROFINET controller disrupted

In **Chapter 7** diagnosis you can find all diagnosis data of the encoder type MCS-EI.

Flashing Codes

Errors which lead to encoder system standstill (hard errors) are indicated by a flashing code on the part of the red NS LED. Following introductory flickering by the red LED, a specific number of flashing cycles are output for the cause of the error.

	Number of flashing cycles (Duration approx. 1 s)	Error cause
Flashing code 1	1	F stack error
Flashing code 2	2	CRC error ROM
Flashing code 3	3	RAM/XRAM error
Flashing code 5	5	Programme sequence error
Flashing code 6	6	Power consumption too high

3.4 Project Planning

A device description file (GSD file) in the XML format GSDML and an image (bitmap) to integrate the absolute encoder into a project planning tool are available in the internet under **www.posital.com**

File name of the GSD file: GSDML-V2.3-FRABA-MCS-20150608.xml
(The version and date may varydepending on the status of the GSD file.)

File name of the bitmap: GSDML-0110-4711-FRABA_MCS.bmp

Project planning using the example of Step7 is explained in the following chapter.

4. Project Planning with Simatic Step7

4.1 Step7, Distributed Satety − Simatic Manager

This chapter explains the procedure for integrating the FRABA MCS-EI absolute encoder into the PROFINET network of a Siemens S7 control system with Step7 version 5.5. and Distributed Safety version 5.4

4.1.1 Prerequisites

You have created a hardware configuration in accordance with your control system structure and a PROFI-NET sub-network.

This is shown here using the example of a CPU314C:

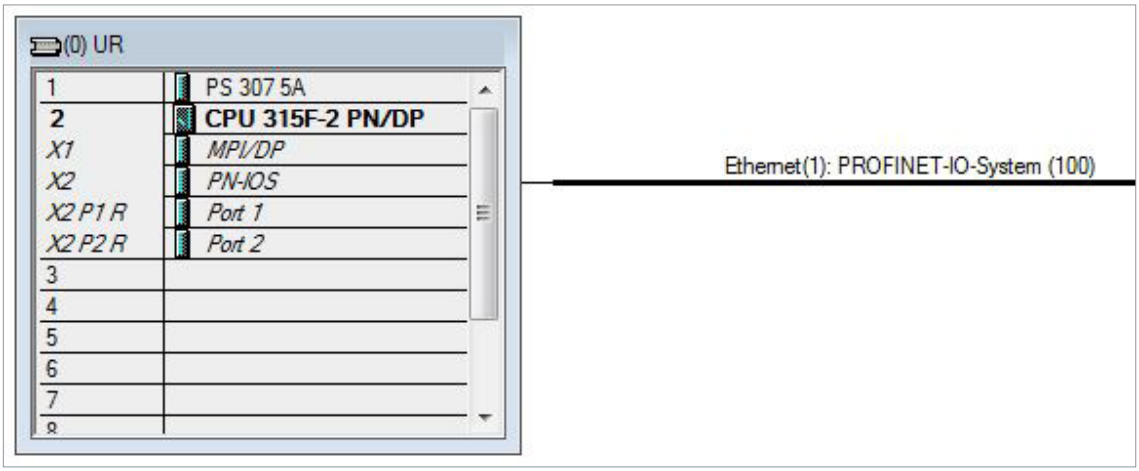


Fig.: 2

4.1.2 Installation of the GSD file

- Under Extras in the hardware configuration, select **Install GSD files**.
- Set "from the directory", "browse" to your GSD file and click on "Install" (see Figure 3).
- The absolute encoder symbol is also installed automatically, provided that it is in the same directory

Note: The GSD file and the encoder symbol are available for download under **www.posital.com**.

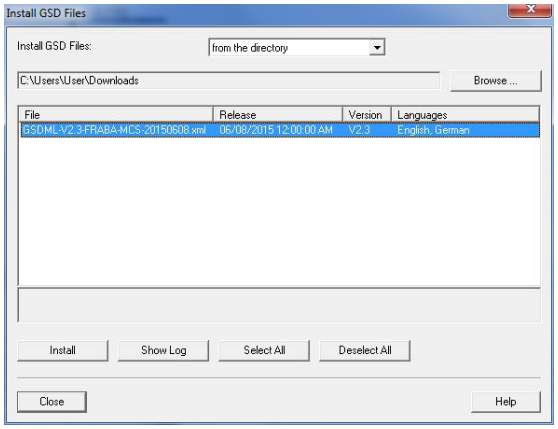


Fig.: 3

After installing the GSD file, the hardware catalogue is automatically updated. The MCS-EI absolute encoder is located under **Additional Field Devices, Encoders, POSITAL MCS, MCS.**

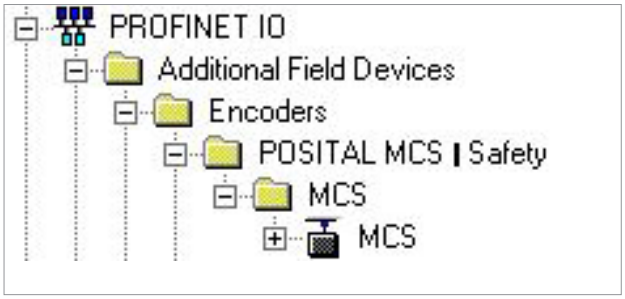


Fig.: 4

4.1.3 Installing the absolute encoder

Now drag the POSITAL encoder onto your PROFINET system using the mouse.

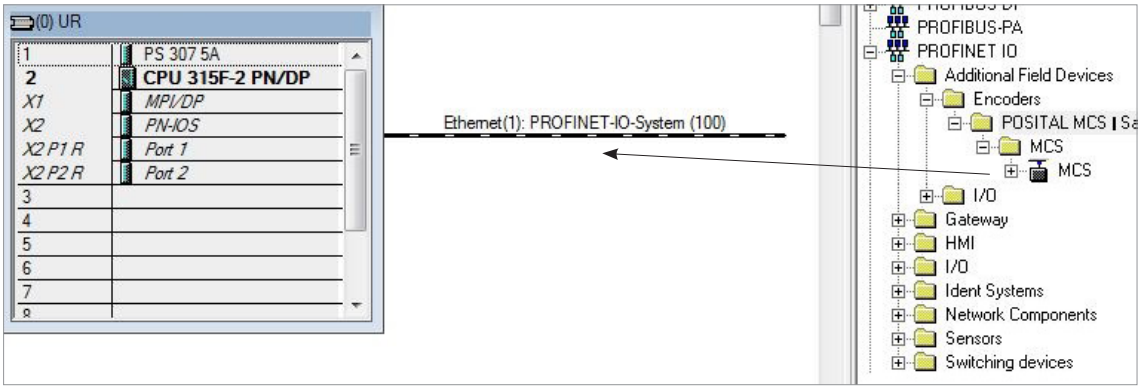


Fig.: 5

The absolute encoder's PROFINET interface is then installed together with its default values. The module corresponding to the absolute encoder then has to be installed.

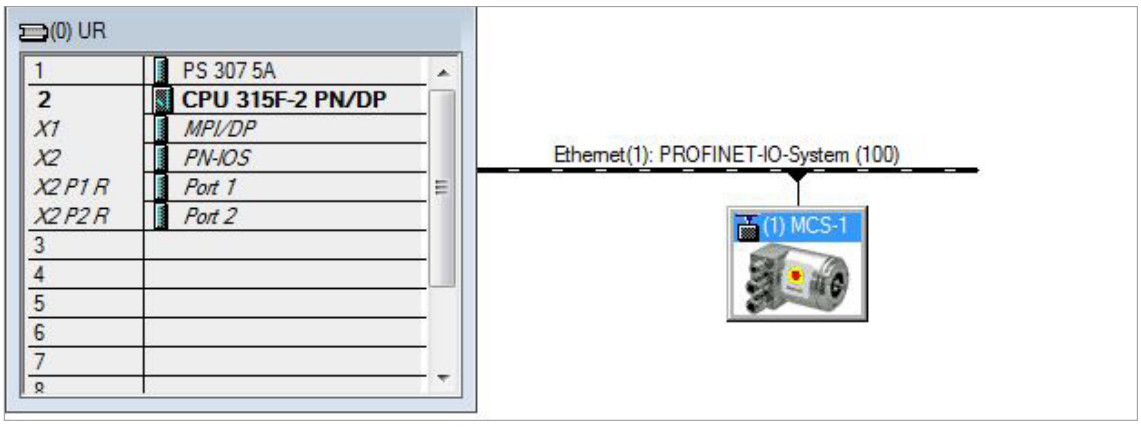


Fig.: 6

4.1.4 Install Module

For the encoder MCS there are modules with a measuring range of 24 and 25 bit and different data formats available. The measurings range and the data format is defined by the encoder type.

Module	Functionality
MCS-EIDDB-1212-xxxx-xxx	Safe position (24 bit, 2x integer16), safe speed, preset
MCS-EIDTB-1212-xxxx-xxx	Safe position (24 bit, 1x integer32), safe speed, preset (module not useable in Distributed Safety)
MCS-EIDDB-1213-xxxx-xxx	Safe position (25 bit, 2x integer16), safe speed, preset
MCS-EIDDB-1213-xxxx-xxx	Safe position (25 bit, 1x integer32), safe speed, preset (module not useable in Distributed Safety)

Now drag the module corresponding to your absolute encoder to slot one in the module list using the mouse.

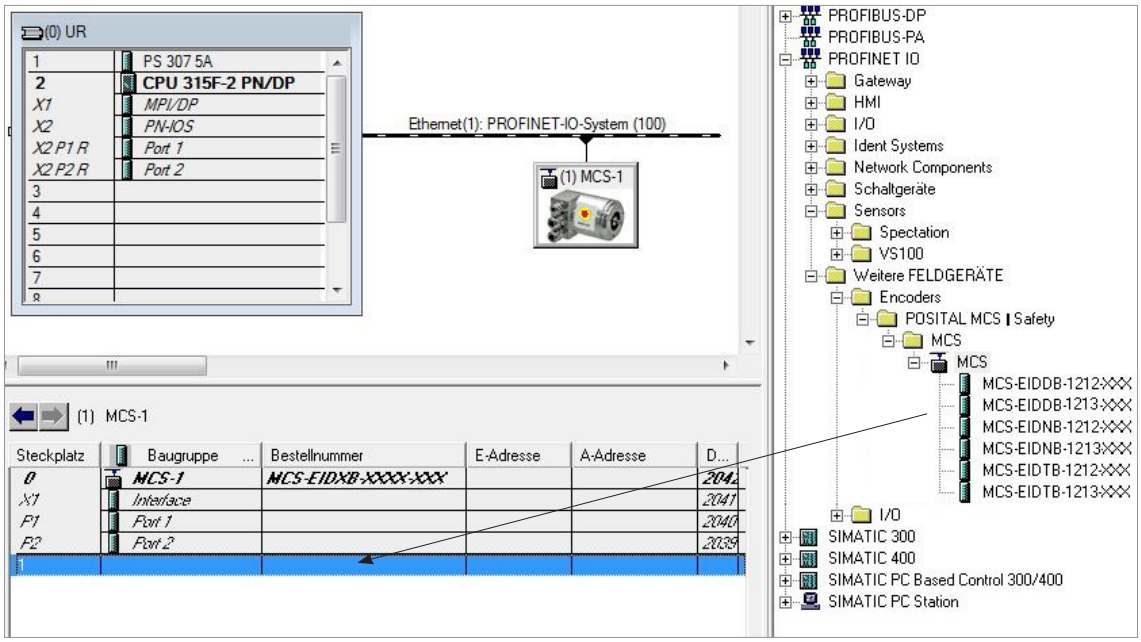


Fig.: 7

The network data can be set by double-clicking onto the absolute encoder symbol (see **Chapter 4.1.5**), and the I/O address plus the absolute encoder parameters can be set by double-clicking onto the line "Slot 1" (see **Chapter 4.1.6**).

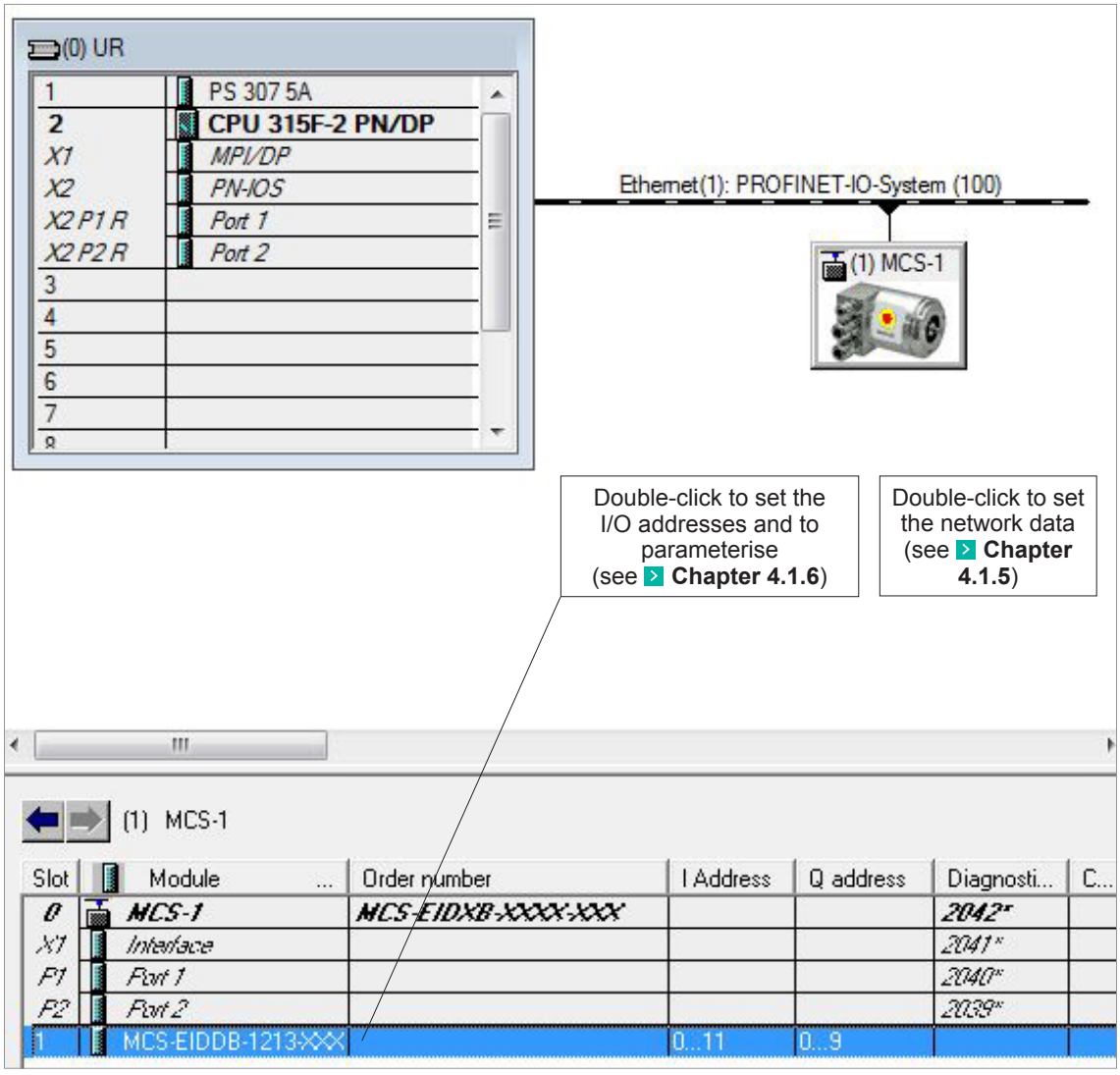


Fig.: 8

4.1.5 Setting the Network Data (Properties MCS)

The following dialogue appears by double-clicking onto the absolute encoder symbol (or via the absolute encoder's context menu). Enter a name which is unique throughout the network to identify the device here. The controller expects this name when the device logs in. The default name is MCS-1.

In the MCS/S3, the Profisafe address must be added to the name. To do this, attach a number between 1 and 65,535 to the end (a special separator between the Profinet name and Profisafe address is not necessary). This must then be entered for F_Dest_Add under the F parameters (see **Chapter 4.1.6.3**).

The name assigned here must either be manually allocated to the absolute encoder (see **Chapter 4.1.9**) or it can be assigned automatically by the controller using the topology editor (see **Chapter 4.1.8** Planning of "Device exchange without programming device" and "Automatic commissioning").

The device name is stored in the absolute encoder, where it is protected against zero voltage. An installed device can be exchanged with a brand new device without a programming device or exchanging a memory card. The correct name is automatically assigned to the new absolute encoder by the controller. To do this, however, the prerequisites under **Chapter 4.1.8** have to be met.

If the tick in front of "IP address assignment by IO controller" is set, the controller automatically assigns an IP address to the device which contacts it with this name. Manually setting an address as is usual in the case of previous field bus systems is not necessary.

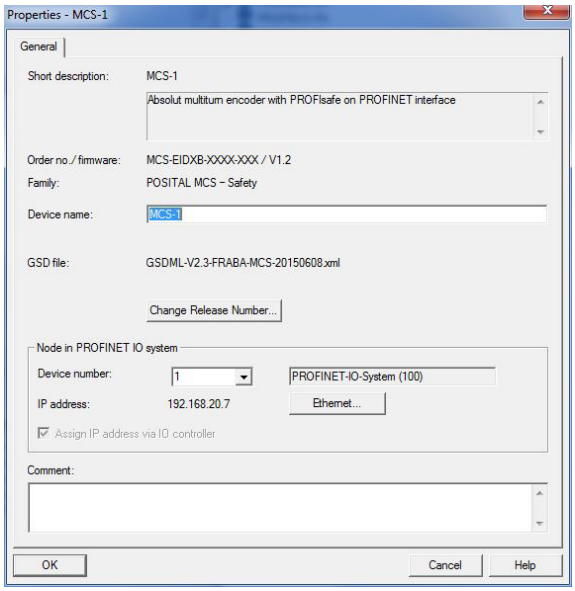


Fig.: 9

4.1.6 Setting the Absolute Encoder (Properties of the Module)

4.1.6.1 Setting the I/O Address

The dialogues for setting the I/O address and for setting the absolute encoder parameters and F-Parameters can be accessed by double-clicking the installed module (slot 1 line) or via the module's context menu.
Set the address for the input data position, velocity and status and the address for the output data control and preset in the "Addresses" tab. (See **Chapter 5** for the data format).

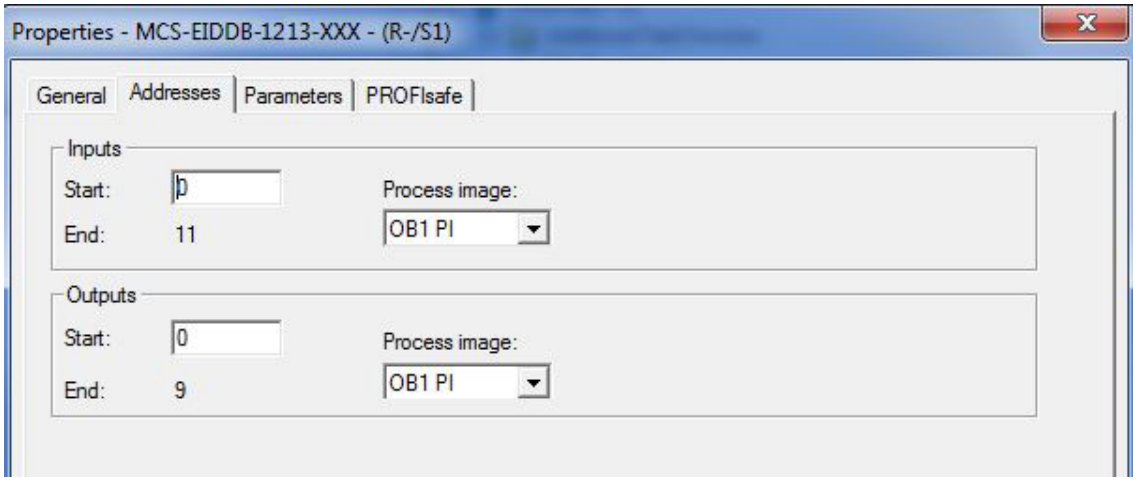


Fig.: 10

4.1.6.2 Parameterising the Absolute Encoder

The absolute encoder's parameters can be changed in the "Parameters" tab. An explanation of the parameters can be found in **Chapter 6**. After changing the encoder parameters the checksum has to be re-calculated and entered under the F-parameters (see next chapter).

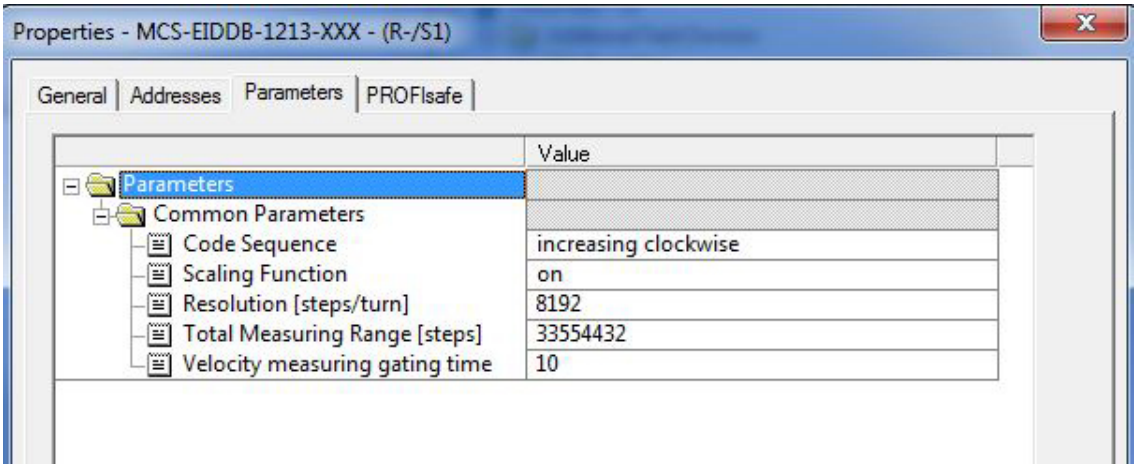


Fig.: 11

4.1.6.3 Setting the F Parameters

The F parameters must be set in the "PROFIsafe" tab. Here, the Profisafe address attached to the Profinet name must be set under "F_Dest_Add" and a watchdog time corresponding to your system must be specified under "F_WD_Time". "F_Source_Add" is assigned automatically by the S7

Once you have changed the rotary encoder parameters, the checksum must be recalculated using these so-called i parameters and must be entered under "F_iPar_CRC". POSITAL provides you with the PsCRC programme for calculating the F_iPar_CRC (see Fig. 12).
An explanation of all F parameters can be found in **Chapter 6.2**.

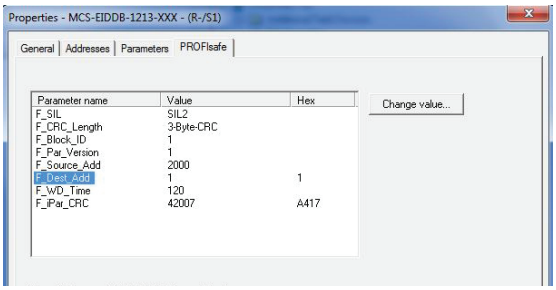


Fig.: 12

The PsCRC programme for calculating the F_ iPar_CRC is available for downloading in the Internet under **www.posital.com**, documentation area.

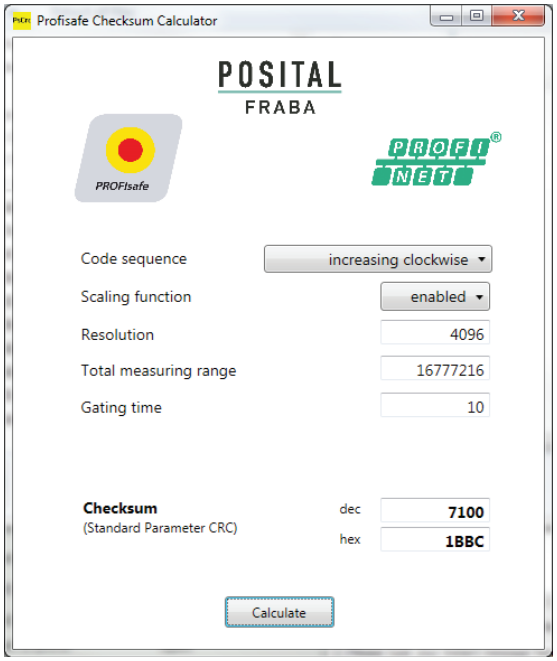


Fig.: 13

4.1.7 Setting Real Time Mode and the Updating Time

The following dialogues are accessed via the PROFINET system's context menu:

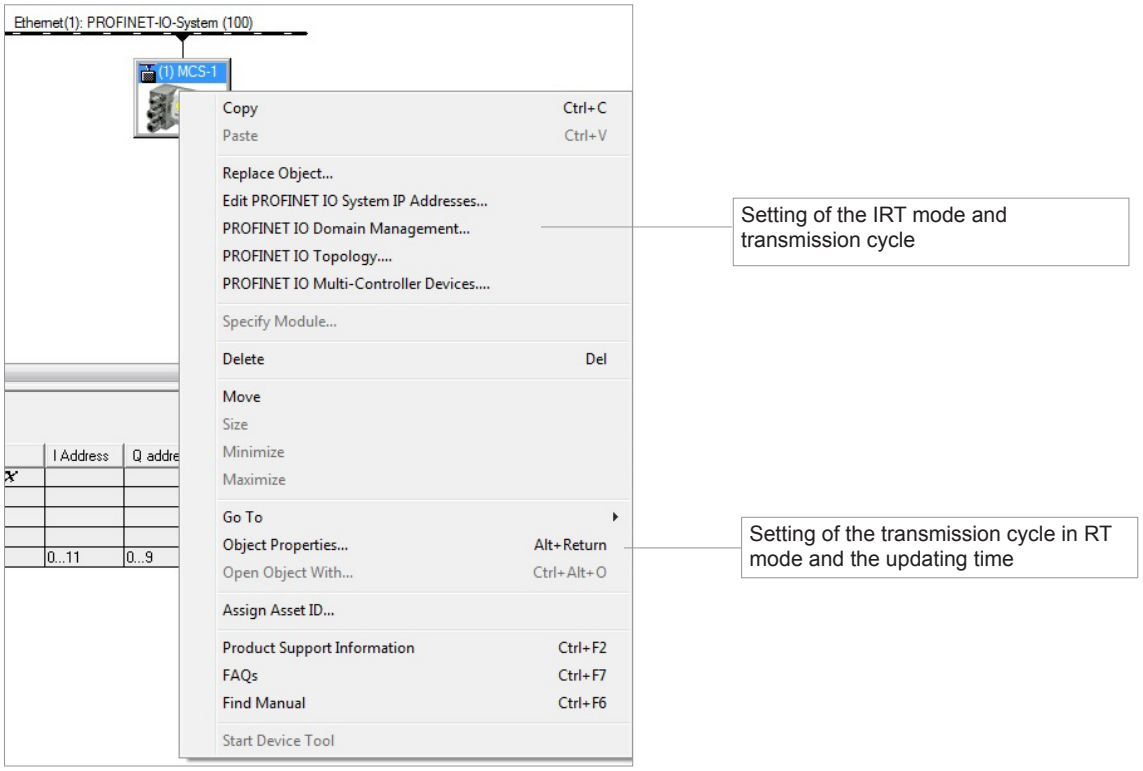


Fig.: 14

Set the transmission cycle and the desired updating time in the corresponding dialogue. Alternatively, the updating time can also be set via the interface's object properties. The default value is 2 ms for the updating time and 1 ms for the transmission cycle. The minimum updating time for the MCS is 250 µs.

4.1.8 Planning of "Device exchange without programming device" and "Automatic commissioning"

If system restarting without the assignment of a new device name or the IP address is to be possible following the exchange of an installed absolute encoder with a mint condition device, this must be taken into consideration during project planning. This also applies to "Automatic commissioning", in which the manual and, in the case of larger projects, time-consuming assignment of the device name (as described in **Chapter 4.1.9**) is avoided during commissioning.

The following prerequisites have to be met:

- The controller and the devices must support the function "Device exchange without interchangeable medium or programming device" (for the latter, at least the device itself and its neighbouring devices). The MCS supports this function.
- The function "Device exchange without interchangeable medium" must be activated in the controller. This is the default setting.
- The devices must be in delivery condition, i.e. they must not yet possess any device name.

Now call the topology editor using the PROFINET system's context menu (see Fig. 12) and define all PROFINET connections between the subscribers. If the project is now loaded into the control system and the actual structure corresponds to the planned topology, all subscribers receive their planned names from the controller and device exchange succeeds without the reassignment of the device name.

4.1.9 Assignment of the Device Name

If a PROFINET topology has not been defined as described in **Chapter 4.1.8** or if the prerequisites for automatic commissioning are not met, the absolute encoder name must be assigned manually.

With the absolute encoder connected and the programming device connected to the control system, select "Target system -> Edit Ethernet subscribers" in the Simatic Manager to do this. Press the "Browse" button in the subsequent dialogue. All accessible PROFINET subscribers should now be shown as portrayed in the example in Figure 15.
It can be seen that the absolute encoder device type MCS does not possess either a valid IP address or a name. Now mark the absolute encoder and exit the dialogue with OK.

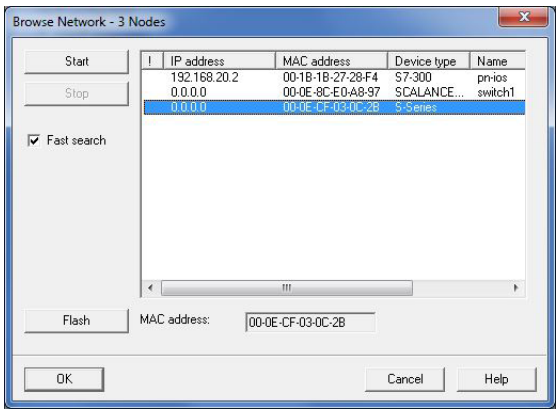


Fig.: 15

In the subsequent dialogue, enter the device name, that who have assigned for this encoder in the project planning (see **Chapter 4.1.5**) and click onto the "Assign name" button. The device name is then stored in the absolute encoder, where it is protected against zero voltage.
The absolute encoder now logs onto the controller with its device name and is then provided with a valid IP address by the controller. This is also stored in the absolute encoder, where it is protected against zero voltage.

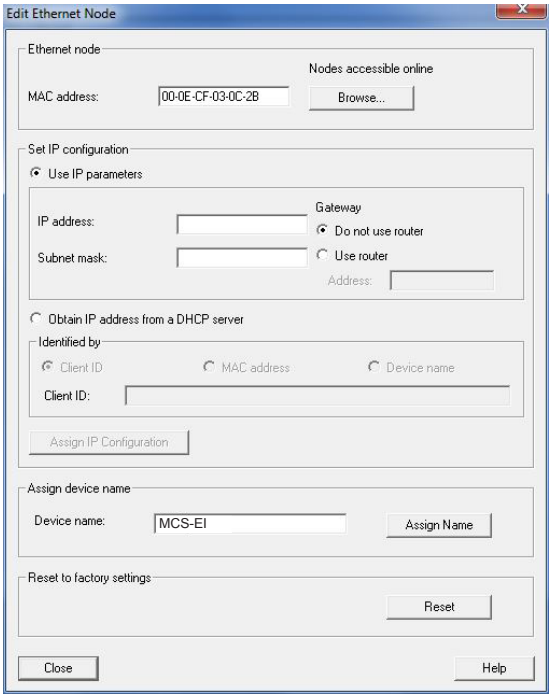


Fig.: 16

4.1.10 Resetting to the Default Settings

The absolute encoder can be reset to its delivery condition using the "Reset" button in the "Edit Ethernet subscribers" dialogue (Figure 16).

The following are reset	Delivery condition
Parameters	See **Chapter 6.1** for default values
Offset	0 (i.e. the preset setting is undone)
Device name	Empty
IP-parameters	All 0
I&M0-revision counter	0

After resetting, the connection to the profinet controller is closed and the NS LED lights up red. After switching the voltage off/on, the connection can be re-established by assigning the device name.
If the connections have been defined using the topology editor, the MCS restarts automatically with the name assigned during project planning.

4.2 Step7, Safety Advance – TIA-Portal

This chapter explains the procedure for integrating the POSITAL MCS absolute encoder into the PROFINET network of a Siemens S7 control system with Step 7 Professional V13 with Safety Advanced.

4.2.1 Prerequisites

You have created a hardware configuration in accordance with your control system structure and a PROFINET sub-network. This is shown here using the example of a CPU314C:

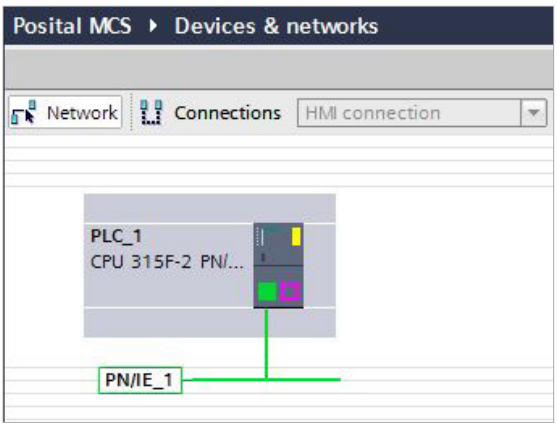


Fig.: 17

4.2.2 Installation of the GSD File

- In the main menu choose **Options**, **Install general station description file (GSD)**.
- Set the source path to your GSD file, check the GSD file and click on "Install" (see Figure 3).
- The absolute encoder symbol is also installed automatically, provided that it is in the same directory

Note: The GSD file and the encoder symbol (bitmap) are available for download under **www.posital.com.**

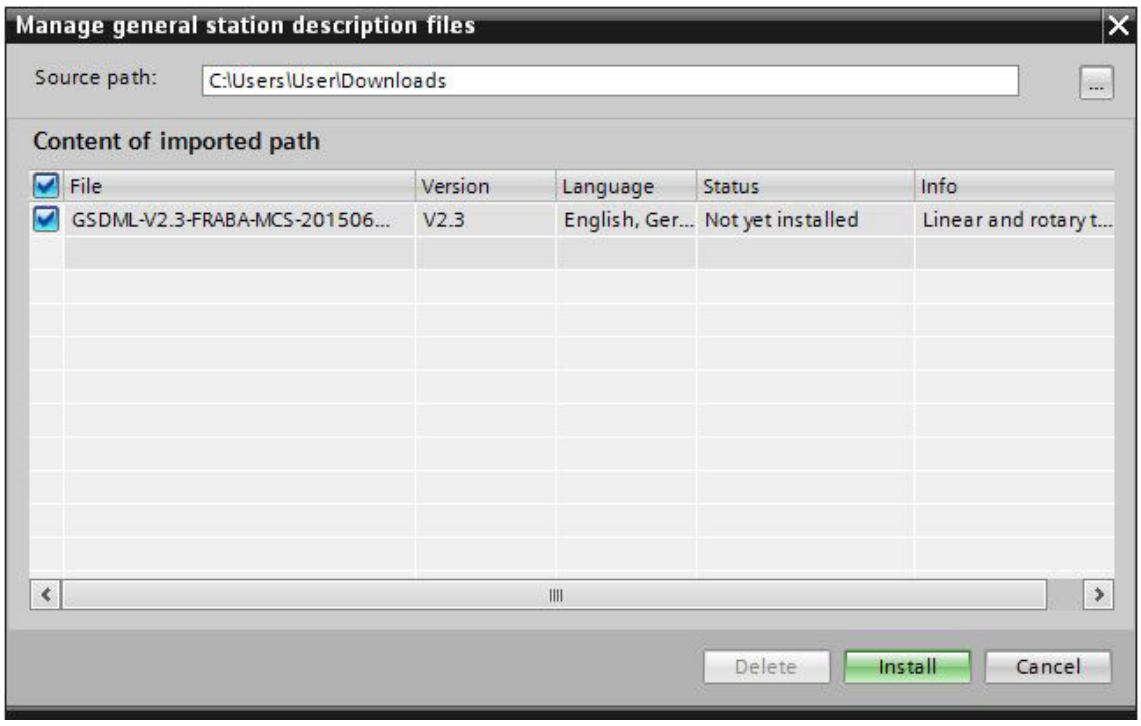


Fig.: 18

After installing the GSD file, the hardware catalogue is automatically updated. The MCS absolute encoder is located under **further FIELD DEVICES, PROFINET IO, Encoders, FRABA B.V., MCS**

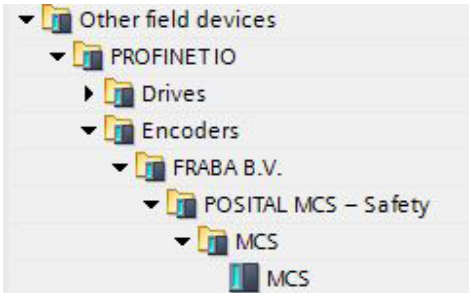


Fig.: 19

4.2.3 Installing the Absolute Encoder

Now drag the MCS-EI encoder form the hardware catalog in the netview of your project.

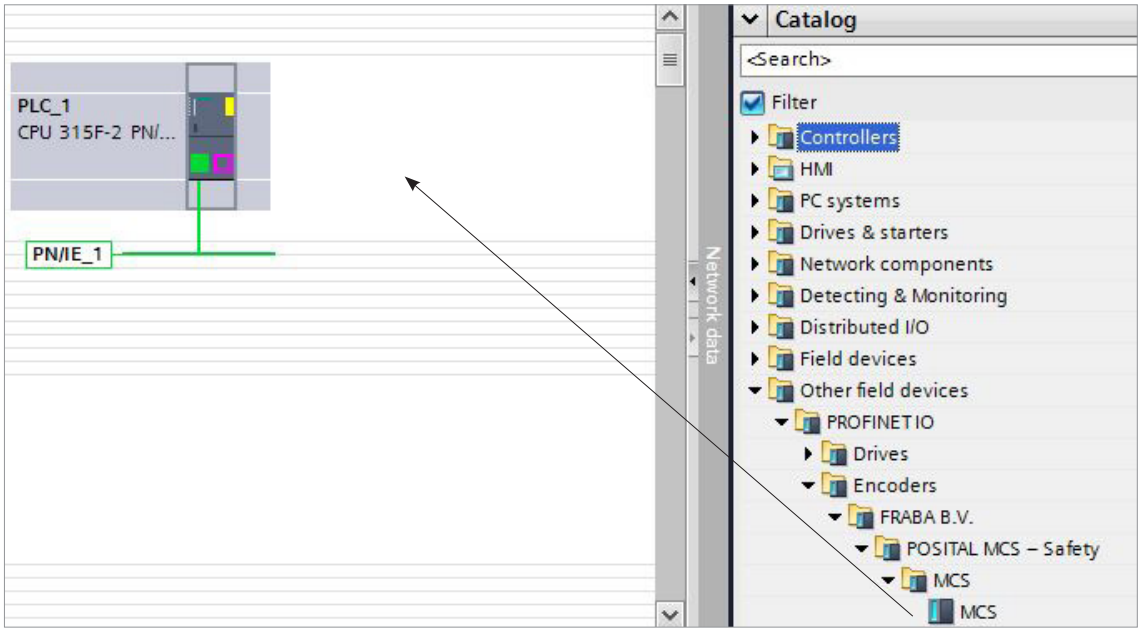


Fig.: 20

Afterwards click on "Not assigned" and assign the encoder to the PROFINET interface of your CPU or draw a network connection from the encoder to the CPU port with your mouse.

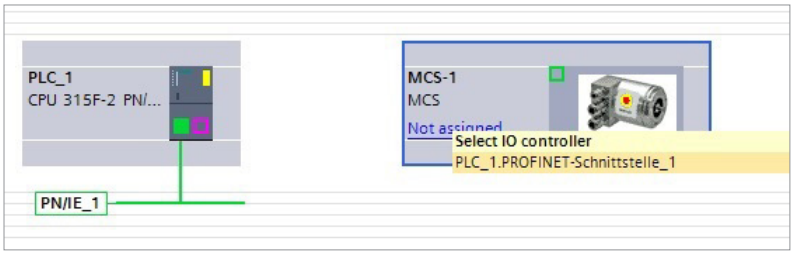


Fig.: 21

The encoder's PROFINET-Interface is now installed with its default values.

4.2.4 Install Module

To install the encoder module change to the **Device view** and drag the module corresponding to you encoder to the first free slot of the module list.

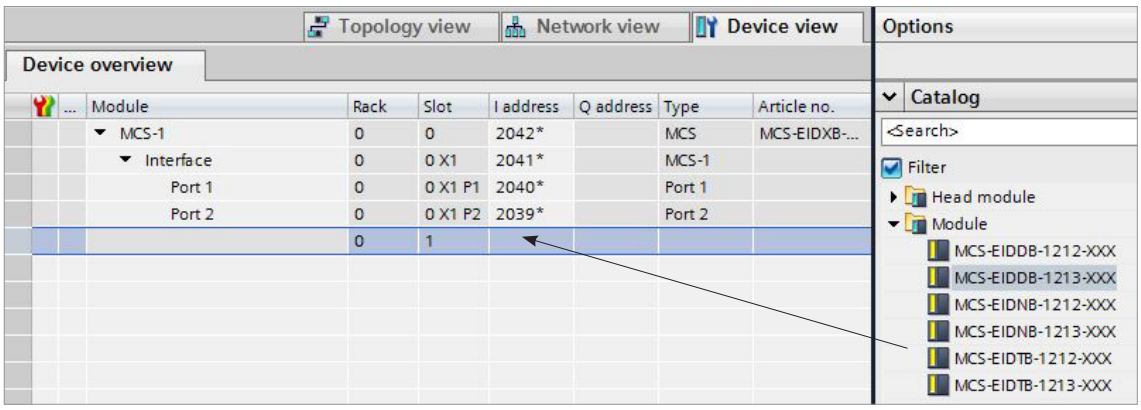


Fig.: 22

For the encoder MCS-EI there are modules with a measuring range of 24 and 25 bit and different data formats available. The measurings range and the data format is defined by the encoder type.

Module	Functionality
MCS-EIDDB-1212-xxxx-xxx	Safe position (24 bit, 2x integer16), safe speed, preset
MCS-EIDTB-1212-xxxx-xxx	Safe position (24 bit, 1x integer32), safe speed, preset (module not useable in Distributed Safety)
MCS-EIDDB-1213-xxxx-xxx	Safe position (25 bit, 2x integer16), safe speed, preset
MCS-EIDDB-1213-xxxx-xxx	Safe position (25 bit, 1x integer32), safe speed, preset (module not useable in Distributed Safety)

In the properties of the installed module you can then set the I/O address and the encoder parameters (see next chapter).

4.2.5 Setting the Network Data

Select the encoder in the Device view to show the properties of the PROFINET interface of the MCS.

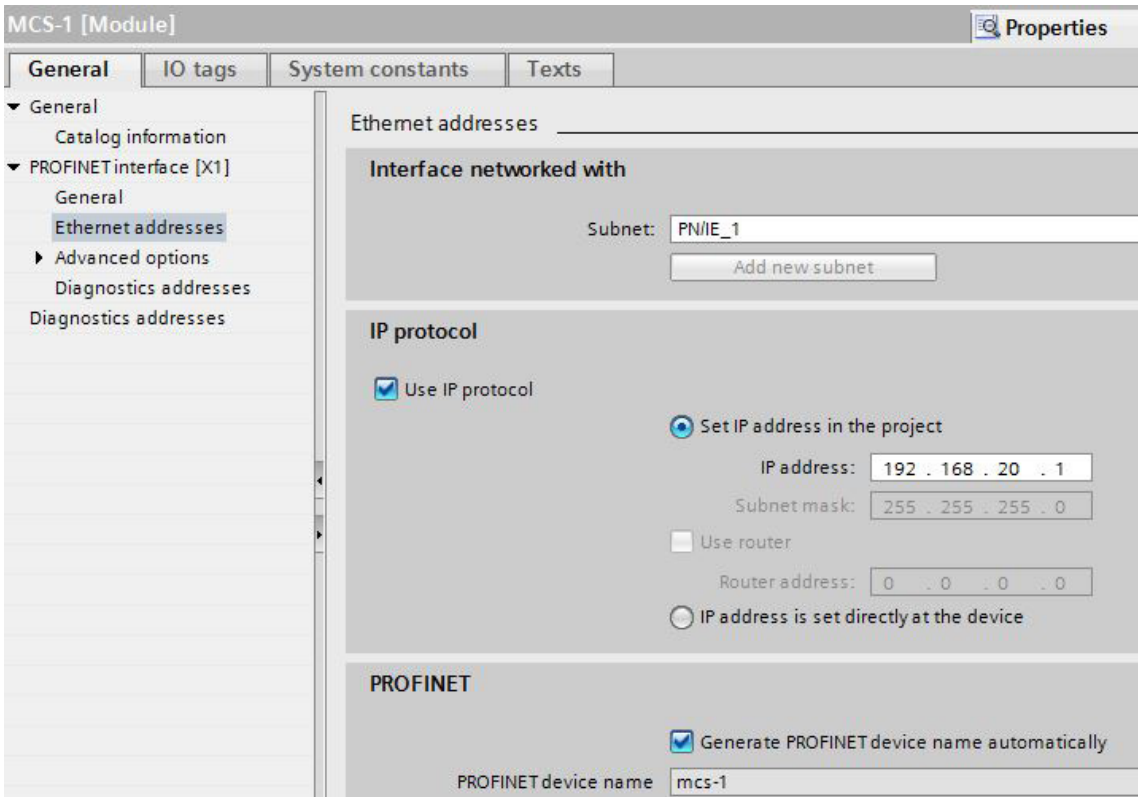


Fig.: 23

4.2.5.1 Setting the PROFINET / PROFIsafe Adresse

Under "General" enter the PROFINET name which must be unique throughout the network to identify the device. If Generate PROFINET device name automatically is selected the name which is entered under PROFINET interface - General will be registered here. The default name is MCS-1.

In the MCS, the Profisafe address must be added to the name. To do this, attach a number between 1 and 65,535 to the end (a special separator between the Profinet name and Profisafe address is not necessary). This must then be entered for F_Dest_Add under the F parameters (see **Chapter 4.2.6.3**).

The name assigned here must either be manually allocated to the absolute encoder (see **Chapter 4.2.8)** or it can be assigned automatically by the controller using the topology editor (see **Chapter 4.2.7** Planning of "Device exchange without programming device" and "Automatic commissioning").

The device name is stored in the absolute encoder, where it is protected against zero voltage. An installed device can be exchanged with a brand new device without a programming device or exchanging a memory card. The correct name is automatically assigned to the new absolute encoder by the controller. To do this, however, the prerequisites under **Chapter 4.2.7** have to be met.

4.2.5.2 IP-Adresse

Under "PROFINET interface - Ethernet addresses - IP protocol" the boxes **Use IP protocol** and **Set IP address in the project** should be checked. Step7 automatically assigns an IP address when inserting the device in the project. Manually setting of the IP address is also possible.

4.2.5.3 Prioritized Startup, Media Redundancy, Update Time and Synchronisation

Via the interface option Prioritized startup the startup time of the MCS from power on until PROFINET I/O data exchange can be reduced from approx. 10s to 5s. However, this can only be achieved as of the second startup.

The MCS can be used as member (client) in a redundant ring. In case of a line topology one network cable from the last client to the controler (manager) is necessary only to achieve a redundant communication. Be-vor setting the **media redundancy role** of the MCS a MRP domain has to be created and the MRP manager (normally the controler) to be assigned.

Under "PROFINET interface", "Advanced options", "Real time settings" the desired **Update time** of the MCS can be set. The possible values depend on the setting of the send clock of the CPU. The minimal update time for the MCS is 250 µs.

The desired real time class can be set under **Synchronisation**. The MCS supports the classes RT and IRT.

4.2.6 Setting the Absolute Encoder (Properties of the Module)

4.2.6.1 Setting the I/O Address

After switching to the device view of the MCS and selecting slot 1 in the device overview the properties of the module can be accessed.

Set the PLC addresses for the input data (position, speed and status word) and for the output data (preset and control word) under I/O addresses (see **Chapter 5** for the data format).

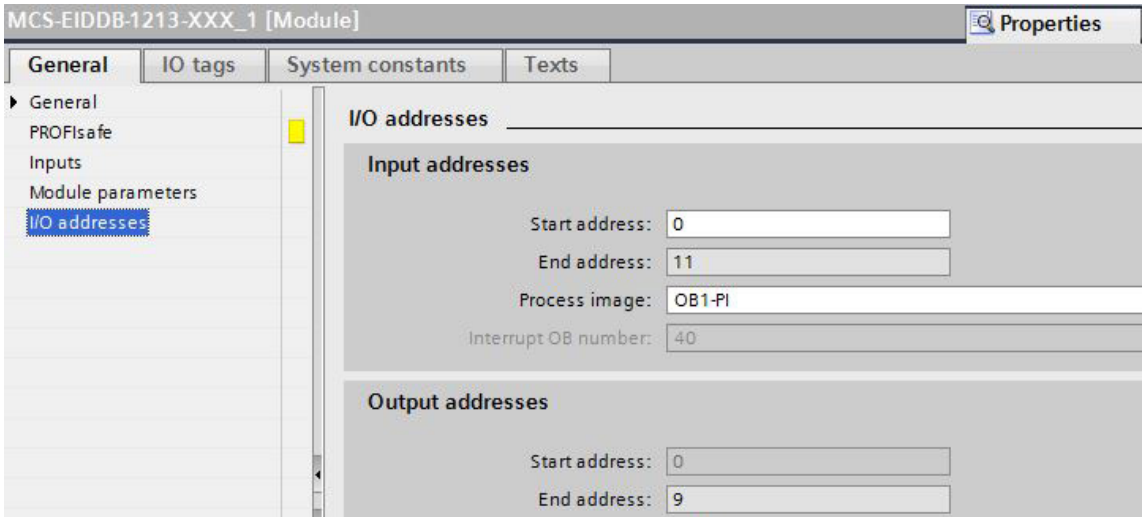


Fig.: 24

4.2.6.2 Parameterising the Absolute Encoder

The absolute encoder's parameters can be changed in the "Module parameters" tab. An explanation of the parameters can be found in **Chapter 6**. After changing the encoder parameters the checksum has to be re-calculated and entered under the F-parameters (see next chapter).

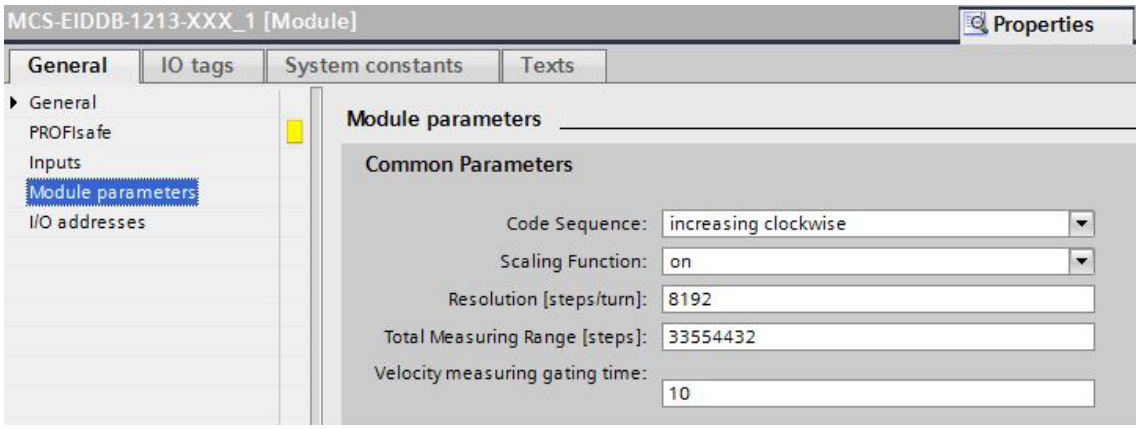


Fig.: 25

4.2.6.3 Setting the F Parameters

The F parameters must be set in the "PROFIsafe" tab. Here, you have to set the Profisafe address attached to the Profinet name under "F_Dest_Add" and to specify a watchdog time corresponding to your system under "F_WD_Time"or you to take over the automatic setting . "F_Source_Add" is assigned automatically by the S7

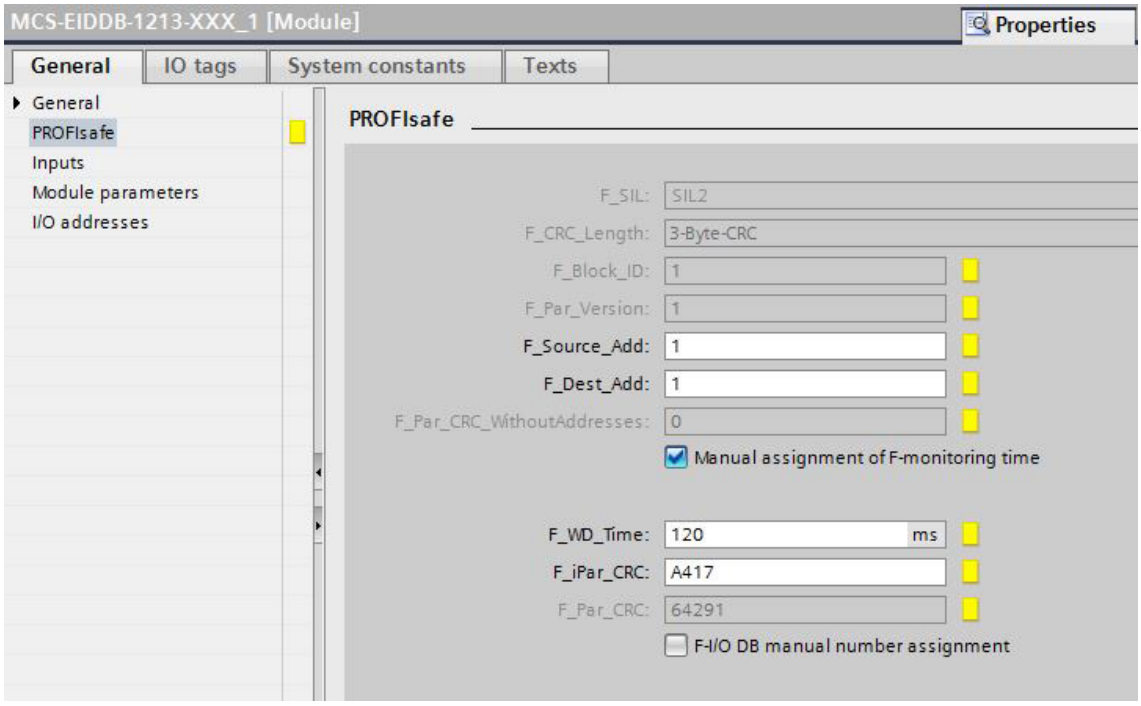


Fig.: 26

At the bottom of this window you can see the number and the symbolic name of the F-IO data block of this encoder assigned by Step7.

Once you have changed the rotary encoder parameters, the checksum must be recalculated using these so-called i parameters and must be entered under "F_iPar_CRC". POSITAL provides you with the PsCRC programme for calculating the F_iPar_CRC (see Fig. 27).

It can be downloaded from the internet under **www.posital.com**.

An explanation of all F parameters can be found in **Chapter 6.2**.

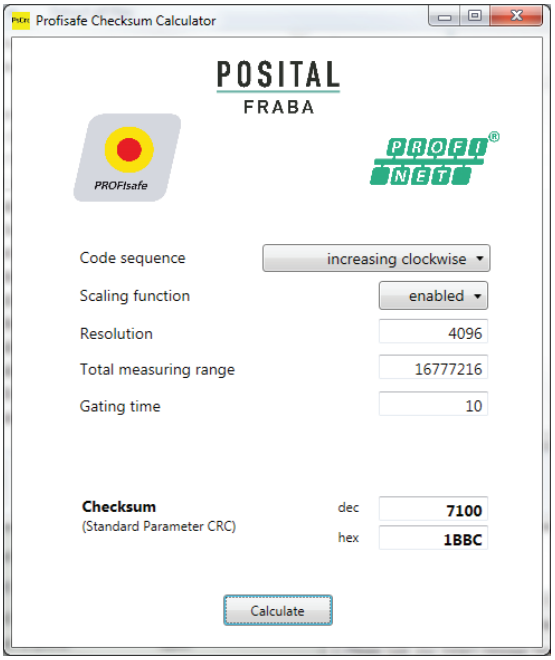


Fig.: 27

4.2.7 Planning of "Device exchange without programming device" and "Automatic commissioning"

If system restarting without the assignment of a new device name or the IP address is to be possible following the exchange of an installed absolute encoder with a mint condition device, this must be taken into consideration during project planning. This also applies to "Automatic commissioning", in which the manual and, in the case of larger projects, time-consuming assignment of the device name (as described in **Chapter 4.2.8**) is avoided during commissioning.

The following prerequisites have to be met:

- The controller and the devices must support the function "Device exchange without interchangeable medium or programming device" (for the latter, at least the device itself and its neighbouring devices). The MCS supports this function.
- The function "Device exchange without interchangeable medium" must be activated in the controller. This is the default setting.
- The devices must be in delivery condition, i.e. they must not yet possess any device name.

Now call the topology editor using the PROFINET system's context menu and define all PROFINET connections between the subscribers.

If the project is now loaded into the control system and the actual structure corresponds to the planned topology, all subscribers receive their planned names from the controller and device exchange succeeds without the reassignment of the device name.

4.2.8 Assignment of the Device Name

If a PROFINET topology has not been defined as described in **Chapter 4.2.7** or if the prerequisites for automatic commissioning are not met, the absolute encoder name must be assigned manually.With the absolute encoder connected and the programming device connected to the control system, select "Assign device name" in the context menu of the PROFINET.

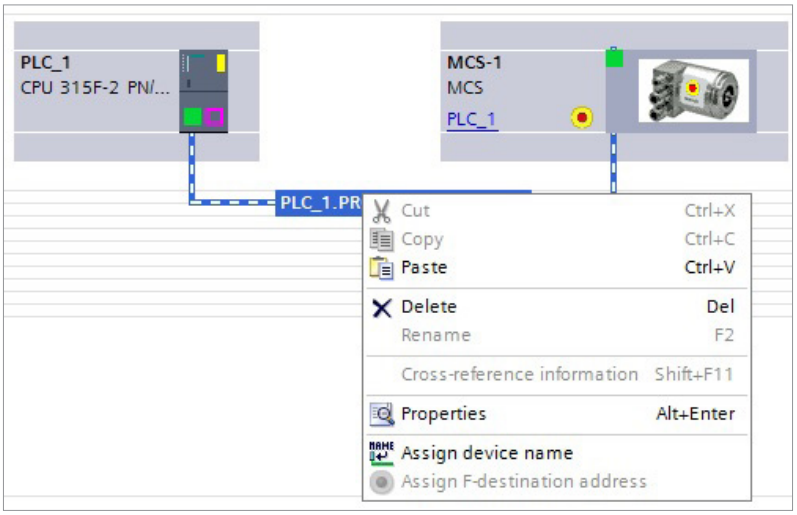


Fig.: 28

Subsequently the window "Assign PROFINET device name" appears. After selecting the correct online connection the accessible devices will be displayed. This for example could look like shown in figure 29.

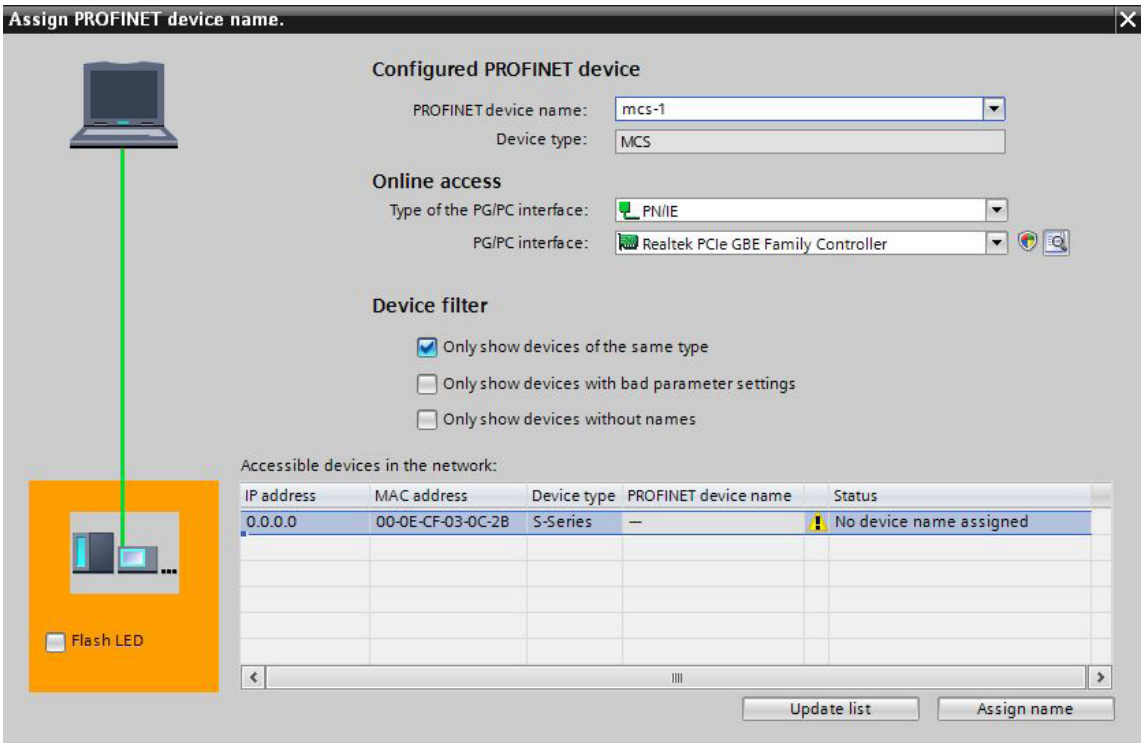


Fig.: 29

It can be seen that the absolute encoder device type MCS does not possess either a valid IP address or a name. Now mark the absolute encoder, check the name proposed at the top of the window and click on "assign name."
The device name is then stored in the absolute encoder, where it is protected against zero voltage.
The absolute encoder now logs onto the controller with its device name and is then provided with a valid IP address by the controller. This is also stored in the absolute encoder, where it is protected against zero voltage.

4.2.9 Resetting to the Factory Settings

After going online the online diagnosis is available via the context menu of the MCS. Under "Functions" the function "Reset to factory settings" is available.

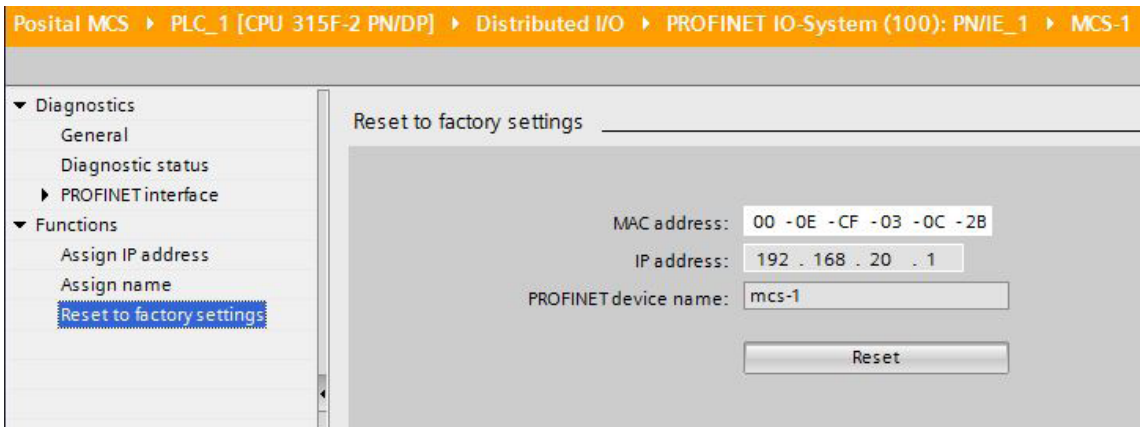


Fig.: 30

The following encoder data will be reset as follows:

The following are reset	Delivery condition
Parameters	See **Chapter 6.1** for default values
Offset	0 (i.e. the preset setting is undone)
Device name	Empty
IP-parameters	All 0
I&M0-revision counter	0

After resetting, the connection to the profinet controller is closed and the NS LED lights up red. After switching the voltage off/on, the connection can be re-established by assigning the device name.
If the connections have been defined using the topology editor, the MCS restarts automatically with the name assigned during project planning.

4.3 Application Program

4.3.1 Remarks

For a detailed documentation for project planning and programming of F programs refer to:
SIMATIC S7 Distributed Safety - Project Planning and Programming, Programming and Operating Manual (A5E00109536-03) /7/ and SIMATIC S7 Distributed Safety Getting Started /8/ respectivly SIMATIC Safety - Project Planning and Programming /9/ und SIMATIC Safety Getting Started /10/ when using Safety Advance in the TIA-Portal.

4.3.2 F-Peripherie-DB

On translation of the hardware configuration, an **F periphery DB** is generated for the absolulute encoder, as for each other Profisafe subscriber. The automatically generated name consists of the I/O address and the module name.
The F periphery DB contains the for the operation of the encoder necessary variables. It has the following appearance: (A detailed description can be found in the documentation mentioned above)

Distributed Safety

Adresse	Deklaration	Name	Typ	Anfangswert	Kommentar
0.0	in	PASS_ON	BOOL	FALSE	1=ACTIVATE PASSIVATION
0.1	in	ACK_NEC	BOOL	TRUE	1=ACKNOWLEDGEMENT NECESSARY
0.2	in	ACK_REI	BOOL	FALSE	1=ACKNOWLEDGEMENT FOR REINTEGRATION
0.3	in	IPAR_EN	BOOL	FALSE	1=ENABLE I-PARAMETER ASSIGNMENT
2.0	out	PASS_OUT	BOOL	TRUE	1=PASSIVATION OUTPUT
2.1	out	QBAD	BOOL	TRUE	1=FAIL-SAFE VALUES ARE OUTPUT
2.2	out	ACK_REQ	BOOL	FALSE	1=ACKNOWLEDGEMENT REQUEST
2.3	out	IPAR_OK	BOOL	FALSE	1=NEW I-PARAMETER VALUES ASSIGNED
3.0	out	DIAG	BYTE	B#16#0	DIAGNOSTIC INFORMATION
4.0	out	QBAD_I_00	BOOL	TRUE	1=FAIL-SAFE VALUE IS OUTPUT AT INPUT CHANNEL
4.1	out	QBAD_I_01	BOOL	TRUE	1=FAIL-SAFE VALUE IS OUTPUT AT INPUT CHANNEL

Safety Advance

F00000_MCS-EIDDB-1312-XXX_1

	Name	Data type	Offset	Start value	Retain	Visible in ...	Setpoint	Comment
1	Input							
2	PASS_ON	Bool	0.0	false				1=ACTIVATE PASSIVATION
3	ACK_NEC	Bool	0.1	TRUE				1=ACKNOWLEDGEMENT NECESSARY
4	ACK_REI	Bool	0.2	false				1=ACKNOWLEDGEMENT FOR REINTEGRATION
5	IPAR_EN	Bool	0.3	false				1=ENABLE I-PARAMETER ASSIGNMENT
6	Output							
7	PASS_OUT	Bool	2.0	TRUE				1=PASSIVATION OUTPUT
8	QBAD	Bool	2.1	TRUE				1=FAIL-SAFE VALUES ARE OUTPUT
9	ACK_REQ	Bool	2.2	false				1=ACKNOWLEDGEMENT REQUEST
10	IPAR_OK	Bool	2.3	false				1=NEW I-PARAMETER VALUES ASSIGNED
11	DIAG	Byte	3.0	16#0				DIAGNOSTIC INFORMATION

4.3.3 Accessing the Encoder in the F Program

Important for the fail safe operation of the encoder are: reintegration after communication or F periphery errors by the variables „ACK_REQ“ and "ACK_REI" or "ACK_GL", evaluation of the failsafe status by the variable "QBAD" and the evaluation of the diagnostic data by the variable "DIAG". All mentioned variables are provided by the F periphery DB. An example can be found in the following example program.
The access to the I/O data of the encoder is different and depending on the output code of the encoder and on the S7 software package.

Because in Distributed Safety the use of double words in the safety program is prohibited in this case, only word access to the 32 bit position and reference value is possible, that means the position and the reference value are devided into 2 words each and the evalutation has to be done seperately. For this use encoder with output code "D" are provided.Two examples for a threshold monitoring of the position value are shown in the example program FB100, Network 10 and 11.
In the safety program of TIA Safety Advanced doublewords can be used now. Thus position and reference value in data type DINT32 can be treated in the same way as in the standard program. For this use encoder with output code "T" are provided
For a description of the data format see **chapter 5**.

4.3.4 Example Program

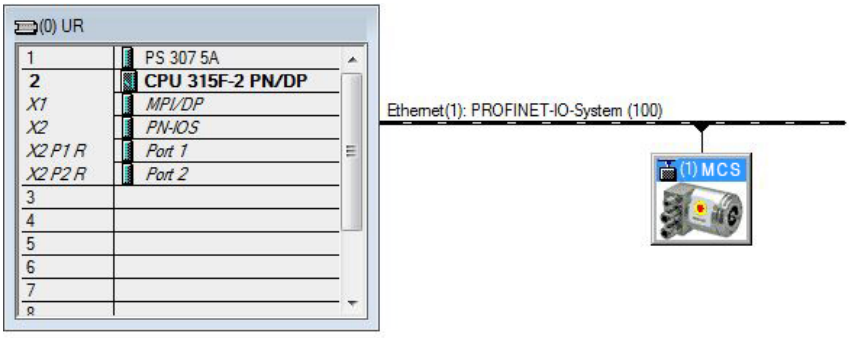
The following example shows how to access the position value and the F periphery DB of the Profisafe absolute encoder in the safety programme. Setting a preset value, the threshold monitoring and reading the diagnosis data is also demonstrated.

Only the programming steps which refer to the POSITAL absolute encoder are shown here. Knowledge regarding the programming and sequence of the failsafe S7 programme is assumed. As an introduction to failsafe programming, we recommend „SIMATIC S7 Distributed Safety - Getting Started“ /8/ and „SIMATIC S7 Distributed Safety – Project Planning and Programming“ /7/ respectively SIMATIC Safety - Project Planning and Programming /9/ and SIMATIC Safety Getting Started /10/ when using Safety Advance under TIA-Portal. All program blocks of the following example can be found in the internet under **www.posital.com**.

Devices required to operate the example program

- F CPU with PROFINET interface
- Profisafe encoder MCS-EI
- Step7 as of V5.4 + S7 distributed safety as of version V5.4 or Step7 Professional V13 with Safety Advanced

Hardware structure of the example program



Inputs and outputs used in the program:

IW 0	encoder status word	QW 0	encoder control word
IW 2	high-word of the encoder position	QW 2	high-word of the encoder preset value
IW 4	low-word of the encoder position	QW 4	low-word of the encoder preset value
IW 6	velocity value		

Remarks to the program

Access to the profisafe absolute encoder is carried out in an F programme module (here FB100), which must be called up in an F call-up module F CALL (F-runtime group when using Safety Advance). Calling the FB100 in the F CALL is not described here. The networks 11 and 12 contain examples for a threshold value monitoring. The examples show how to carry out the comparision between the position and the threshold values although the position value consists of two words and the compare operation needs integer values. With TIA - Safety Advance and encoders with output code "T" it is possible to use double word compare commands like in the standard program. The following listing contains only the for the handling of the encoder relevant part. Program blocks like F-CALL, clock OBs or peripheral data blocks are not listed. The non-secure signals in the safety programme (FB100 in this case) are shown in red.

OB1, NW 1 - 3: Load preset value, show F error messages with the DIAG byte

OB1 : "Main Program Sweep (Cycle)"

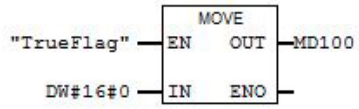
(The safety programme (FB100) is called by the FC100.)

Network 1: True Flag

Generate true flag

Network 2 : Title:

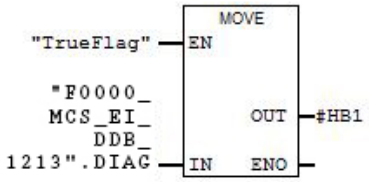
The preset value is stored in the MD100. This is then read word-by-word in the safety programme (FB100)



Remark:
With TIA Safety Advance and encoder with output code "T" use double word access.

Network 3 : Title:

Display of F error messages (here in help byte 1; in a real system, this should be further processed in the error message system). Polling the DIAG variable in the safety programme is not permissible.
(Meaning of the individual bits in /7/)



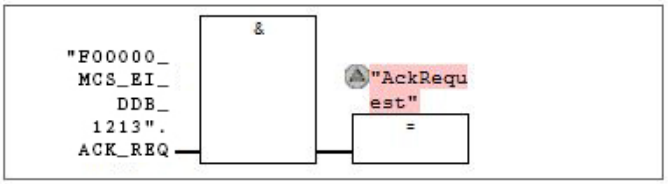
FB100, NW 1 - 3: Acknowledge and reading QBAD

FB100 : POSITAL absolute encoder as a PROFISAFE subscriber

Quittierung, Preset setzen und Istwert auslesen

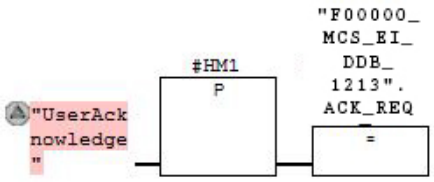
Netzwerk 1: Quittierungsanforderung

Display necessary user acknowledgement



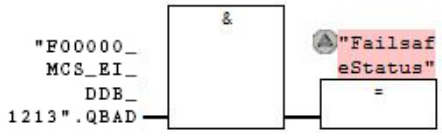
Netzwerk 2 : 1=ACKNOWLEDGEMENT FOR REINTEGRATION

Carry out user acknowledgement



Netzwerk 3 : Fehlersicherer Zustand

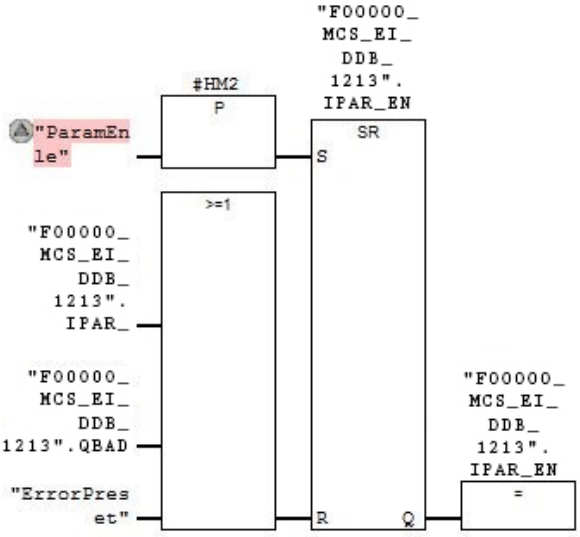
Polling of the failsafe status of the absolute encoder. In a real system this bit must be polled to introduce the fail safe state of the system. In case of QBAD = 1 the system has to go in the fail safe state.



FB100, NW 4 - 7: Set reference value

Network 4 : 1=ENABLE I-PARAMETER ASSIGNMENT

Enabling the preset setting via iPar_EN

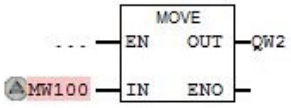


Network 5 : Title:

Set preset bit

Network 6 : Title:

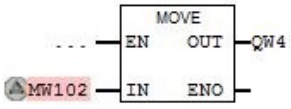
Write higher-value preset value from OB1 to higher-value output word
(Only word-by-word access is permitted in the safety programme)



Remark:
With TIA Safety Advance and encoder with output code "T" use double word access.

Network 7 : Title:

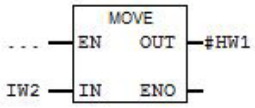
Write lower-value preset value from OB1 to lower-value output word



FB100, NW 8 - 10: Accessing position and velocity

Network 8 : Title:

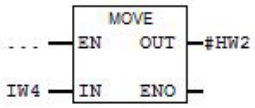
```
Display of the higher-value actual position value
(Only word-by-word access is permitted in the safety programme)
```



Remark:
With TIA Safety Advance and encoder with output code "T" use double word access.

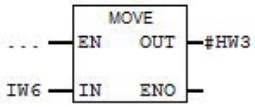
Network 9 : Title:

```
Display of the lower-value actual position value
```



Network 10 : Title:

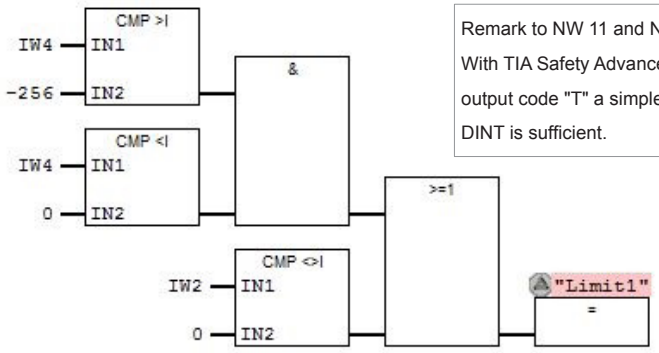
```
Display of the speed value
```



FB100, NW 11- 12: Threshold value monitoring

Network 11: Treshold comparison

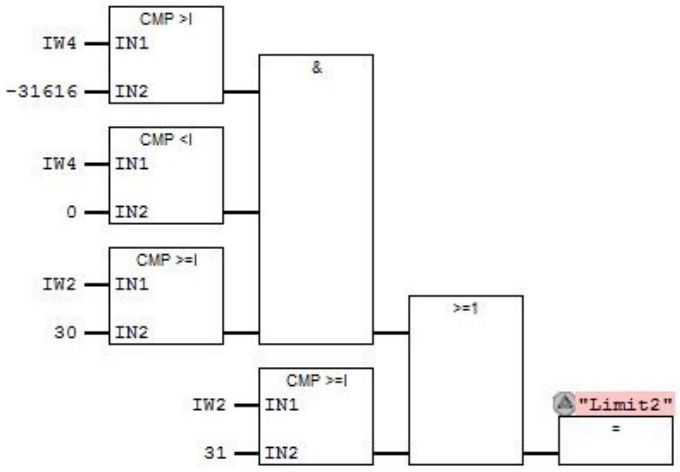
```
Example 1:
Comparison: position value > 65280 (0xff00).
The comparison position value > 65280 in word format is equivalent to -256 <
position value < 0 in integer format.
(Values from 0,...,65536 in word format are equivalent to
0,...,32767,-32768,...,-1 in int format)
On carry over to the high word the output will be held to one by the third
comparison.
The result of the comparison is output on a non safety output here. In a real
application this signal has to be used in the safety program according to the
application.
```



Remark to NW 11 and NW 12:
With TIA Safety Advance and encoder with output code "T" a simple CMP with data format DINT is sufficient.

Network 12 : Treshold comparison

```
Example 2:
Comparison: position value > 2000000 (0x1E8480).
The comparison position value > 2000000 in word format is in interger format
equivalent to -31616 < position value < 0 for the low word and position value
>= 30 for the high word.
On the next carry over to the high word, the output will be held to one by the
fourth comparison.
The result of the comparison is output on a non safety output here. In a real
application this signal has to be used in the safety program according to the
application.
```



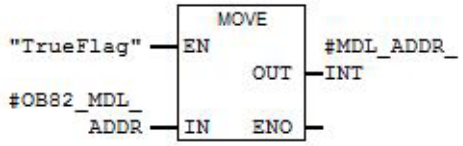
On occurrence of a PROFINET device diagnostic alarm, OB 82 is run through in S7. Amongst other aspects, the trigger for the diagnostic alarm can be ascertained in this. The diagnostic data can then be read-out with SFB52.

The events which trigger a diagnostic alarm in the absolute encoder can be found in **Chapter 7.2.**

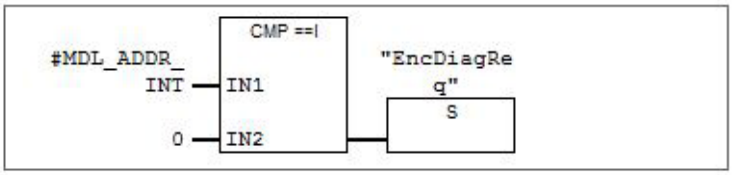
The following example shows how this can be implemented in Step7. The absolute encoder again has the I/O address (logical basic address) 0 in this case. The control system transfers the logical basic address of the device which has transmitted the diagnostic alarm in the local variable #OB82_MDL_ADDR.

OB 82: Evaluation of the local OB 82 data and initialisation of the read job

```
OB82 : Title:
The system will jump to the OB82 as soon as a modul or device requests
diagnostic or senda an alarm.
Network 1 : Conversion into integer format
```

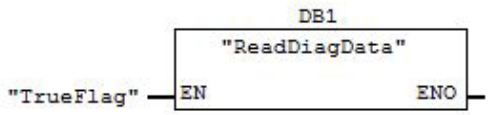



```
Network 2: Set diagnostic request
Encoder with logical base address 0
```



OB 1 NW 4: Calling the FB 1 to read the diagnostic data

```
Netzwerk 4 : Titel:
Datensatz lesen mit dem SFB52
```



FB 1: Reading the diagnostic data with the SFB52 RDREC

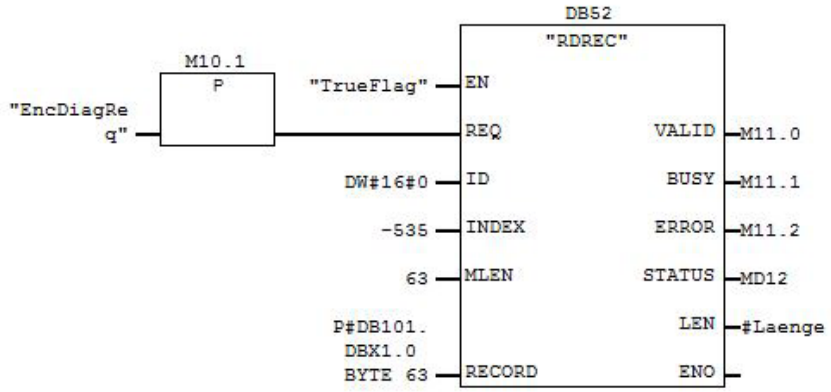
FB1 : Read diagnostic data

The data will be written to the DB101 or DB102 starting with byte 1.

Network 1 : Calling SFB52 (RDREC)

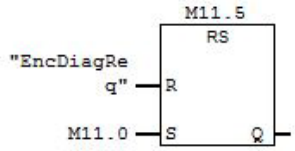
ID = Record Index

-535 dez = FDE9 hex - Encoder diagnostic data 63 byte (DB101)
-16639 dez = BF01 hex - Parameter data 11 byte (DB102)



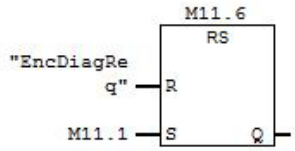
Network 2 : Data Valid

Shows if the last read was successfull and if the data are valid.



Network 3 : Busy

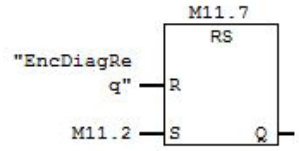
Shows if the last reading was initiated.



FB 1:

Network 4 : Error

Shows if the last read was successfull.



Network 5 : Reset the diagnostic request

5. I/O data

5.1 Overview

5.1.1 Output code "D" (MCS-EIDDB-xxxx-xxxx-xxx)

Input data: Device -> Controler

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9	Octet 10	Octet 11	Octet 12
status word		position data				velocity		F input data			

Output data: Controler -> Device

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9	Octet 10
control word		preset value				F output data			

5.1.2 Output code "T" (MCS-EIDTB-xxxx-xxxx-xxx)

Input data: Device -> Controler

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9	Octet 10	Octet 11	Octet 12
status word		velocity		position data				F input data			

Output data: Controler -> Device

Octet 1	Octet 2	Octet 3	Octet 4	Octet 5	Octet 6	Octet 7	Octet 8	Octet 9	Octet 10
control word		preset value				F output data			

5.2 Status word

The status word contains error bits which can be interpreted by the application program of the PLC.

Octet 1								Octet 2							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

16 bit status word

Bit	Name	Remarks/remedy
0	Error_Preset	Error during preset setting - the preset value has to be in the range of 0 ... total number of steps -1 - set the preset value only during standstill of the shaft - switch on scaling
1 - 15	not used	

5.3 Position data

The position value is output as a 2x 16 bit signed integer value in Motorola format (Big Endian). The factory setting of the resolution of the position value is 4096 respectively 8192 steps / turn. It can be adjusted via the parameterization. For the standard data format it can be adjusted via the parameterization.

5.3.1 Data format coding D

Octet 3								Octet 4								Octet 5								Octet 6							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	position value[1]									position value[1]															
0	0	0	0	0	0	0	0	position value[2]								position value[2]															

1) MCS-EIDDB-1213-xxxx-xxx
2) MCS-EIDDB-1212-xxxx-xxx

5.3.2 Data format coding T

Encoder with the output code D (MCS-EIDTB-12xx-xxxx-xxx) provide a position- und preset representation as double word (Integer32).

Octet 5								Octet 6								Octet 7								Octet 8							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	position value[1]																								
0	0	0	0	0	0	0	0	position value[2]																							

1) MCS-EIDTB-1213-xxxx-xxx
2) MCS-EIDTB-1212-xxxx-xxx

5.4 Velocity

The velocity value is determined via the cyclically read-in of the position data. The dimension is steps per gating time. The gating time (time interval for determining the change of position) is adjustable in the range of 10 - 1000 ms. The default value is 10 ms.

Coding D	Octet 7								Octet 8							
Coding T	Octet 3								Octet 4							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	16 bit velocity															

The speed value is output as a 16-bit signed integer value in Motorola format (Big-Endian). The following applies to the prefix:

positive for increasing position
negative for decreasing position

The refresh rate of the velocity signal is independent from the selected gating time always 10 ms.
The speed measurement resolution is independent of the resolution set for the position value (resolution parameter). It is always based on a resolution of 4096 steps per revolution.
The steps/gating time unit can be converted to rpm as follows:

$$u = \frac{v \times 60000 / t}{4096}$$

v = encoder output for speed value
t = gating time in ms
u = speed in rpm

5.5 F Input Data

The 4-byte F input data consist of the 1-byte F status and the 3-byte CRC checksum. Their content is defined in the Profisafe profile /1/. The status of the F status bit must be evaluated in the F application programme (see programme example in **Chapter 4.3.4**).

5.6 Control Word

Octet 7								Octet 8							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

16 bit control word

Bit	Name	Meaning
0	Set_Preset	The preset value is activated on the rising edge.
1 - 15	not used	

5.7 Preset Value (Reference Value)

In certain cases, setting the reference value is unavoidable in order to compare the machine position values and the absolute position of the absolute encoder. The reference value is the position value which is displayed at the reference point. The user must note that the reference value must lie within the range of 0 to (total number of steps - 1). This particularly has to be taken into consideration when changing the total number of steps.

The preset value is set in the cyclical I/O data traffic by transferring the preset value in the output bytes (octets 1 - 4) and subsequently (or simultaneously) setting bit 0 of the control word (octets 5 - 6).

The set reference value (preset value) function can only be executed whilst the absolute encoder shaft is stationary! Setting the reference value is only possible when scaling is switched on (see Chapter 6)!

Before setting the preset value, the i parameterization must be enabled with the F control bit iPar_EN. The rotary encoder reports the completion of the process with the F status bit iPar_OK. If an error occurs on setting the preset value, e.g. due to a rotating rotary encoder shaft, this is reported via status bit 0 in the status word. In both cases, i.e. in the case of successful preset and in the event of an error, the iPar_EN bit must be reset. The rotary encoder then resets its iPAR_OK to zero. (See programme example in **Chapter 4.3.4.**)

The preset value is taken over with the rising edge of bit 31. An offset value is calculated (from the current actual position and the reference value) by the absolute encoder in this case. This is stored in the absolute encoder, where it is protected against zero voltage, with the result that the new position is correctly output again even following voltage failure.

5.7.1 Data format coding D

Octet 3								Octet 4								Octet 5								Octet 6							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	preset value[1]									preset value[1]															
0	0	0	0	0	0	0	0	preset value[2]								preset value[2]															

1) MCS-EIDDB-1213-xxxx-xxx
2) MCS-EIDDB-1212-xxxx-xxx

5.7.2 Data format coding T

Octet 3								Octet 4								Octet 5								Octet 6							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	preset value[1]																								
0	0	0	0	0	0	0	0	preset value[2]																							

1) MCS-EIDTB-1213-xxxx-xxx
2) MCS-EIDTB-1212-xxxx-xxx

5.8 F Output Data

The 4-byte F output data consist of 1 control byte and the 3-byte CRC checksum. Their content is defined in the Profisafe profile /1/. The F control bits are made available by the F control system and must be implemented in the F application program (see programme example › **Chapter 4.3.4**).

6. Parameterisation

Parameterisation of the absolute encoder is carried out using the acyclical PROFINET services. In the case of the Simatic S7 control system, this is carried out during starting as default. Changing the parameter of the MCS during cyclic I/O data exchange is not possible.

Attention: Never change the parameterisation whilst a system or machine is in operation! A complete function test has to be performed after each parameter change befor returning to normal operation.

Record index	Data
0xBF02	Encoder parameter
0x64	F parameter

6.1 Encoder parameter

6.1.1 Overview

Byte	Data type	Designation	Default
1	BYTE	Operating mode	0x08
2 - 5	UINT32	Single turn resolution [steps/turn]	4096 (8192)
6 - 9	UINT32	Total measuring steps [steps]	16.777.216 (33.554.432)
10 - 11	INT16	Gating time [ms]	10

The values in brackets represent the absolute encoders with 25-bit total number of steps (MCS-EIDDB-xxxx-xxxx-xxx).

6.1.2 Description of the Absolute Encoder Parameters

Byte	Bit No.	Parameter	Value range	Default	Remark
1	0	Code path	0: clockwise (cw) 1: counter clockwise (ccw)	clockwise (cw)	Ascending values on rotation clockwise (CW) or counter clockwise (CCW). (When looking towards the shaft)
	1-2	Not used			
	3	Scaling function	0: off 1: on	on	Enables/disables scaling of the position value via the resolutioin, the total number of steps and the preset.
	4-7	Not used			
2 - 5		Resolution [steps/ revolution]	1 - 4096 (8192)	4096 (8192)	To change this, the parameter "Scaling function" must be set to "on"
6 - 9		Total number of steps [steps]	1 - 16,777,216 (33,554,432)	16,777,216 (33,554,432)	To change this, the parameter "Scaling function" must be set to "on"
10 - 11		Gating time [ms]	10 - 1000	10	

The values in brackets represent the absolute encoders with 25-bit total number of steps (MCS-EIDDB-xxxx-xxxx-xxx).

Notes:

Coding:

All values in Motorola format (Big Endian)

Total number of steps:

It must be noted that the number of revolutions is calculated in powers of 2n internally in the encoder. Irrespective of this requirement, the user can programme the desired total number of steps and the desired resolution according to the application. During calculation, the absolute encoder uses the next highest power of 2n if necessary. In this case, the values are designated as the effective resolution or the effective total number of steps and are displayed as the output values.

Example :

Desired total number of steps:	20,480
Desired resolution:	4096
Desired number of revolutions:	5
Internal absolute encoder calculation	
Effective total number of steps:	32,768
Effective resolution:	4096
Calculated number of revolutions:	8

(Note: The above notice is to be taken into consideration in the case of non-reversible operation. In the listed example, position 0 is only reached after 32,767 steps and not after 20,479 steps as desired.)

6.2 F Parameter

6.2.1 Overview

Octet	Data type	Description	Default
1	Unsigned8	F_Prm_Flag1	
2	Unsigned8	F_Prm_Flag2	
3-4	Unsigned16	F_Source_Add	0
5-6	Unsigned16	F_Dest_Add	200
7-8	Unsigned16	F_WD_Time	120
9-12	Unsigned32	F_iPar_CRC	7100
13-14	Unsigned16	F_Par_CRC	-----

6.2.2 Description of the F parameters

Octet 1: F_Prm_Flag1

Bit no.	Parameter name	Value range	Default	Remarks
0	**F_Check_SeqNr**	0: NoCheck	NoCheck	Fixed to "No Check"
1	**F_Check_iPar**	0: NoCheck	NoCheck	Fixed to "No Check"
2-3	**F_SIL**	1: SIL2	SIL2	Fixed to "SIL2"

4-5	**F_CRC_Length**	0: 3-Byte-CRC (V2 Mode)	3-Byte-CRC	Checksum of the process data (CRC2).
6-7	not used			

Octet 2: F_Prm_Flag2

Bit no.	Parameter name	Value range	Default	Remarks
0-2	not used			
3-5	**F_Block_ID**	0 - 7	1	1 = F parameter block contains F_iPar_ CRC
6-7	**F_Par_Version**	1: V2-Mode	1	Parameter version

Octet 3-14

Octet	Parameter name	Value range	Default	Remarks
3-4	**F_Source_Add**	1 - 65534		Automatically assigned by the SIMATIC manager
5-6	**F_Dest_Add**	1 - 65535	200	Must correspond to the Profisafe address set in the Profinet name. The MCS-EI is a F device with PROFIsafe address type 1, i.e. the F_Dest_Add has be unique netwide and CPU-wide.
7-8	**F_WD_Time**	1 - 65534	120	Monitoring time in the failsafe slave. Within the monitoring time, a valid, current safety message must be received from the F CPU. Otherwise, the device goes to the safe state. Set the monitoring time long enough to ensure not only that the communication functions tolerate telegram delays, but also that the fault response is triggered quickly enough if a fault occurs (e.g. interruption of the communication connection).The minimum watchdog time for the MCS-EI is 120 ms (for 4 ms actualisation time).
9-12	**F_iPar_CRC**	1 - 0xFFFF FFFF	0x1BBC	CRC checksum on the iParameters (encoder parameters). A checksum calculation program is availabe for download on **www.posital.com** menu documentaton.
13-14	**F_ParCRC (CRC1)**	0 - 65535		CRC checksum on the F parameters. Is generated from the SIMATIC Manager.

7. Diagnostic

7.1 Overview

The encoder MCS-EI provides diagnostic data in 3 different ways.

- LEDs (see **Chapter 3.3**)
- PROFINET alarms (see **Chapter 7.2**)
- Diagnostic data (see **Chapter 7.3**)

7.2 PROFINET Alarms

The following alarms are send via the PROFINET alarm mechanism. In the PROFINET controler they are displayed in plain text and partially with a help text.

Erro no. (hex)	Error text	Reaction	Status-LED (NS)	Remarks/remedy
0x001A	Internal communication error (TPS-1)	Input and F data = 0		Please switch power off/on or change the device
0x0040	Mismatch of safety destination address (F_Dest_Add)	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0041	Safety destination address not valid (F_Dest_Add)	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0042	Safety source address not valid (F_Source_Add)	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0043	Safety watchdog time value is 0 ms(F_WD_ Time)	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0044	Parameter "F_SIL" exceeds SIL from specific device application	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0045	Parameter "F_CRC_ Length" does not match the generated values	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0046	Version of F-Parameter set incorrect (F_Par_ Version)	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0047	F parameter CRC error (CRC1-Fault)	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x0048	Error in F parameterset	Diagnostic data: F parameter error	red flashing (1 Hz)	
0x004B	Inconsistent iParameters (iPar-CRC error)	Diagnostic data: F parameter error	red flashing (1 Hz)	Please check the value of the F parameter F-iPar-CRC.
0x1100	Device error	Diagnostic data: device error F status word: FV_activated, Device_Fault	fast red flashing (10 Hz)	Please switch power off/on or change the device.

0x1110	Preset error	Diagnostic data: Preset error Status word: Error-Preset	red flashing (1 Hz)	The preset value has to be in the range of 0 ... total number of steps -1. Setting the preset is only allowed when the shaft is in standstill. Scaling has to be on.
0x1120	Velocity measuring range exceeded	Diagnostic data: velocity error F status word: FV_activated	red flashing (1 Hz)	Please reduce the velocity or decrease the gating time.
0x1140	Parameter error	Diagnostic data: Parameter error	red flashing (1 Hz)	The value for the total measuring range has to be in the range of: resolution ... (resolution x max. number of turns (4096)).
0x1150	Supply voltage out of range	F status word: FV_activated, Device_Fault	red flashing (1 Hz)	Please check the supply voltage and switch power supply off/on.
0x1160	Wrong Record Index on startup	F status word: FV_activated, Device_Fault	red flashing (1 Hz)	Please check your GSD file.
0x1170	Sensor not ready	F status word: FV_activated, Device_Fault	red flashing (1 Hz)	Please switch power off/on or change the device.

7.3 Diagnostic Data Records

The following diagnostic records are available in the MCS-EI. They can be read out with the PROFINET acyclic read services.

Record index	Data
0xAFF0	I&M0 data (according to I&M-specification version 1.2 /9/)
0xBF02	Parameter data (see **Chapter 6**)
0xFDE9	Diagnostic data according to Encoder Class 2 Profile (see below)

7.3.1 Diagnostic Data According to Encoder Class 2 Profile

Diagnosis data in data record 0xFDE9

Byte	Datatyp	Diagnostic function	Default (values in hex)	Diagnostic alarm	Remark
1 - 8	BYTE	Reserved	00		
9	BYTE	Operating status	08	No	CW, Scaling on
10	BYTE	Encoder typ	01	No	Absolute multiturn encoder
11 - 14	UINT32	Maximum resolution	0000.1000 (0000.2000)	No	4096 (8192) steps/revolution

15 - 16	UINT16	Maximum measuring range	1000	No	4096 revolutions
17	UINT8	Additional alarm messages	00	No	Not supported
18 - 19	UINT16	Supported alarm messages	0000	No	Not supported
20 - 21	UINT16	Warning messages	0000	No	Not supported
22 - 23	UINT16	Supported warning messages	0000	No	Not supported
24 - 25	UINT16	Profile version	0101	No	Current encoder profile version
26 - 27	UINT16	Software version	xx.xx	No	Current firmware version
28 - 31	UINT32	Operating time	FFFF.FFFF	No	Not supported
32 - 35	UINT32	Offset value	0000.0000	No	Current internally calculated offset value
36 - 39	UINT32	Manufacturer offset value	0000.0000	No	Not supported
40 - 43	UINT32	Resolution	0000.1000 (0000.2000)	No	Currently set resolution
44 - 47	UINT32	Total number of steps	01.000.0000 (02.000.0000)	No	Current total number of steps
48 - 57	BYTE	Serial number		No	Serial number of the device
58 - 59	BYTE	Reserved	0000	No	
60 - 63	BYTE	Manufacturer specific diagnostic data	00000000	Yes	See below

The values in brackets represent the absolute encoders with 25 bit total number of steps (MCS-EIDDB-1213-xxxx-xxx).

Encoder Specific Diagnostic Data

Byte	Bit	Error message	Diagnostic alarm	Status-LE (NS)	Remarks/remedy (see Profinet alarms)
60		reserviert			
61		reserviert			
62	0	Flash error	yes	fast red flashing (10 Hz)	
	1	not used			
	2	F parameter error	yes	red flashing (1 Hz)	
	3 - 7	not used			
63	0	not used			
	1	Device error	yes	fast red flashing (10 Hz)	
	2	Parameter error	yes	red flashing (1 Hz)	
	3	Scaling error	yes	red flashing (1 Hz)	
	4	Supply voltage out of range	yes	red flashing (1 Hz)	
	5	not used			
	6	Preset error	yes	red flashing (1 Hz)	
	7	Velocity error	yes	red flashing (1 Hz)	

8. Scope of Delivery

The scope of delivery includes:

- Absolute encoder with PROFIsafe interface
- Instruction Leaflet, CD

Available for download on **www.posital.com** are:

- the corresponding datasheet
- this user manual
- the checksum calculation program PsCrc
- the certificates
- example programmes
- GSD file and bitmap

9. Literature

/1/ PROFIsafe-Profile for Safety Technology, Order No. 3.092 und 3.192, PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe, www.profibus.com

/2/ PROFINET - Interface nach IEC 61158 / 61784 bzw. PNO-Spezifikation, Order No. 2.712 und 2.722, PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe, www.profibus.com

/3/ PROFINET Installation guidline, Order No. 8.071, PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe, www.profibus.com

/4/ PROFINET Cabling and Interconnection Technology, Order No.: 2.252, PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe, www.profibus.com

/5/ Installation Guideline PROFINET Part2: Network Components, Order No.: 2.252 p2, PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe, www.profibus.com

/6/ PROFIsafe - Environmental Requirements related to PROFIsafe - Profile for Safety Technology on PROFIBUS DP and PROFINET IO (IEC 61784-3-3), Order No. 2.232, PROFIBUS Nutzerorganisation e. V., Haid-und-Neu-Str. 7, D-76131 Karlsruhe, www.profibus.com

/7/ SIMATIC S7 Distributed Safety - Project Planning and Programming, Programming and Operating Manual (A5E00109536-03) - http://support.automation.siemens.com

/8/ SIMATIC S7 Distributed Safety Getting Started (A5E00320725-01) - http://support.automation.siemens.com

/9/ Profile Guidelines Part 1: Identification & Maintenance Functions, Order No. 3.502, www.profibus.com

/10/ SIMATIC Safety - Project Planning and Programming (A5E02714440-AC) - http://support.automation.siemens.com

/11/ SIMATIC Safety - Getting Started (A5E02714463-01) - http://support.automation.siemens.com