



Operating and configuration instructions

UO-SPN-1 PROFINET module

PROFINET IO interface and PROFIsafe profile

U-ONE[®]-SAFETY-LWL

Universal encoder system – Generation II

Read the configuration manual before completing assembly,
starting installation and carrying out other work.
Store the manual for future use.

Manufacturer / Publisher

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Further current information on this product series can be found online in our Service Point. Simply scan the QR Code and open the link in your browser.



These instructions and the enclosed declaration of conformity can also be accessed via our Service Point. For this purpose, the QR code on the type plate of the corresponding device must be scanned.

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Change reservation

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

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Writing styles

Cursive or **bold** texts indicate the title of a document, or are used for emphasis.

Courier-New font indicates text that is visible on the screen and software or software menu selections.

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1 General information

1.1 Information on the Operating and assembly manual

This operating and assembly manual provides important information for using the UO-SPN-1 electronic function module. It must be read carefully before beginning any work and observed. The UO-SPN-1 electronic function module is referred to in the following documentation as the SPN.





Furthermore, the local accident prevention regulations and general safety regulations applicable for the area where the device will be used must be observed.

1.2 Scope of delivery

The scope of delivery for the function module includes the operating and configuration manual and the software & support CD.

1.3 Explanation of symbols

Warning information is designated using symbols. Information is preceded by signal words which express the extent of the danger involved. Always comply with these notices, and use caution to avoid accidents, personal injury and property damage.

	<p>WARNING! Indicates a potentially hazardous situation that could lead to death or severe injury if it is not avoided.</p>
	<p>CAUTION! Indicates a potentially hazardous situation that could lead to minor or slight injuries if it is not avoided.</p>
	<p>CAUTION! Indicates a potentially hazardous situation that could lead to property damage if it is not avoided.</p>
	<p>NOTE! Emphasises useful tips and recommendations, and provides information useful for efficient, smooth operation.</p>

1.4 Warranty and liability


Only the “General Terms and Conditions” of Johannes Hübner Fabrik elektrischer Maschinen GmbH apply. These will be provided to the operator at the latest when the order is confirmed or when the contract is concluded. All warranty and liability claims for personal injury and property damage are excluded, and the operator's operating permit will be null and void if one or more of the following apply:

- Failure to observe the operating and assembly manual.
- Improper use of the function module.
- Improper assembly, installation, commissioning and programming of the function module.
- Operating the function module despite technical defects.
- Independently carrying out mechanical or electrical modifications to function modules.
- Independently carrying out repairs.
- Catastrophes due to external interference or force majeure.
- Use of non-qualified personnel.
- Opening the function module.

1.5 Organisational measures

- The operating and assembly manual must always be stored easily within reach in the area where the function module is used.
- In addition to the operating and assembly manual, general statutory and other binding regulations on accident prevention and environmental protection must be observed. Operators must be trained on these regulations.
- Applicable national, local, and system-specific provisions and requirements must be observed.
- The operator is obligated to inform personnel of special operating considerations and requirements.
- The type plate and any prohibitions or notice signs adhered to the function modules must always be legible.
- Repairs may only be carried out by the manufacturer, or by an agency or individual authorised by the manufacturer.

1.6 Copyright protection

	<p>NOTE!</p> <p>Content information, texts, drawings, images, and other illustrations are copyright protected and subject to industrial property rights. Copying of any kind not associated with use of the function module is prohibited without a written declaration from the manufacturer. Violations will result in claims for damages.</p>
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1.7 Warranty provisions

Warranty provisions are outlined in the manufacturer's General Delivery Conditions.

1.8 Customer service

Contact persons are available by phone, fax, or e-mail for technical questions. See the manufacturer's address on page 2.

2 Basic safety information

DANGER!

This section provides an overview of all significant safety aspects necessary to protect personnel and ensure safe, fault-free operation of the function module. Failure to observe this information may result in significant danger.

2.1 Responsibility of the operator

The function modules are used in a commercial capacity. The operator of the function modules, therefore, is subject to statutory occupational safety requirements and the safety, accident prevention and environmental regulations applicable to the areas in which the function modules are used.

2.2 Selecting and qualifying personnel; basic obligations

- All work on function modules may be carried out only by qualified personnel. Qualified personnel are personnel with the training, experience, and instruction, as well as expertise on relevant standards, specifications, accident prevention regulations and operating circumstances necessary to carry out the required work, and who have been authorised to do so by the persons responsible for the safety of the system. They are able to identify and avoid potential hazards.
- In addition, please see standards VDE 0105-100 and IEC 364 for the definition of “qualified personnel” (reference, e.g. Beuth Verlag GmbH, VDE-Verlag GmbH)
- Responsibilities for assembly, installation, commissioning and operation must be clearly defined. Personnel who are receiving instruction or training must be supervised.

2.3 Proper use


The SPN must be used in conjunction with the USL(H) 42 basic device and the UO-SCU.

The system manufacturer must review whether the properties of the function module fulfil the safety requirements in its specific application. The system manufacturer is responsible for use of the function module and for deciding whether to use the module. Function modules are designed for unsupervised, continuous operation.


Proper use also includes:


- observing all information in this operating and assembly manual
- observing type plates and any prohibition or information signs
- observing the operating manual of the machine or system manufacturer
- operating the function module within the limits stipulated in the technical data
- not engaging in improper use

2.4 Improper use

	<p>WARNING! Danger of death, physical injury and property damage due to improper use of the function module!</p> <p>In particular, the following uses are prohibited:</p> <ul style="list-style-type: none"> • Use in environments with an explosive atmosphere. • Use in environments with radioactive radiation. • Use on ships. • Use for medical purposes.
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2.5 Safety information

	<p>WARNING! ATTENTION! NOTE! Destruction, damage or impact to the function of the function module.</p> <p>Only complete wiring work and only connect or disconnect electrical connections when the module is powered down.</p> <p>Review any potential hazards due to interactions with other systems and devices currently installed in the surrounding area, or which are to be installed. The user is responsible for taking relevant measures.</p> <p>The power supply must be secured with a fuse appropriate for the diameter of the intake line.</p> <p>Cables used must be suitable for the temperature range.</p> <p>Defective function modules may not be operated.</p> <p>Opening function modules is prohibited.</p> <p>The type plates specify the technical properties of the function modules. If a type plate is no longer legible, or if a type plate is missing entirely, the function module may not be operated. Contact Hübner service (see page 2).</p>
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	<p>NOTE! Disposal:</p> <p>If the function module needs to be disposed after its service life, applicable national regulations must be observed.</p>
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3 Assembly

3.1 Safety information

	<p>WARNING!</p> <p>Assembly and disassembly may only be carried out by qualified personnel. In general, the requirements and acceptance conditions for the system as a whole must be observed.</p>
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 	<p>DANGER! ATTENTION!</p> <p>Danger of death, severe physical injury and/or property damage due to deactivating safety functions, caused by an unsecured shaft drive.</p> <p>In general, the requirements and acceptance conditions for the system as a whole must be observed.</p>
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3.2 Basic regulations

	<p>WARNING!</p> <p>Power and signal lines must be installed separately.</p> <p>Observe the manufacturer's information when installing converters, shielding on power lines between the frequency converter and motor.</p> <p>Ensure the energy supply is sufficient for the application.</p>
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3.3 Replacing function modules

When replacing function modules, observe the following:

- The new function module must have the same item no. (ID) as the old one.
- When using a new measurement system, the operator must ensure that the PROFIsafe target address set via hardware switches is the same as the previous address.
- Since the F parameter and iParameter of the measurement system are saved in the security program for the controller, the new measurement system is configured with the project-specific settings in the start-up phase.
- If the project does not support neighbourhood detection, then the previously assigned device names must be assigned to the new measurement system as well during the exchange. The device name is recognised when the system starts up, and the new MAC address and IP address are automatically assigned to the device name.
- When recommissioning the replaced function module, a secure test run must be completed first to ensure it functions correctly.

4 Technical data and functions

4.1 Type plate

The following image shows an example of a type plate.

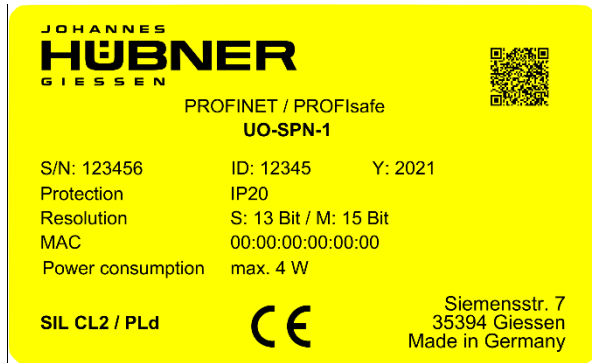
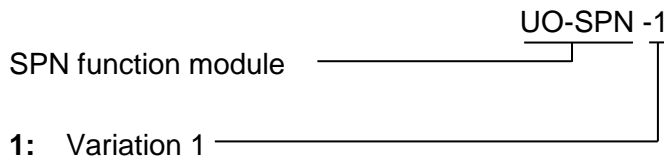


Fig. 4-1: Type plate (example)

The type plate is located on the outside of the housing, and includes the following information:

- Manufacturer
- Type, year of construction
- CE mark
- Serial number (S/N)
- Protective class
- Power consumption
- ID number
- Liquidation
- MAC address
- Certification information

4.2 Type designation



4.3 Electrical data

Information	Value
Supply voltage	Delivered to the SCU module via the bus connector
Additional UO-SPN-1 module power consumption	< 4 W
Overall resolution	≤ 28 Bit
Protective class in accordance with DIN EN 60529	IP20 for cabinet installation Degree of protection of cabinet: ≥ IP54
Singleturn functional	≤ 13 Bit (8192 steps/revolution)
Singleturn safety-specific	8 Bit (256 steps/revolution)
Multiturn	≤ 15 Bit (32768 revolutions)
PROFINET IO interface	in accordance with IEC 61158 and IEC 61784
PROFIsafe profile	3.192b in accordance with IEC 61784-3-3

Information	Value
Additional functions	Preset
Parameter	Configurable via PROFINET IO
Integration time Safe	50 ms...500 ms
Integration time Unsafe	5 ms...500 ms
Monitoring window size	50...4000 increments
Standstill tolerance preset	1...5 increments/integration time Safe
Counting direction	Forward, reverse
PROFINET specifications	V2.2
Software stack	V3.2.0.1
Conformance Class	Conformance Class B, C
Physical Layer	PROFINET 100Base-TX, Fast Ethernet, ISO/IEC 8802-3
Output code	Binary
Cycle time	≥ 1 ms (IRT / RT)
Transmission rate	100 MBit/s
Transmission	CAT-5 cable, shielded (STP), ISO/IEC 11801
Addressing (configurable via PROFINET IO)	By name (name assignment via project management software). Name assignment -->MAC during start-up
Cycle time	
Not safety-related	0.5 ms, output via JHG-PROFIBUS module
Safety-related	5 ms, output via JHG-PROFIsafe module
Preset write cycles	$\geq 4\ 000\ 000$
Connection technology	M12 plug
Wiring diagram	PN165-413 (see section 14.2)
Elevation above sea level	≤ 3000 m

4.3.1 PROFINET IO transmission technology, cable specification

Safety- related PROFIsafe communication, as well as PROFINET communication, are transmitted via the commonly used network.

PROFINET supports line, tree and star structures. The bus or line structure used in field buses, therefore, is also available for Ethernet. This is especially practical when wiring systems, since

lines and stubs can be combined. Since the US 42-PROFINET module already has an integrated switch, the line topology can be easily created.

Only cables and plug connectors for which the manufacturer has issued a PROFINET manufacturer declaration may be used. Line type A/B/C, mechanical and chemical properties, and the design of the PROFINET cable must be selected according to the automation task in question. The cables must be designed for bit rates of up to 100 MBit/s. The transmission speed is detected automatically by the USC 42 PROFINET module, and does not have to be set using a switch.

Bus addressing via switches, as in the PROFIBUS-DP, is likewise not necessary, as this is handled automatically by the addressing features of the PROFINET controller, however, the PROFIsafe target address "F_Dest_Add" must be set, see section 5.4.1.6.

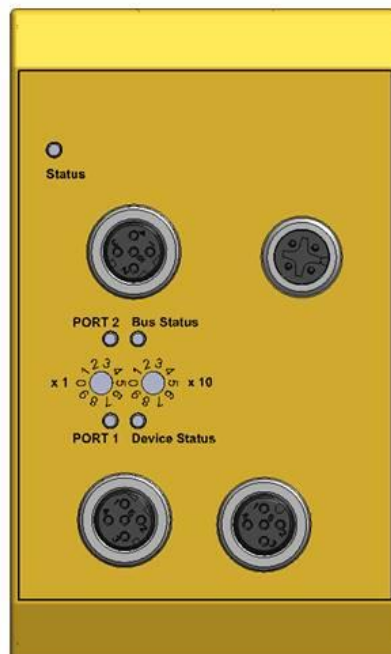
The cable length, including patch cable, may be a max. of 100 m for copper cabling between two devices. This transmission path is defined as the *PROFINET-End-to-end-link*. The number of detachable connections within the end-to-end-link is limited to six pairs of plug connectors (plug/socket). If over six pairs of plug connectors are required, the maximum permitted damping values (channel class D values) for the entire transmission path must be complied with.

NOTE!

With IRT communication, the topology is planned in a wiring table. Ports 1 and 2 must be connected correctly.

This is not the case for RT communication, which can be wired freely.

4.4 Operating statuses and displays






4.4.1 Module status display

Operating status	Status LED	Bus status
Start	flashing yellow/green 2 Hz	not ready for operation
normal	green	ready for operation
bootloader	flashing yellow/red 1 Hz	not ready for operation
Warning	flashing yellow 1 Hz	ready for operation
Fault	red	Fault





Warning:

A warning is generated when the SPN reaches the end of its service life (20 years).




4.4.2 Bus status indicator

	ON		OFF		FLASHING
---	----	---	-----	---	----------



Device Status

	No supply, hardware fault
	Ready for operation
	Operator acknowledgement requested, 3x 5 Hz
	System or security error



Bus Status

	No errors
	Parameter or F-parameter error; 0.5 Hz
	No connection to the IO controller

PORT 1

	green	Ethernet connection formed
	yellow	Data transmission TxD/RxD

PORT 2

	green	Ethernet connection formed
	yellow	Data transmission TxD/RxD

For appropriate measures in case of a fault, see section 10.

5 PROFINET IO / PROFIsafe – Commissioning

5.1 PROFINET IO

Important information on commissioning is provided in the **PROFINET commissioning guidelines, order no.: 8,081**

This and further information on the PROFINET or PROFIsafe is available from the office of the PROFIBUS user organisation:

PROFIBUS Nutzerorganisation e.V.

Haid-und-Neu-Str. 7
D-76131 Karlsruhe
www.profibus.com
www.profisafe.net

Phone: + 49 721 96 58 590
Fax: + 49 721 96 58 589
E-mail: germany@profibus.com

5.1.1 Device classes

The following device classes are differentiated in a PROFINET IO system:

- **IO-Controller**
For example, a PLC that addresses the connected IO device.
- **IO-Device**
Decentrally located field device (measurement system) that is assigned to one or more IO controllers and transmits alarms in addition to process and configuration data.
- **IO-Supervisor** (Engineering Station)
A programming device or industrial PC that has access to all process and parameter data at the same time as the IO controller.

5.1.2 Device description file (XML)

The GSDML file and associated bitmap file are part of the measurement system: "**GSDML-V2.3-HU-024A-AMPN(H)41-aktuelles Datum.xml**".

The files are included on the software and support CD. This is part of the delivery.

5.1.3 Device identification

Each PROFINET-IO device has a device identification. This consists of a company designation, vendor ID, and a manufacturer-specific part, the device-ID. The vendor ID is assigned by the PNO; this ID is **0x024A** for Johannes Hübner - Fabrik elektrischer Maschinen GmbH, and the device ID is **0x03E8**.

The planned device identification is reviewed during start-up, in order to detect errors in the project planning.

5.1.4 Address assignment

Parameter	Standard value	Description
MAC address	–	The measurement system has a stored <i>MAC address</i> upon delivery as a standard feature. This is printed on the device's type plate, e.g. "00:03:12:04:00:60", and cannot be modified.
Device type	AMPN(H)41	The name of the device type is "AMPN(H)41" and cannot be changed.
Device names	–	<p>Before an IO device can be addressed by an IO controller, it must have a <i>device name</i>, since the IP address is permanently assigned to the device name. The IO controller can also assign IP addresses to IO devices during start-up according to their device names. The advantage of this process is that names are easier to handle than complex IP addresses.</p> <p>Assigning a device name to a specific IO device is comparable to setting the PROFIBUS address for a DP Slave.</p> <p>The measurement system does not have any stored device names upon delivery, or after a reset. The measurement system can only be addressed by an IO controller after a device name is assigned using the engineering tool, for instance to transmit project planning data (such as the IP address) during start-up, or for user data exchange during cyclical operation.</p> <p>The name is assigned before commissioning by the engineering tool via the DCP protocol used as a standard on PROFINET-IO field devices.</p>
IP address	0.0.0.0	The measurement system does not have a stored IP address upon delivery, or after a reset. Standard value: "0.0.0.0"
Subnet mask	0.0.0.0	The measurement system does not have a stored subnet mask upon delivery, or after a reset. Standard value: "0.0.0.0"

Process for assigning device names and addresses to an IO device:

- Determine the device name, IP address, and subnet mask. However, this may also be done automatically depending on the configuration of the IO controller.
- The device name is assigned to an IO device (MAC address) – transmit the device name to the device
- Load project plan to the IO controller
- The IO controller assigns IP addresses to the device names during start-up. Assignment of IP addresses can also be switched off; in this case, the available IP address in the IO device is used.

5.2 Start-up on the PROFINET IO

Following a successful start-up, IO devices will independently begin data transmission. A PROFINET-IO communication relationship always follows the provider-consumer model. During cyclical transmission of the measured value, the IO device is the provider of the data, while the IO controller (such as a PLC) is the consumer. The transmitted data is always assigned a status (good or bad).

5.3 Configuration

The following applies:

- Flow of input data: F-Device → F-Host
- Flow of output data: F-Host → F-Device

5.3.1 Safety-related data, “AMPN(H)41 E/A safety” module

Structure of input data

Byte	Bit	Input data	
X+0	2^8-2^{15}	Cam	Unsigned16
X+1	2^0-2^7		
X+2	2^8-2^{15}	Status	Unsigned16
X+3	2^0-2^7		
X+4	2^8-2^{15}	Speed	Integer16
X+5	2^0-2^7		
X+6	2^8-2^{15}	Actual value, Multiturn, 15 bit	Integer16
X+7	2^0-2^7		
X+8	2^8-2^{15}	Actual value, Single turn, 13 bit	Integer16
X+9	2^0-2^7		
X+10	2^0-2^7	Safe Status	Unsigned8
X+11	$2^{16}-2^{23}$	CRC2	3 Bytes
X+12	2^8-2^{15}		
X+13	2^0-2^7		

Structure of output data

Byte	Bit	Input data	
X+0	2^8-2^{15}	Control1	Unsigned16
X+1	2^0-2^7		
X+2	2^8-2^{15}	Control2	Unsigned16
X+3	2^0-2^7		
X+4	2^8-2^{15}	Preset, Multi-Turn	Integer16
X+5	2^0-2^7		
X+6	2^8-2^{15}	Preset, Single-Turn	Integer16
X+7	2^0-2^7		
X+8	2^0-2^7	Safe Control	Unsigned8
X+9	$2^{16}-2^{23}$	CRC2	3 Bytes
X+10	2^8-2^{15}		
X+11	2^0-2^7		

5.3.1.1 Input data

Cam: Unsigned16

Byte	X+0	X+1
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$

Bit	Description
2^0	Speed overrun — This bit is set when the speed value is outside a range of –32768...+32767.
$2^1...2^{15}$	reserved

Status: Unsigned16

Byte	X+2	X+3
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$

Bit	Description
2^0	Preset_Status — This bit is set when the F-Host triggers a preset query. The bit is reset automatically after the end of Preset execution, see also section 9.
$2^1 \dots 2^{14}$	reserved
2^{15}	Error — This bit is set when a Preset query could not be executed due to excessive speed. The current speed must be within the range of the speed set in the lower standstill tolerance Preset. This bit is reset after the F-Host has deleted the variable assigned to the control bit 2^0 iPar_EN, see also section 9.

Speed: Integer16

Byte	X+4	X+5
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$

The speed is output as a signed two's complement value.

Setting the direction of rotation = **Forward**

- In light of the flange mounting, turning the shaft clockwise:
→ positive speed output

Setting the direction of rotation = **Reverse**

- In light of the flange mounting, turning the shaft clockwise:
→ negative speed output

If the measured speed exceeds the display range of $-32768 \dots +32767$, this will cause an overrun reported in the cam register via Bit 2^0 . At the time of the overrun, the speed will remain stopped at the respective +/- maximum value until it is back in the display range. In this case, the message will also be deleted from the cam register. The speed is indicated in `increments per integration time Safe`.

Multi-Turn / Single-Turn

	Multi-Turn, Integer16		Single-Turn, Integer16	
Byte	X+6	X+7	X+8	X+9
Bit	15 – 8	7 – 0	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$	$2^{15} - 2^8$	$2^7 - 2^0$

The number of revolutions is noted in the `Multi-Turn` tab, while the current `Single-Turn` position in steps is noted in the `Single-Turn` tab. The position can be calculated alongside the resolution of the measurement system, max. number of steps per revolution according to the type plate:

Position in steps = steps/revolution x number of revolutions + Single-Turn position

Steps per revolution: **8192 ± 13 Bit**

Number of revolutions **0...32767 ± 15 Bit**

The output position is not signed.

Safe-Status: Unsigned8

Byte	X+10
Bit	7 – 0
Data	$2^7 - 2^0$

Bit	Description
2^0	iPar_OK: New iParameter values have been assigned to the F-Device. This bit is set when a Preset query has been successfully completed via the F-Host (Bit <code>iPar_EN</code>), see also section 9.
2^1	Device_Fault: Error in the F-Device or F-module This bit is set when the value set under the iParameters for window increments has been exceeded, and/or the internally calculated PROFIsafe telegram is faulty. The measurement system is then transitioned to a failsafe state, and outputs its passivated data. This state can only be exited by correcting the error and supply voltage OFF/ON.
2^2	CE_CRC: Checksum error in communication This bit is set when the F-Device detects an F communication error, for instance a missing serial number (detected via a CRC2 error in V2 mode) or if data integrity has been violated (CRC error). The F-Host is then requested to count all faulty messages within a certain time T and, if the maximum permitted number of faulty messages has been exceeded, to enter a configured safe state. This error can also be triggered by incorrect CRC values in the iParameters (<code>F_iPar_CRC</code>) or F-Parameters (<code>F_Par_CRC</code>) in the configuration sequence. The measurement system reports a parameter error via PROFINET standard diagnosis, and does not start up.
2^3	WD_timeout: Watchdog timeout in communication

Bit	Description
	This bit is set when the set Watchdog time <code>F_WD_Time</code> in the F-parameters has been exceeded. A valid, current security telegram must be received from the F-Host within this time; otherwise, the measurement system is transitioned to a fail-safe state and outputs its passivated data. This state can only be exited by correcting the error and supply voltage OFF/ON. See also section 5.4.1.7.
2 ⁴	FV_activated: Failsafe values activated This bit is set when the measurement system is in a failsafe state and outputs its passivated data.
2 ⁵	Toggle_d: Toggle bit The toggle bit is device-based, and initiates incrementation of the virtual serial number within the F host. The toggle bit is used to synchronise the counters in the measurement system/F host to generate the virtual serial number.
2 ⁶	cons_nr_R: Virtual serial number was reset. The counter is reset when the F host detects an F communication error (<code>CE_CRC</code>).
2 ⁷	reserved

i	<p>NOTE!</p> <p>The Safe Status can only be accessed indirectly with the help of variables from the security program, see also section 8</p> <p>For a more detailed description of status bits, see the PNO document “PROFIsafe – Profile for Safety Technology on PROFIBUS DP and PROFINET IO”, order no.: 3.192b.</p>
---	--

5.3.1.2 Output data

Control1: Unsigned16

Byte	X+0	X+1
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$

Bit	Description
2^0	Preset_Request This bit is used to control the preset function. When this function is executed, the measurement system is set to the position value saved in the tabs <code>Preset Multi-Turn/Preset Single-Turn</code> . An exact process must be observed to execute the function, see also section 9.
$2^1...2^{15}$	reserved

Control2:

reserved

Preset Multi-Turn / Preset Single-Turn

	Preset Multi-Turn, Integer16		Preset Single-Turn, Integer16	
Byte	X+4	X+5	X+6	X+7
Bit	15 – 8	7 – 0	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$	$2^{15} - 2^8$	$2^7 - 2^0$

The desired preset value must be in the range of 0 to 268 435 455 (28 Bit). The relevant values for `Preset Multi-Turn/Preset Single-Turn` can be calculated alongside the resolution of the measurement system, max. number of steps per revolution according to the type plate (8192):

$\text{Number of revolutions} = \text{desired preset value} / \text{steps per revolution}$
--

The integer portion of this division indicates the number of revolutions, and must be entered in the `Preset Multi-Turn` tab.

$\text{Single-Turn-Position} = \text{desired preset value} - (\text{steps per revolution} * \text{number of revolutions})$
--

The results of this calculation are entered into the `Preset Single-Turn` tab.

The preset value is set as a new position when the preset function is executed, see also section 9.

Safe-Control: Unsigned8

Byte	X+8
Bit	7 – 0
Data	$2^7 - 2^0$

Bit	Description
2^0	iPar_EN: iParameter assignment unlocked This bit must be set indirectly by the F host via a variable in order to be able to execute the preset function, see also section 9.
2^1	OA_Req: Operator confirmation query requested This bit is set via the F host driver if an error has been detected in safety-related communication and it has been corrected. The bit is also set if the measurement system/F host could not be integrated synchronously into bus operation during start-up of the F-system. In relation to the measurement system, an operator confirmation query is indicated via the green LED (3x with 5 Hz). In this case, an operator acknowledgement is required of the function modules in the security program. This allows the counter in the F host and F device to be synchronised for the virtual serial number. The measurement system is then transferred from safe status, output passivated data, to normal status, output cyclical data.
2^2	R_cons_nr: Reset the counter for the virtual serial no. This bit is set when the F host detects an F communication error, either via the status byte or through itself.
2^3	reserved
2^4	activate_FV: Activate failsafe values This bit is set internally within the device via the firmware if the measurement system cannot output any more failsafe data due to a device error, errors in safety-related communication, or when starting up the F system. Instead, the measurement system outputs its passivated data.
2^5	Toggle_h: Toggle bit The toggle bit is host-based, and initiates incrementation of the virtual serial number within the F host. The toggle bit is used to synchronise the counters in the measurement system/F host to generate the virtual serial number.
2^6-2^7	reserved

	<p>NOTE! The Safe Control tab can only be accessed indirectly with the help of variables from the security program, see also section 8 For a more detailed description of control bits, see the PNO document “PROFIsafe – Profile for Safety Technology on PROFIBUS DP and PROFINET IO”, order no.: 3.192b.</p>
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5.3.2 Non safety-related process data

Structure of input data

Byte	Bit	Input data	
X+0	2^8-2^{15}	Cam	Unsigned16
X+1	2^0-2^7		
X+2	2^8-2^{15}	Speed	Integer16
X+3	2^0-2^7		
X+4	2^8-2^{15}	Actual value, Multi turn, 15 bit	Integer16
X+5	2^0-2^7		
X+6	2^8-2^{15}	Actual value, Single turn, 13 bit	Integer16
X+7	2^0-2^7		

5.3.2.1 Input data

Cam: Unsigned16

Byte	X+0	X+1
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$

Bit	Description
2^0	Speed overrun This bit is set when the speed value is outside a range of $-32768\dots+32767$.
$2^1\dots2^{15}$	reserved

Speed: Integer16

Byte	X+2	X+3
Bit	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$

The speed is output as a signed two's complement value.

Setting the direction of rotation = **Forward**

- In light of the flange mounting, turning the shaft clockwise:
→ positive speed output

Setting the direction of rotation = **Reverse**

- In light of the flange mounting, turning the shaft clockwise:
→ negative speed output

If the measured speed exceeds the display range of -32768...+32767, this will cause an overrun reported in the cam register via Bit 2⁰. At the time of the overrun, the speed will remain stopped at the respective +/- maximum value until it is back in the display range. In this case, the message will also be deleted from the cam register.

The speed is indicated in increments per integration time Unsafe.

Multi-Turn / Single-Turn

	Multi-Turn, Integer16		Single-Turn, Integer16	
Byte	X+4	X+5	X+6	X+7
Bit	15 – 8	7 – 0	15 – 8	7 – 0
Data	$2^{15} - 2^8$	$2^7 - 2^0$	$2^{15} - 2^8$	$2^7 - 2^0$

The number of revolutions is noted in the `Multi-Turn` tab, while the current `Single-Turn` position in steps is noted in the `Single-Turn` tab. The actual position can be calculated alongside the resolution of the measurement system, max. number of steps per revolution according to the type plate: The output position is not signed.


Position in steps = (steps per revolution * number of revolutions) + Single-Turn position

Steps per revolution: **8192 ± 13 Bit**

Number of revolutions: **0...32767 ± 15 Bit**

5.4 Configuration

Typically, the configuration program provides an input screen for the IO controller where the user can enter the parameter data or select it from a list. The structure of the input screen is provided in the device master file.

	<p>DANGER! ATTENTION!</p> <p>Danger of death, severe physical injury and/or property damage due to a malfunction, caused by incorrect configuration.</p> <p>The system manufacturer must ensure proper function through a secured test run during commissioning and each time the parameters are changed.</p>
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5.4.1 F-Parameter (F_Par)

The following is a list of F parameters supported by the measurement system.

Byte-Order = Big Endian

Byte	Parameter	Type	Description		Page
X+0	–	Bit	Bit 0 = 0: not used		–
	F_Check_iPar	Bit	Bit 1 = 0: no review		26
	F_SIL	Bit range	Bit 3-2	00: SIL1 01: SIL2 10: SIL3 [default] 11: no SIL	26
	F_CRC_Length	Bit range	Bit 5-4	00: 3-Byte-CRC	26
X+1	F_Block_ID	Bit range	Bit 5-3	001: 1	26
	F_Par_Version	Bit range	Bit 7-6	01: V2-Mode	27
X+2	F_Source_Add	Unsigned16	Source address, Default = 1, range: 1-65534		27
X+4	F_Dest_Add	Unsigned16	Target address, Default = 1, range: 1-99		27
X+6	F_WD_Time	Unsigned16	Watchdog time, Default = 125, range: 125-10000		27
X+8	F_iPar_CRC	Unsigned32	CRC of the iParameter, Default = 1132081116, range: 0-4294967295		27
X+12	F_Par_CRC	Unsigned16	CRC of the F parameter, Default = 17033, range: 0-65535		27

5.4.1.1 F_Check_iPar

This parameter is set to “NoCheck” and cannot be changed. This means that the checksum value from the iParameters is not evaluated.

5.4.1.2 F_SIL

F_SIL indicates the SIL the user expects from the specific F device. It is compared to the manufacturer information stored locally. The measurement system supports the safety classes no SIL and SIL 1 to SIL3, SIL3 = standard value.

5.4.1.3 F_CRC_Length

The measurement system supports the CRC length of 3 bytes. This value is preset and cannot be changed.

5.4.1.4 F_Block_ID

Since the measurement system supports device-specific safety parameters such as “Safe integration time”, this parameter is pre-set to a value of “1 = form F_iPar_CRC” and cannot be changed.

5.4.1.5 F_Par_Version

This parameter identifies the PROFIsafe version “V2 Mode” implemented in the measurement system. This value is preset and cannot be changed.

5.4.1.6 F_Source_Add / F_Dest_Add

The parameter `F_Source_Add` defines a unique source address within a PROFIsafe island. The parameter `F_Dest_Add` defines a unique target address within a PROFIsafe island. The PROFIsafe target address must conform to the address set via the address switch implemented in the measurement system.

Valid addresses: 1...99.

Standard value `F_Source_Add = 1`, Standard value `F_Dest_Add = 1`,
`F_Source_Add ≠ F_Dest_Add`.

5.4.1.7 F_WD_Time

This parameter stipulates the monitoring time [ms] in the measurement system. A valid, current security telegram must be received from the F-Host within this time; otherwise, the measurement system is transitioned to a safe state.

The default value is 125 ms.

In general, the watchdog time should be high enough that the communication tolerates telegram run times, but that the error reaction function can be executed quickly enough in case of an error.

5.4.1.8 F_iPar_CRC

This parameter represents the checksum value (CRC3) calculated from all iParameters for the device-specific part of the measurement system, and ensures secure transmission of the iParameters. It is calculated in a program “JHG_iParameter” provided by Johannes Hübner Gießen. The checksum value calculated there must then be entered manually into the engineering tool of the F-Host, see section 6.

5.4.1.9 F_Par_CRC

This parameter represents the checksum value (CRC1) calculated from all F-parameters for the measurement system, and ensures secure transmission of the iParameters. It is calculated externally in the engineering tool of the F-Host and must then be entered here under this parameter, or is automatically generated.

5.4.2 iParameter (F_iPar)

Application-specific device properties are stipulated in the iParameters. A CRC calculation is required to securely transmit the iParameters, see section 5.4.2

The following is a list of iParameters supported by the measurement system.

Byte-Order = Big Endian

Byte	Parameter	Type	Description	Page
X+0	Integration time Safe (Integration Time Safe)	Unsigned16	Default = 2 Range: 1-10	28
X+2	Integration Time Unsafe	Unsigned16	Default = 20 Range: 1-100	28

Byte	Parameter	Type	Description	Page
X+4	Window Increments	Unsigned16	Default = 1000 Range: 50-4000	28
X+6	Idleness Tolerance Preset	Unsigned8	Default = 1 Range: 1-5	28
X+7	Direction	Bit	0: Reverse 1: Forward [default]	28

5.4.2.1 Integration Time Safe

This parameter is used to calculate the safe speed output via the cyclical data of the AMPN(H)41 I/O safety module. Long integration times facilitate high-resolution measurements at low speeds. Short integration times indicate speed changes faster, and are well suited for high speeds and a high level of dynamism. The time base is set to 50 ms. Therefore, 50 ... 500 ms can be set over the value range of 1 ... 10. Standard value = 100 ms.

5.4.2.2 Integration Time Unsafe

This parameter is used to calculate the unsafe speed output via the process data of the AMPN(H)41 I/O safety module. Long integration times facilitate high-resolution measurements at low speeds. Short integration times indicate speed changes faster, and are well suited for high speeds and a high level of dynamism. The time base is set to 5 ms. Therefore, 5 ... 500 ms can be set over the value range of 1 ... 100. Standard value = 100 ms.

5.4.2.3 Window Increments

This parameter defines the maximum permitted position deviation in increments for the Master/Slave scanning system integrated into the measurement system. The permitted tolerance window depends primarily on the maximum speed in the system, and must first be calculated by the system operator. Higher speeds require a larger tolerance window. The value range is 50...4000 increments.

Standard value = 1000 increments.

The larger the window increments, the greater the angle until an error is detected.

5.4.2.4 Idleness Tolerance Preset

This parameter defines the maximum permitted speed in `increments per Integration time Safe` for carrying out the preset function.

The permitted speed depends on the bus behaviour and system speed, and must be calculated first by the system operator. The value range is from 1 increment per `integration time Safe` up to 5 increments per `Integration Safe`.

This means that the measurement system shaft has to be almost at a standstill for the preset function to be executed.

Standard value = 1 increment per standard value `Integration time Safe`.

5.4.2.5 Direction

This parameter defines the current counting direction for the position value in light of the flange connection when the shaft is turning clockwise.

Forward = counting direction increasing

Reverse = counting direction decreasing

Standard value = Forward

6 Determining the parameters / CRC calculation

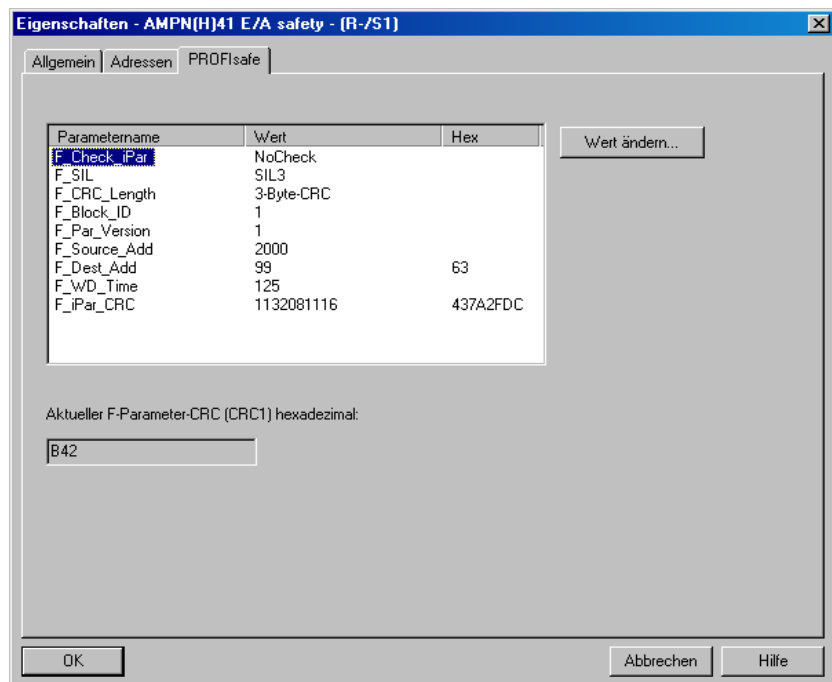
It is useful to stipulate the known parameters in the F-Host even before project planning, so that they can be taken into consideration in the project plan.

The following section describes the process in conjunction with SIEMENS project management software SIMATIC Manager and the option package S7 Distributed Safety.

The software JHG_iParameter required to calculate the CRC is included in the Software and Support CD.

6.1 iParameter

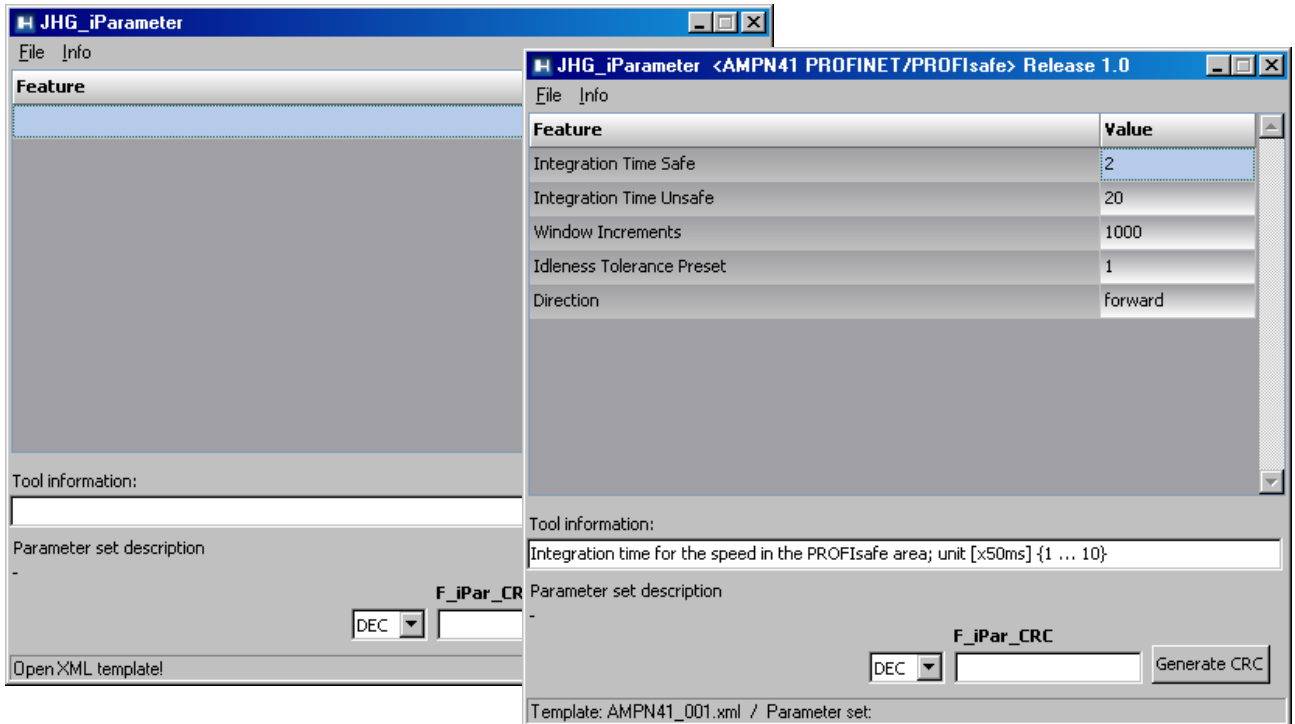
The iParameter are set with feasible default values in the standard settings, and should only be changed if the automation task expressly requires this. A CRC calculation is required to securely transmit the individual set iParameters. This must be completed when changing the default iParameters using the program "JHG_iParameter". The calculated checksum corresponds to the F-Parameter F_iPar_CRC. This must be entered during project planning for the measurement system with the hardware configurator in the window Properties - AMPN(H)41 I/O safety in the field of the same name, see section 7.3.1.



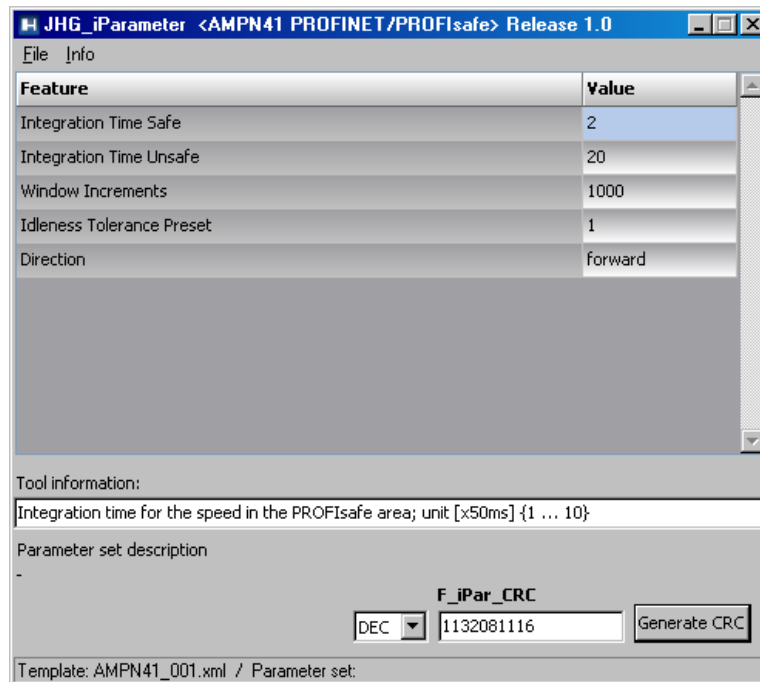
6.1.1 CRC calculation via the iParameter

The default standard values are used for the following example CRC calculation. These can be loaded via an XML template file in the program `JHG_iParameter`. If deviating values are required, these can be overwritten by double clicking the relevant entry. The changed parameters can be saved as a complete parameter set or opened as a template.

- Install `JHG_iParameter` using the installation file “`JHG_iParameter_Setup.exe`”.
- Start `JHG_iParameter` using the start file “`JHG_iParameter.exe`”, then use the menu `File` -> `Open XML template` to open the template file included with the measurement system (here, the example: `AMPN41_001.xml`).



If necessary, adjust the relevant parameters, then - to calculate the F_iPar_CRC - click the **Generate CRC** button. The result is displayed in the field F_iPar_CRC as either a decimal or hex value.

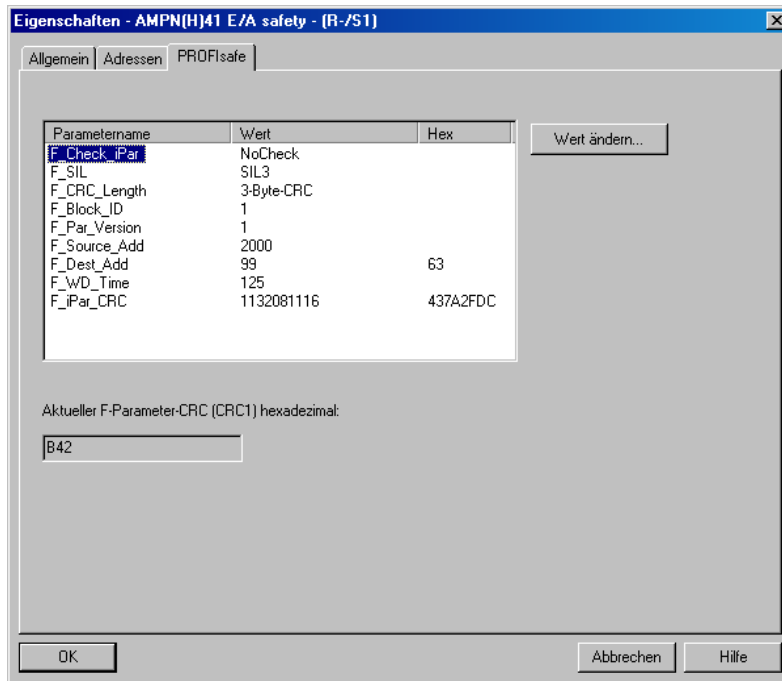


Each time the parameters are changed, F_iPar_CRC must be calculated once again. This must be taken into consideration in the project planning. If there is already a security program, it must be regenerated.

Further information on handling $JHG_iParameter$ is used in the help file in the menu **Info** → **Help**.

6.2 F-Parameter

The F-Parameters are set with feasible default values in the standard settings, and should only be changed if the automation task expressly requires this. A CRC is required to securely transmit the individual set F-Parameters, and is calculated automatically by the **SIMATIC Manager**. This checksum corresponds to the F-Parameter F_Par_CRC , which is displayed during project management of the measurement system with the hardware configurator in the window **Properties - AMPN(H)41 I/O safety** under the heading **Current F-Parameter-CRC (CRC1)** as a hexadecimal value: The value entered in the example below B42 is valid for the standard setting shown here, see section 7.3.2.



6.2.1 Non-adjustable F-Parameters

The following F-Parameters are managed either by the measurement system or the F-Host and therefore cannot be changed manually:

- F_Check_iPar: NoCheck
- F_CRC_Length: 3-Byte-CRC
- F_Block_ID: 1
- F_Par_Version: V2-mode
- F_Source_Add: 2002 (example value, specified by the F-Host)

6.2.2 Adjustable F-Parameters

It is assumed that the following parameters are set to their standard values:

- F_SIL: SIL3
- F_Dest_Add: 513 (Address switch)
- F_WD_Time: 125
- F_iPar_CRC: 1132081116 (calculated via the JHG-Tool "JHG_iParameter")

Any change in parameters will result in a new `F_Par_CRC` value, which is displayed as shown above. If there is already a security program, it must be regenerated.

7 Create security program - Example configuration

This section describes the process for creating the security program using SIEMENS project manager `SIMATIC Manager` and the option package `S7 Distributed Safety`.

The security program is created using the `FUP/KOP-Editor` in `STEP 7`. Failsafe FBs and FCs are programmed in the programming language `F-FUP` or `F-KOP`, while failsafe DBs are created in the `F-DB` language. Failsafe application modules that can be used in the security program are available to the user in the `F-library Distributed Safety`, which is available to the user.

Security tests are completed automatically when generating the security program, and additional failsafe modules for error recognition and error reaction are integrated. This ensures that outages and errors are detected and that appropriate reactions are triggered which keep the `F`-system in a safe state or transfer it to a safe state.

A standard user program can run in the `F-CPU` in addition to the security program. The standard and security program can coexist in an `F-CPU`, since the safety-related data of the security program is protected against accidental influence by data in the standard user program.

Data can be exchanged between the security and standard user programs in the `F-CPU` via markers and through access to the process map of inputs and outputs.

Access protection

Access to the `F-System S7 Distributed Safety` is secured by two password queries, the password for the `F-CPU` and the password for the security program. The online and offline passwords for the security program are differentiated:

- The offline password is part of the security program in the offline project on the programming device.
- The online password is part of the security program in the `F-CPU`.

7.1 Requirements



WARNING!

Danger of deactivating the failsafe function through improper security program project planning!

- The security program may only be created in conjunction with the system documentation provided by SIEMENS for the software and hardware.
- Full documentation on the topic of “Project planning and programming” a secure controller is available from SIEMENS in the handbook S7 Distributed Safety - Project Planning and Programming, document order number: A5E00109536-04. This documentation is part of the option package S7 Distributed Safety.
- The following descriptions refer to the process itself, without including information from the SIEMENS handbook.
The information and notices provided in the SIEMENS handbook, in particular the safety information and warnings, must therefore be observed and complied with.
- The project planning should be considered an example. The user is obligated to review and adjust the project planning to determine whether it is useful in their application. The use must also choose appropriate safety-related hardware components, and must select the necessary software requirements.

Software components used for the S7 Distributed Safety example configuration:

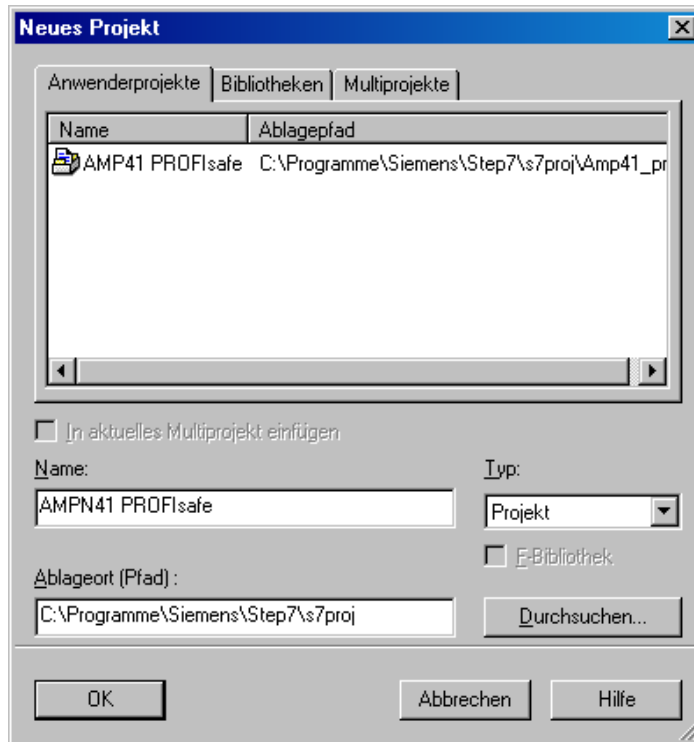
- STEP 7 V5.5 + SP2
- S7 Distributed Safety Programming V5.4 + SP5
- S7 F ConfigurationPack V5.5 + SP9

Hardware components of the SIMATIC 300 series used for the S7 Distributed Safety example configuration:

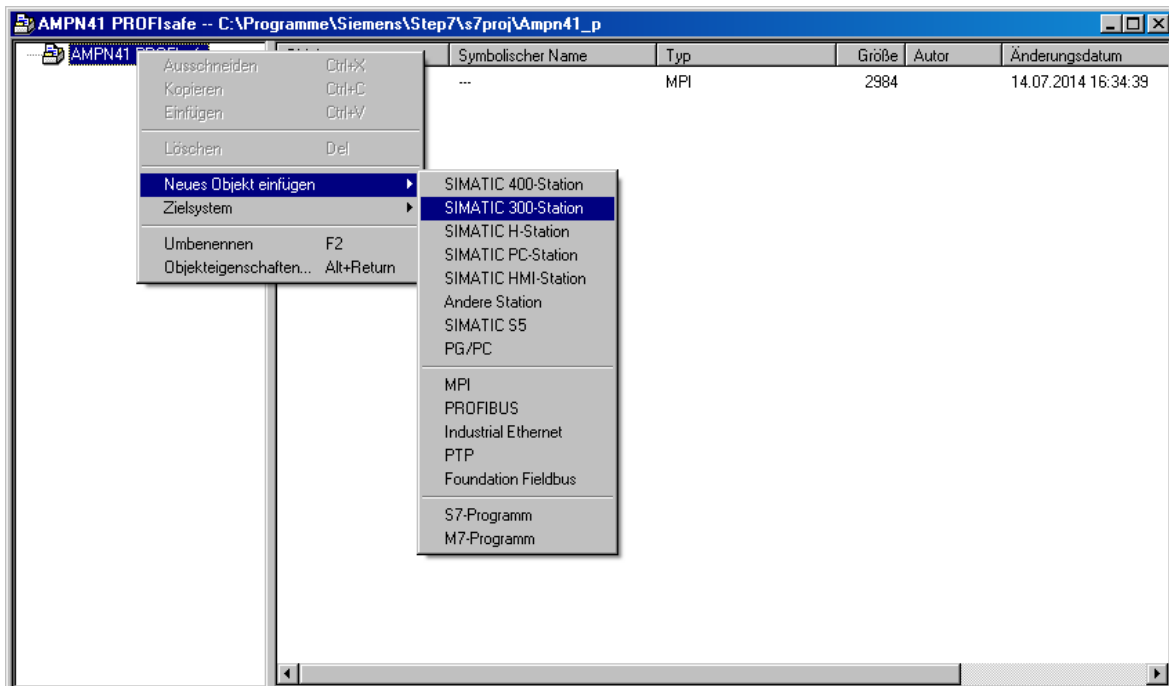
- Hardware rail
- Power supply “PS307 2A” (307-1BA00-0AA0)
- F-CPU unit “CPU317F-2 PN/DP” (317-2FK13-0AB0)
- Digital output assembly “SM 326F DO 10xDC24V/2A” (326-2BF01-0AB0), is not actively used in the following security program, and is provided for customer-specific outputs, for instance to display the variable statuses of the F periphery module: PASS_OUT, QBAD, ACK_REQ, IPAR_OK etc.
- Digital input assembly “SM 326F DI 24xDC24V” (326-1BK01-0AB0), is used to carry out an Operator Acknowledgement.

7.2 Hardware configuration

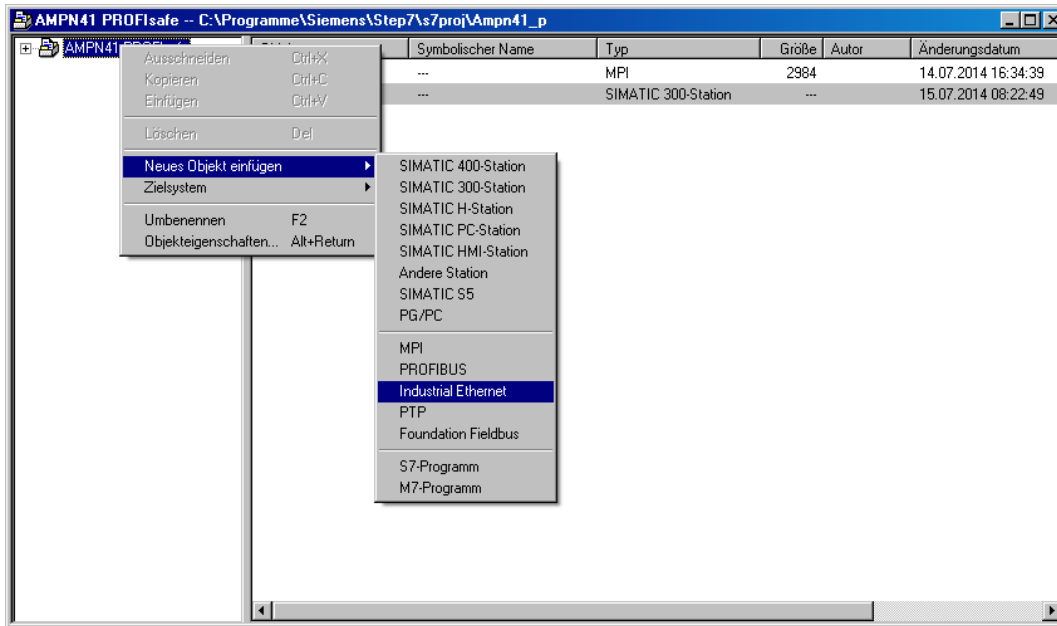
- Start SIMATIC Manager and create a new project.



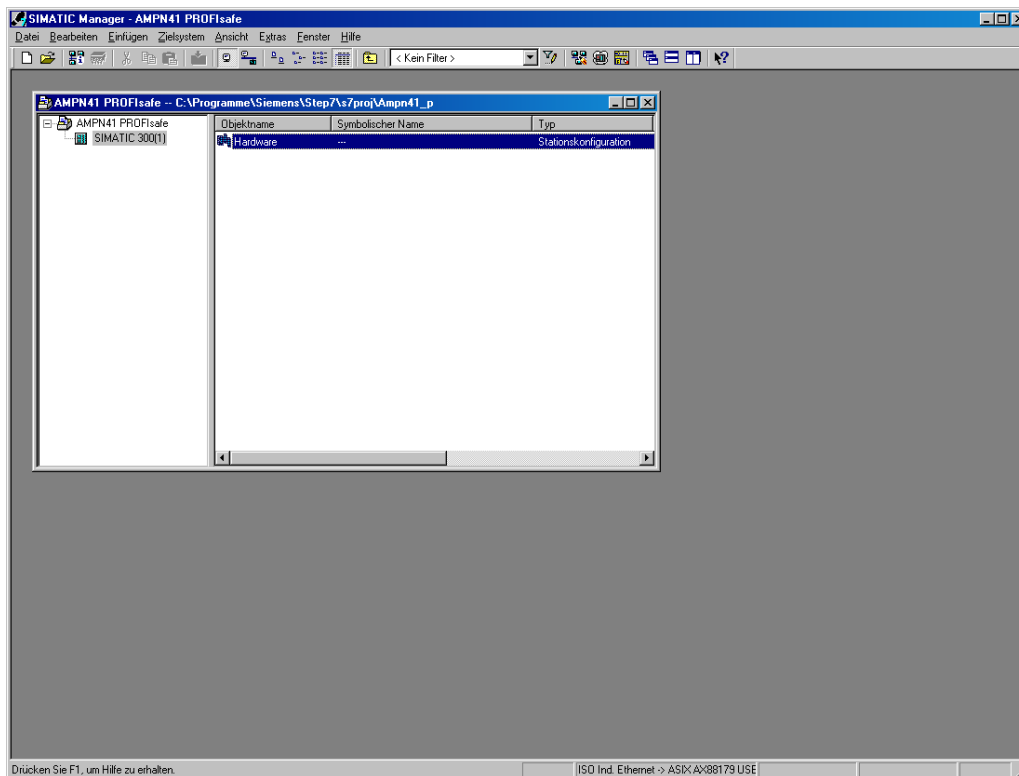
- Right click in the project window to insert the SIMATIC 300-Station as a new object.



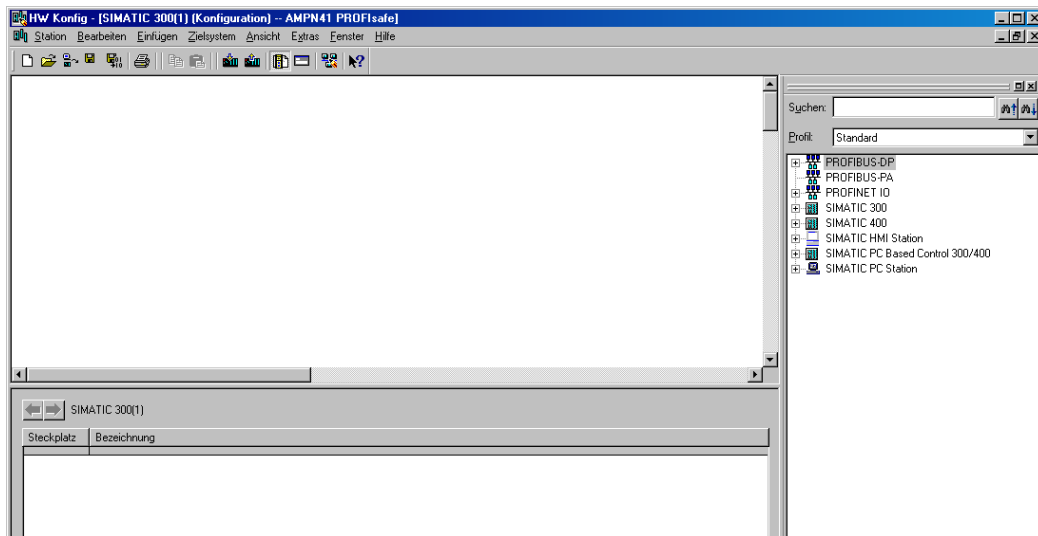
- Use the same process to create an Industrial Ethernet for PROFINET as a new object.



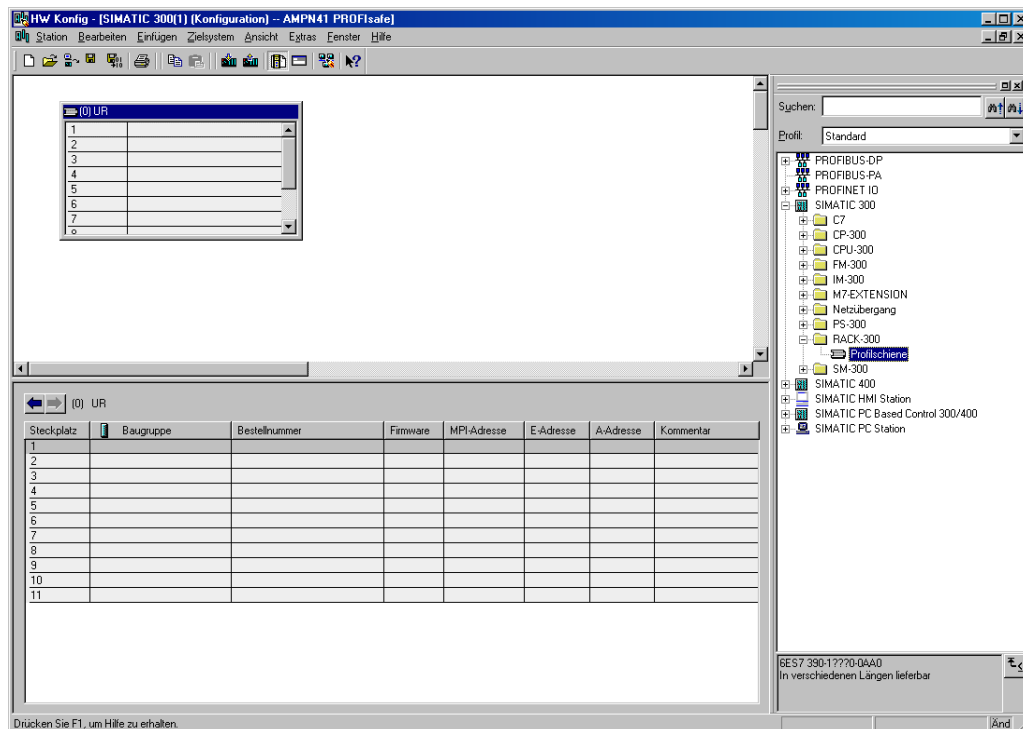
- Double click the Hardware entry to start the hardware configurator HW Config.



- If the hardware catalogue is not shown at the right side, it can be displayed using the View → Catalogue menu.

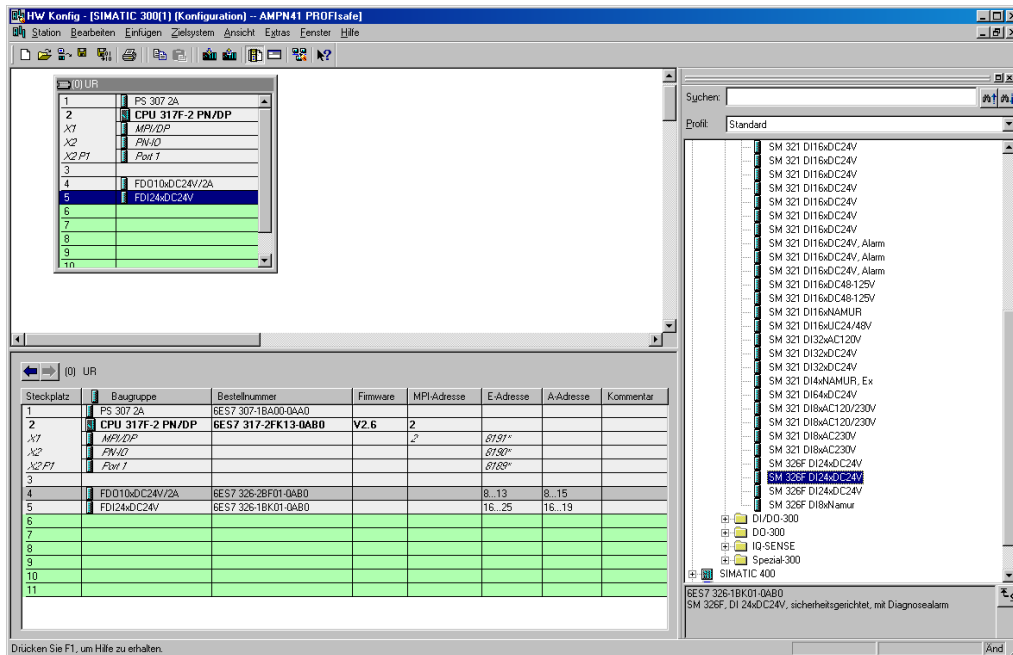


- Drag a profile rail into the project window to include the hardware components.



- Drag power supply PS 307 2A in the SIMATIC 300 → PS-300 → PS 307 2A catalogue to position 1 in the rack.
- Drag CPU 317F-2 PN/DP in the SIMATIC 300 → CPU-300 → CPU 317F-2 PN/DP → 6ES7 317-2FK13-0AB0 → V2.6 catalogue to position 2 in the rack. If necessary, the properties of the Ethernet interfaces should also be entered here.
- Drag digital output assembly SM 326F DO 10xDC24V/2A in the catalogue via SIMATIC 300 → SM-300 → DO-300 → SM 326F DO 10xDC24V/2A (6ES7 326-2BF01-0AB0) to position 4 in the rack.

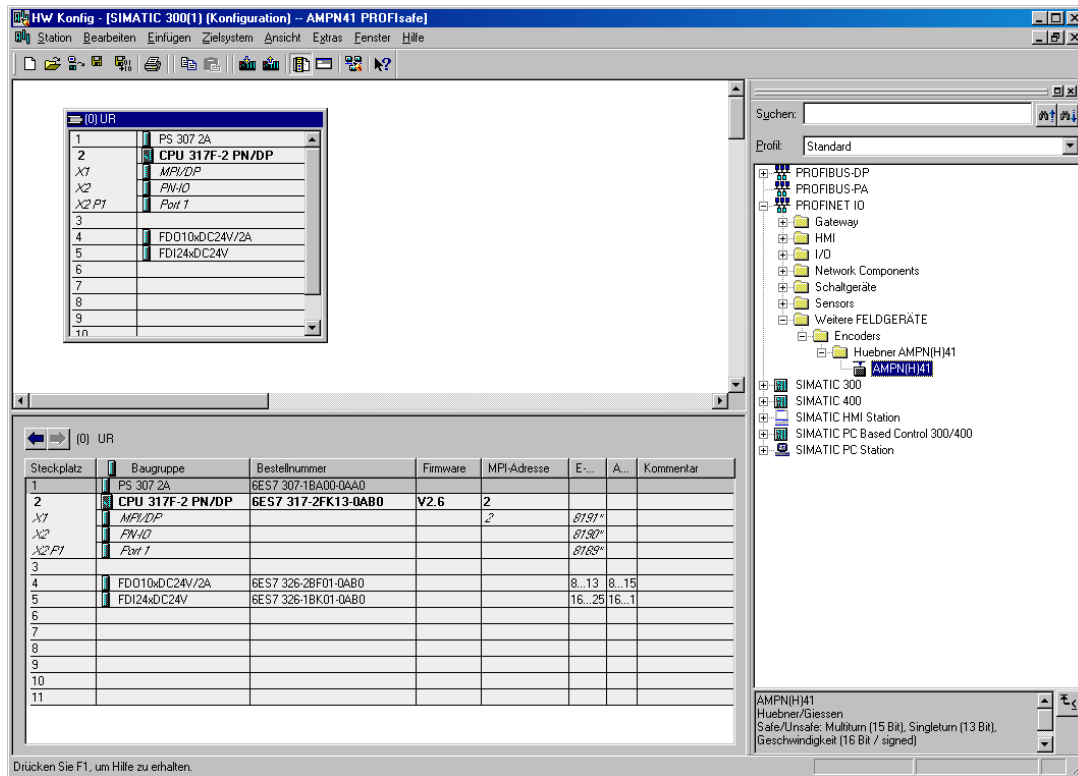
- Drag digital input assembly SM 326F DI 24xDC24V in the catalogue via SIMATIC 300 → SM-300 → DI-300 → SM 326F DI 24xDC24V (6ES7 326-1BK01-0AB0) to position 5 in the rack.



The hardware components to be included in the rack are now complete.

In the next step, the GSDML file for the measurement system must be installed. This is copied into the appropriate installation folder of the SIMATIC Managers with the associated bitmap file. Please note that the directory structure may vary.

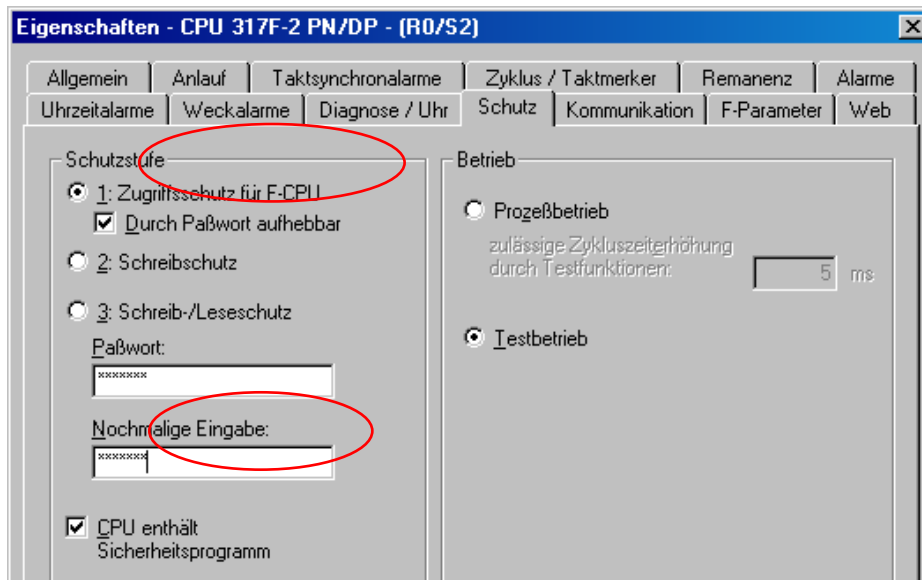
- Install the GSDML in the saved directory using the menu Extras → Install GSD files....
The measurement system will now appear in the catalogue as a new entry: PROFINET IO → Additional FIELD DEVICES → Encoders → HUEBNER AMPN (H) 41 → AMPN (H) 41



7.2.1 Set the hardware configuration properties

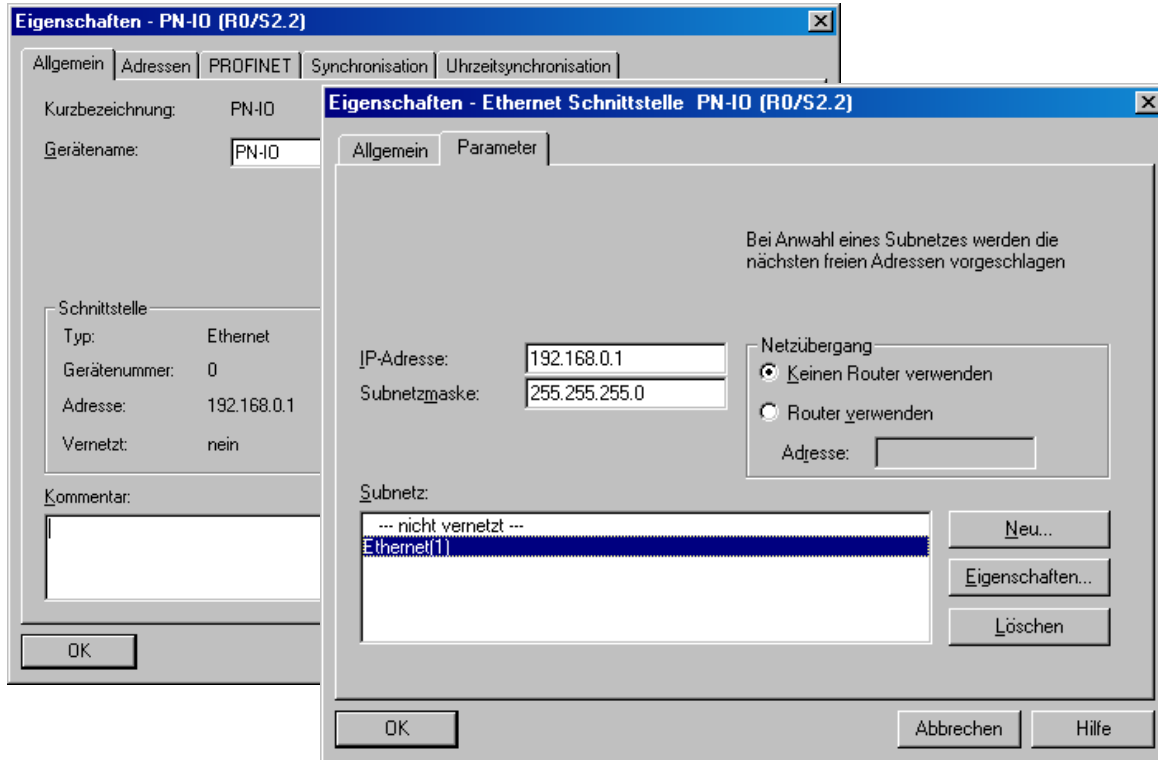
The object properties of the individual hardware components are set to the relevant position in the rack or slot by right clicking the position:

- Protection class 1 and a password must be planned for the CPU in the Protection tab. The Operation field is not relevant for safety operation.

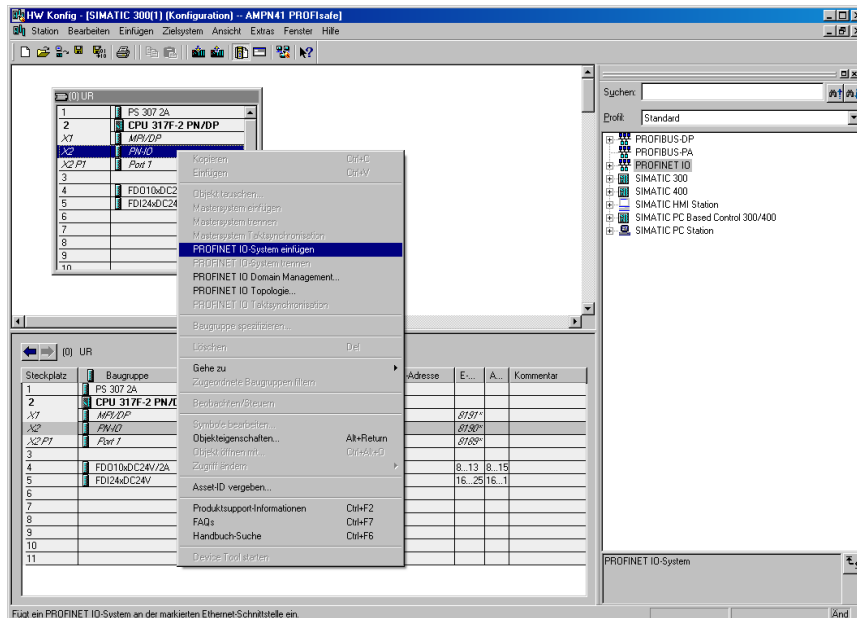


- In the sub-entry PN-IO, General → tab, select the type Ethernet in the Interface field.
- Ethernet settings for the controller (PLC) must be entered into the Properties window for the Ethernet interface PN-IO:
- IP address of the PLC

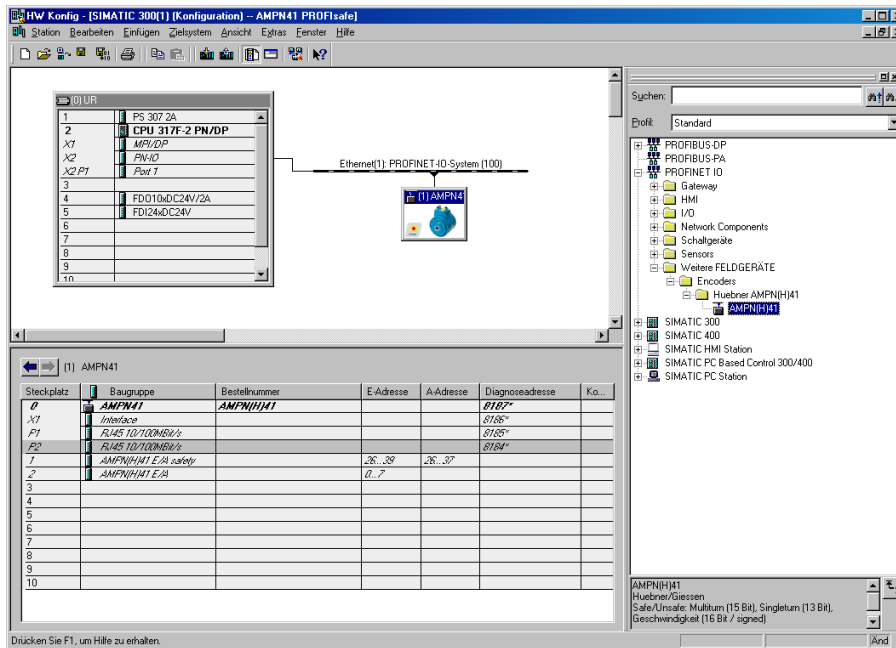
- Subnet mask of the PLC
- Subnet: Ethernet



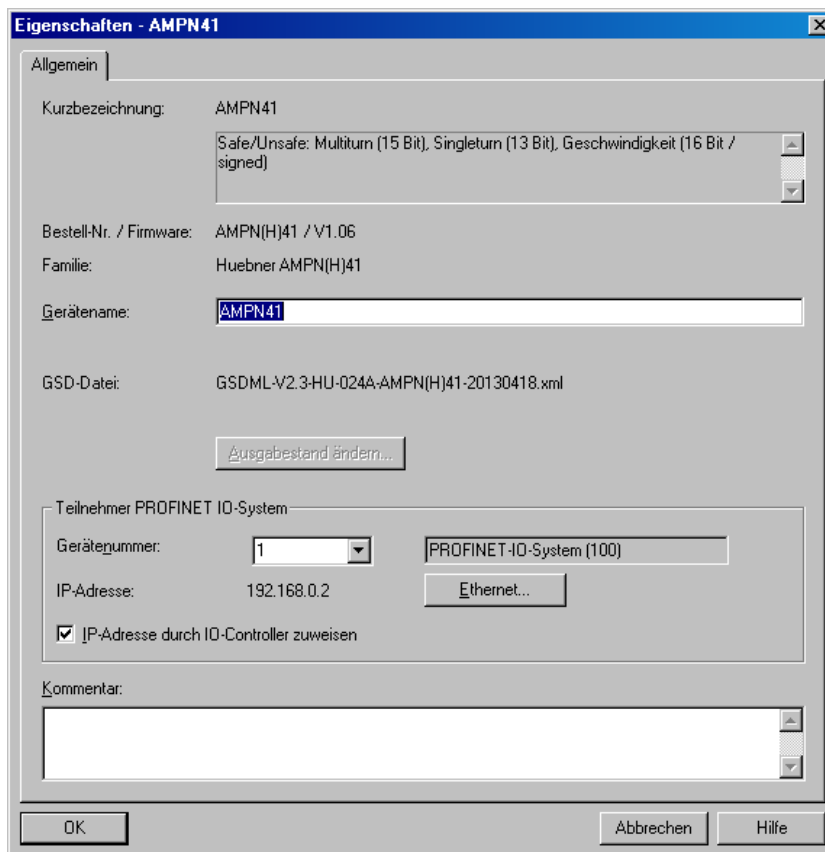
- Add PROFINET IO – System: Right click the entry “PN-IO” and then select “Insert PROFINET IO-System”.



- Connect the measurement system AMPN (H) 41 from the catalogue to the available bus line via drag&drop to the PROFINET IO-System.



- When the measurement system is connected to the master system, the device name must be entered in the Properties window in the General tab, and the check-box “Assign IP address through IO-Controller” must be marked.



- Assign device name via DCP:
- In the “HW Config” window, access the menu “Target system → Ethernet → Assign device name”.

- The measurement system which is powered up and connected to the network should be visible in the list after pressing the “Update” button.

Gerätenamen vergeben

Gerätename: AMPN41 Gerätetyp: Huebner AMPN(H)41

Vorhandene Geräte:

IP-Adresse	MAC-Adresse	Gerätetyp	Gerätename
...	00-03-12-EF-DC-EE	Huebner AMPN(H)41	...

Teilnehmer-Blinktest
Dauer (Sekunden): 3

nur Geräte gleichen Typs anzeigen nur Geräte ohne Namen anzeigen

A few seconds after pressing the “Assign name” button, the list will be updated and the new device name will be accepted.

Gerätenamen vergeben

Gerätename: AMPN41 Gerätetyp: Huebner AMPN(H)41

Vorhandene Geräte:

IP-Adresse	MAC-Adresse	Gerätetyp	Gerätename
...	00-03-12-EF-DC-EE	Huebner AMPN(H)41	AMPN41

Teilnehmer-Blinktest
Dauer (Sekunden): 3

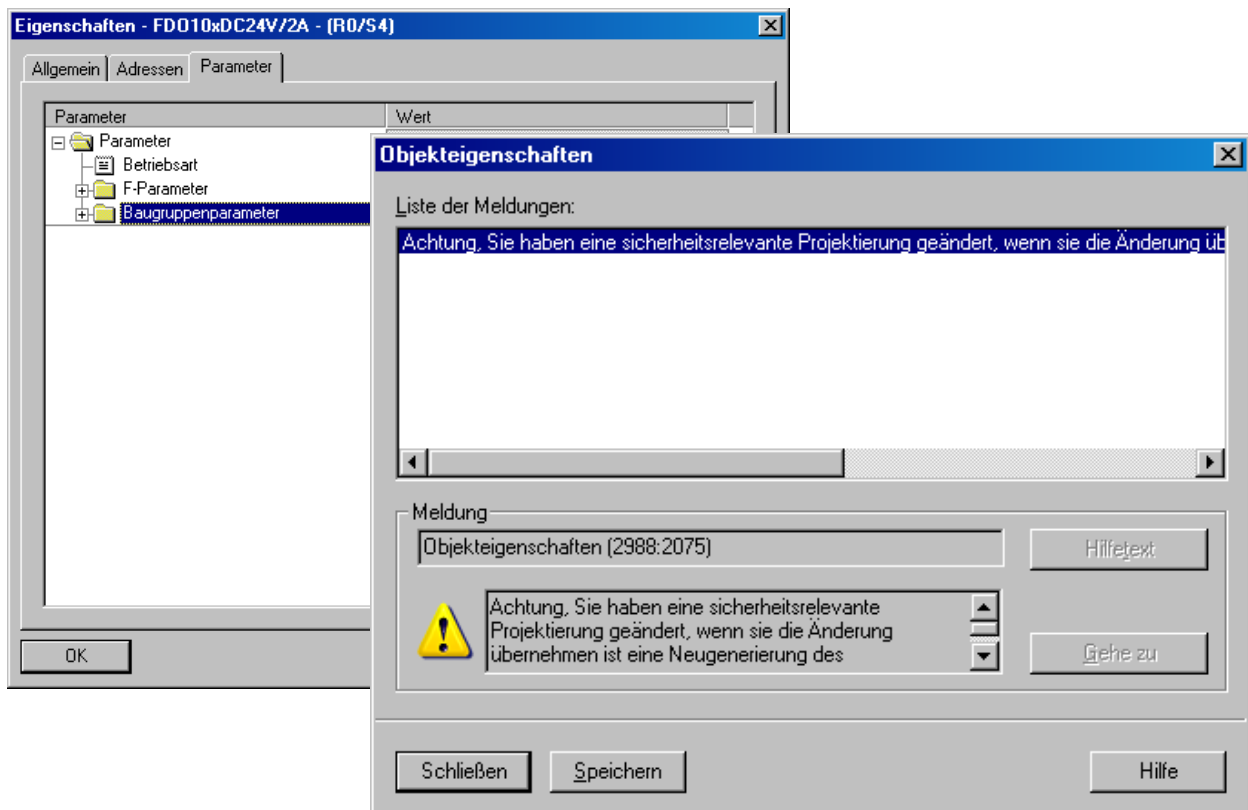
nur Geräte gleichen Typs anzeigen nur Geräte ohne Namen anzeigen



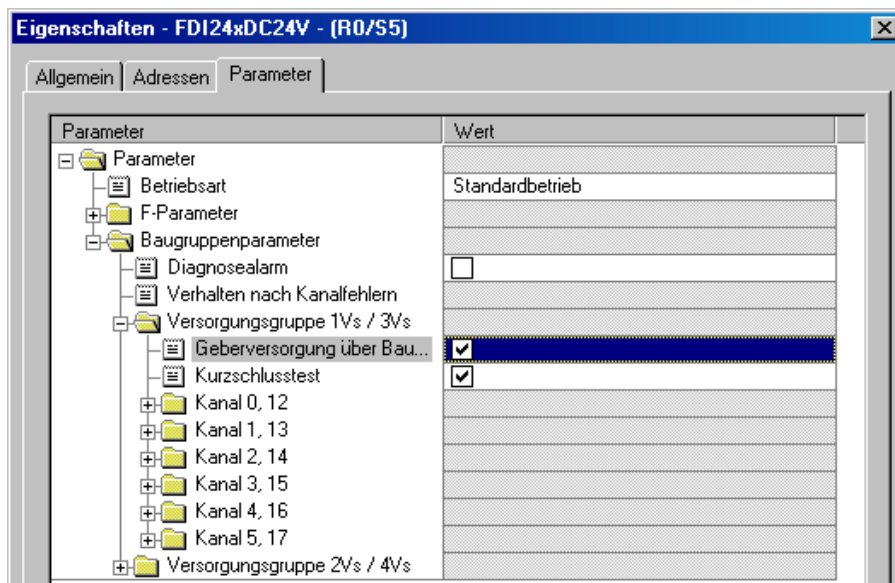
NOTE!

The measurement system does not have any stored device names upon delivery, or after a reset.

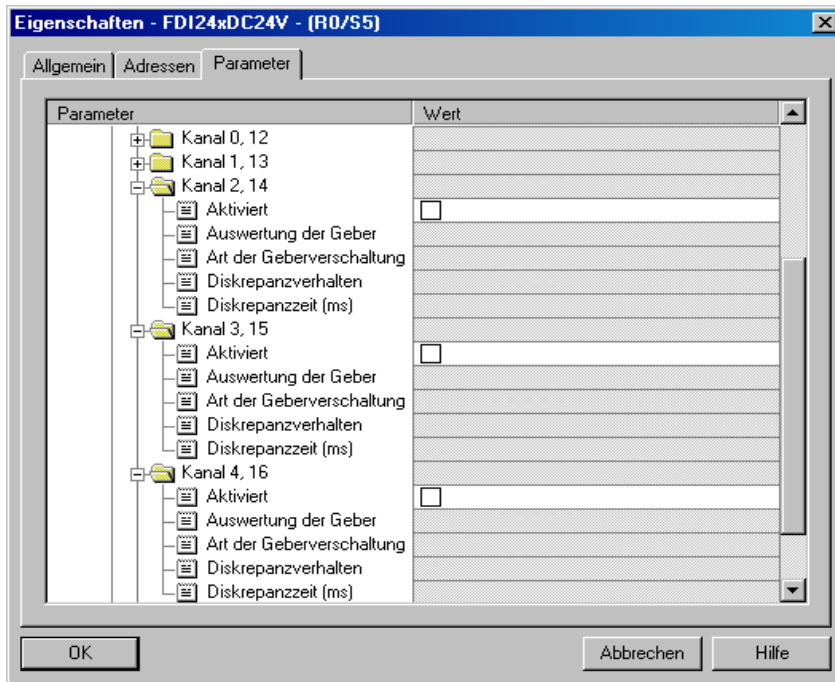
- In the Parameter tab, the Operating mode → Safety mode according to SIL3/AK5, 6 must be planned for the project for the digital output assembly. Confirm the following window by pressing Close.



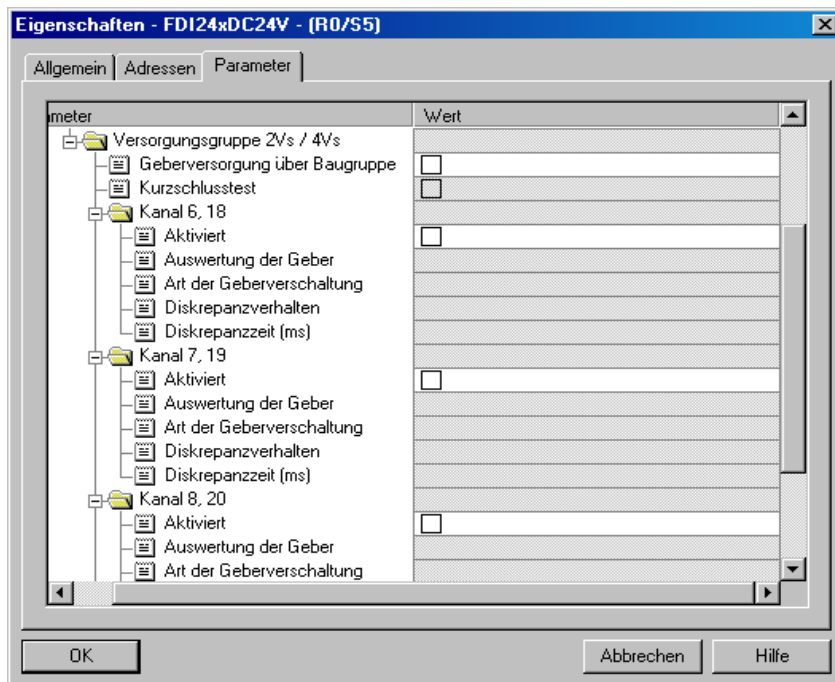
- In the Parameter tab, in the Parameter → Assembly parameters → Supply group 1Vs/3Vs folder structure, the entries Encoder supply via assembly and Short circuit test must be checked.



- The settings for channels 0, 12 and 1, 13 remain unaffected. For the channels 2, 14 / 3, 15 / 4, 16 and 5, 17 the check under the entry *Activated* must be removed for each channel.

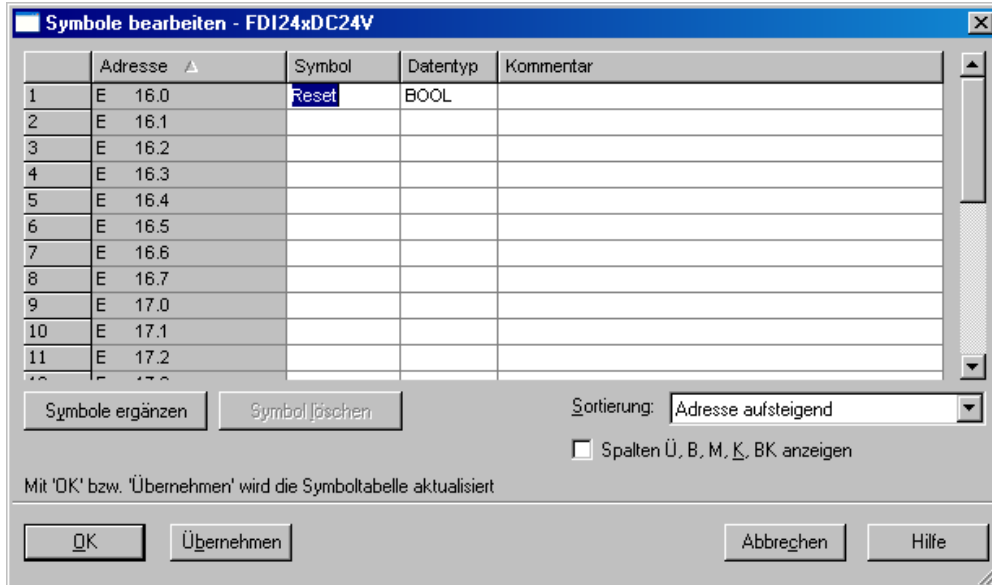


- In the supply group 2Vs/4Vs sub-folder, for all channels 6, 18 / 7, 19 / 8, 20 / 9, 21 / 10, 22 and 11, 23 the check under the entry *Activated* must be removed for each channel.



A RESET symbol is required for the digital input E 16.0 for the F-periphery Operator Acknowledgement.

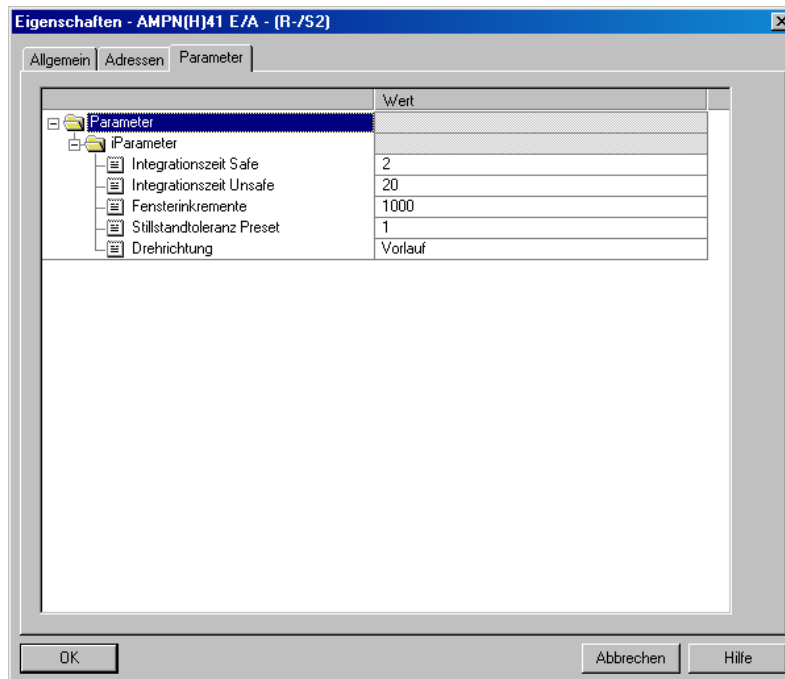
- To do so, right click the entry FDI24xDC24V in the rack or the slot and select Edit symbols.... The symbol name Reset is entered under the Symbol column, and the data type BOOL is then automatically adopted.
- Update by pressing OK.



7.3 Configuration

7.3.1 Setting the iParameters

- The iParameters can be set by marking the symbol for the measurement system → Double click on the slot entry AMPN(H) 41 E/A → Select the Parameter tab.

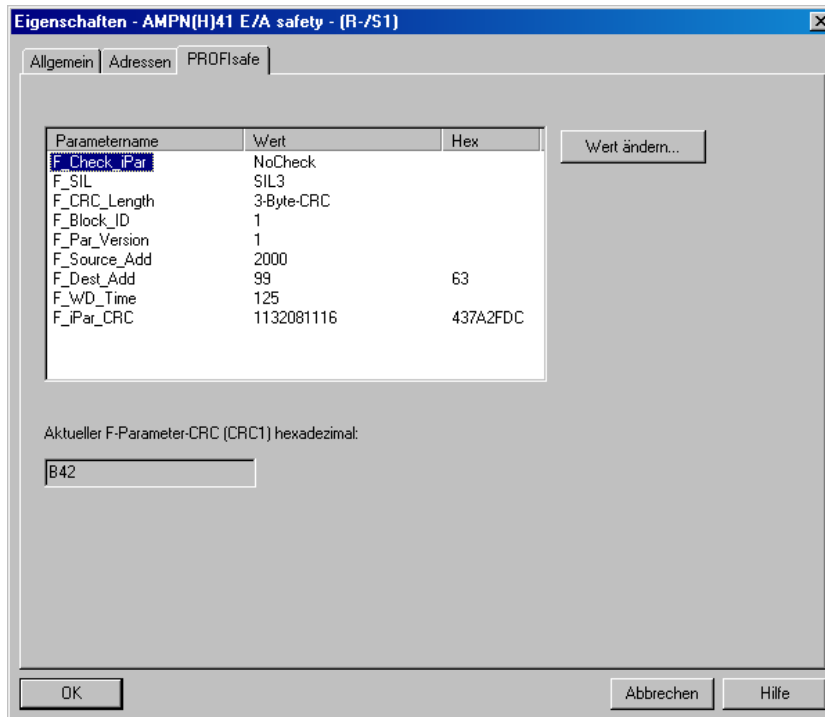


If deviating parameter values are required, as shown above, then an F_iPar_CRC calculation must be completed for this new parameter data set, see section 6.

The calculated value must then be entered in the parameter data set for F-parameters under F_iPar_CRC, see section 7.3.2.

7.3.2 Setting the F-parameters

- The F-Parameters can be set by marking the `symbol` for the measurement system → Double click on the slot entry AMPN(H)41 I/O Safety → Select the PROFIsafe tab.



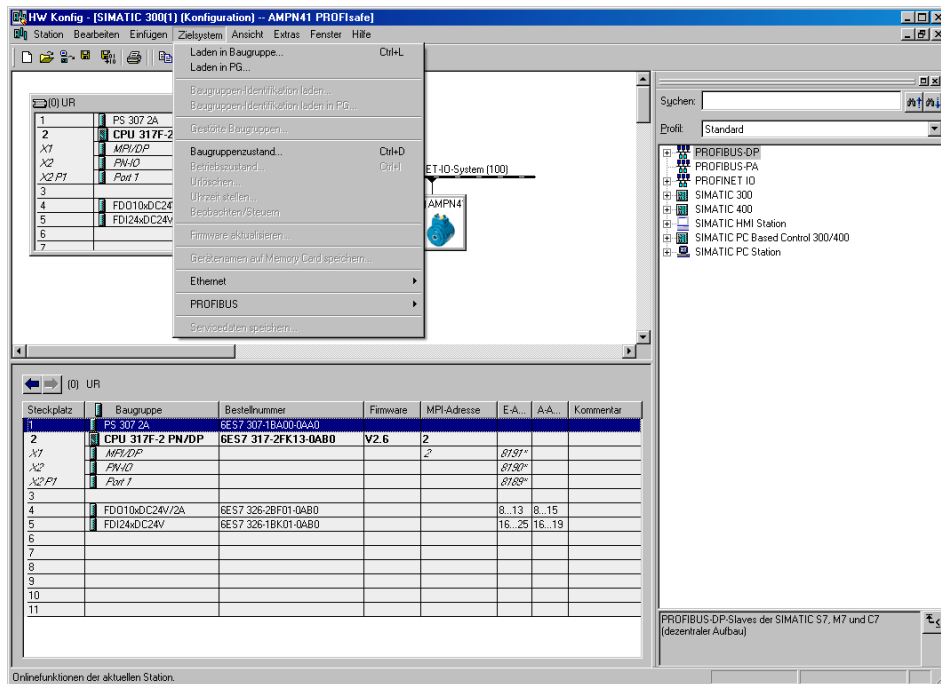
NOTE!

The F_Dest_Add entry and setting for the SPN address switch must match!

The value for the parameter `F_iPar_CRC` is determined from the set parameter data set for the `iParameter` and the calculated CRC value, see section 7.3.1.

To ensure the security program can be generated automatically, the menu `Station` → `Save and translate` must be used to translate the hardware configuration.

- Then, the HW-Configuration must be loaded to the hardware using the menu “Load target system → to assembly”..



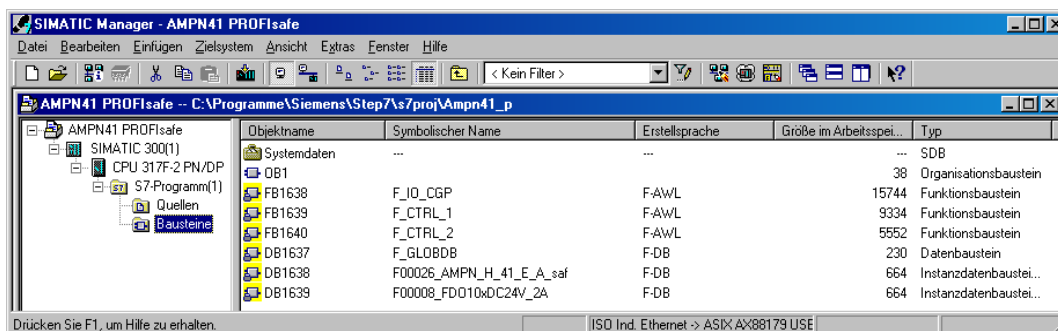
The HW Config can now be closed.

7.4 Setting the missing (F) modules

The previously automatically created modules are available for viewing in the SIMATIC Manager project folder under:

AMPN41 PROFIsafe → SIMATIC 300(1) → CPU 317F-2 PN/DP → S7-Programm(1) → modules.

All failsafe modules are highlighted yellow, to differentiate them from modules in the standard user program.



7.4.1 Program structure

Access the F-CALL from the standard user program to enter the security program. The F-CALL is accessed directly, for instance in the wake alarm-OB OB 35.

The advantage of wake alarms OBs is that interrupt cyclical program processing in the OB 1 of the standard user program at set intervals, for instance the security program is accessed and processed at set intervals in a wake alarm OB.

After the security program is run, the standard user program is continued.

7.4.2 F runtime group

For ease of use, the security program consists of an “F runtime group”. The F runtime group is a logical construct from multiple associated F modules, formed internally by the F system.

The F runtime group consists of:

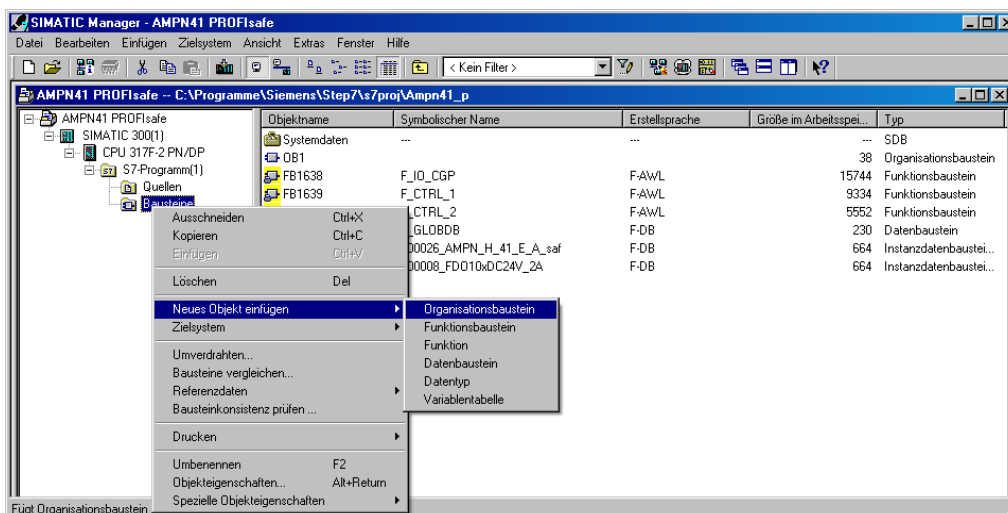
- an F-call module F-CALL, “FC1”
- an F-program module to which the F-CALL is assigned, “FC2”
- other F-FBs
- multiple F-DBs
- F-periphery DBs
- F-system modules F-SBs
- automatically generated F modules

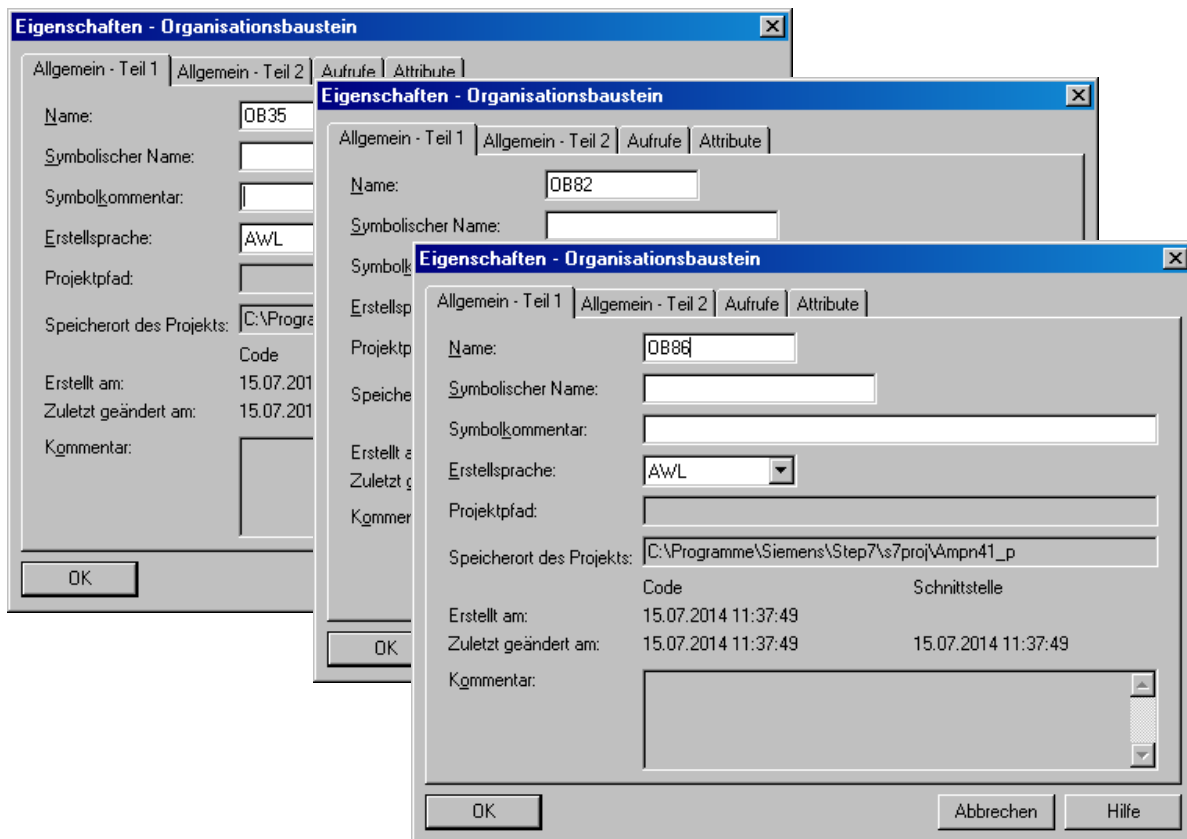
7.4.3 Generating object modules (OBs)

Then, the required organisational modules OB35 and OB82 to OB86 are generated.

- The organisational modules are inserted by right clicking in the project window `Insert new object` → `Organisational module`.

The language in which all organisational modules is created is `AWL`.



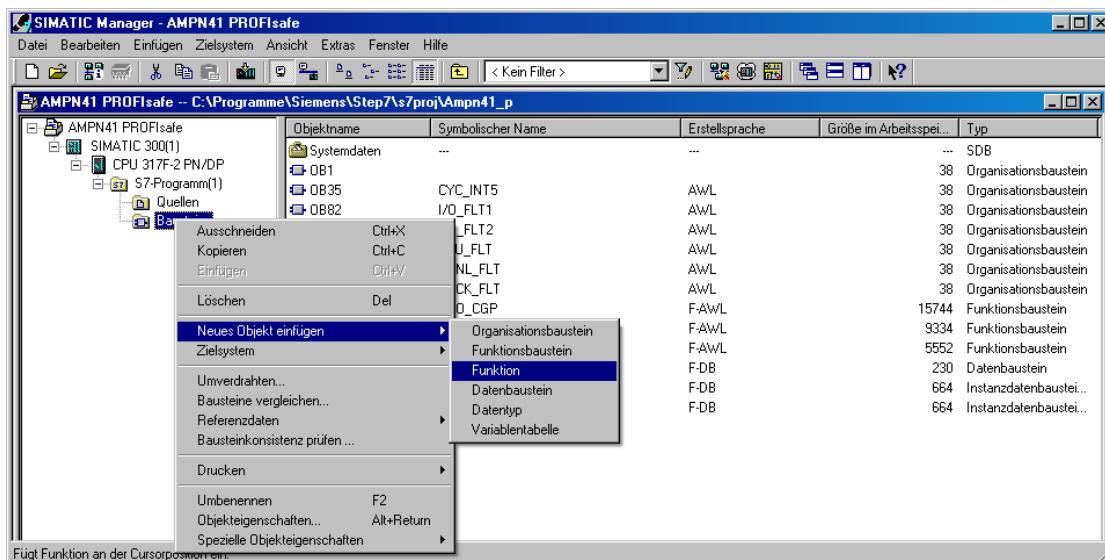


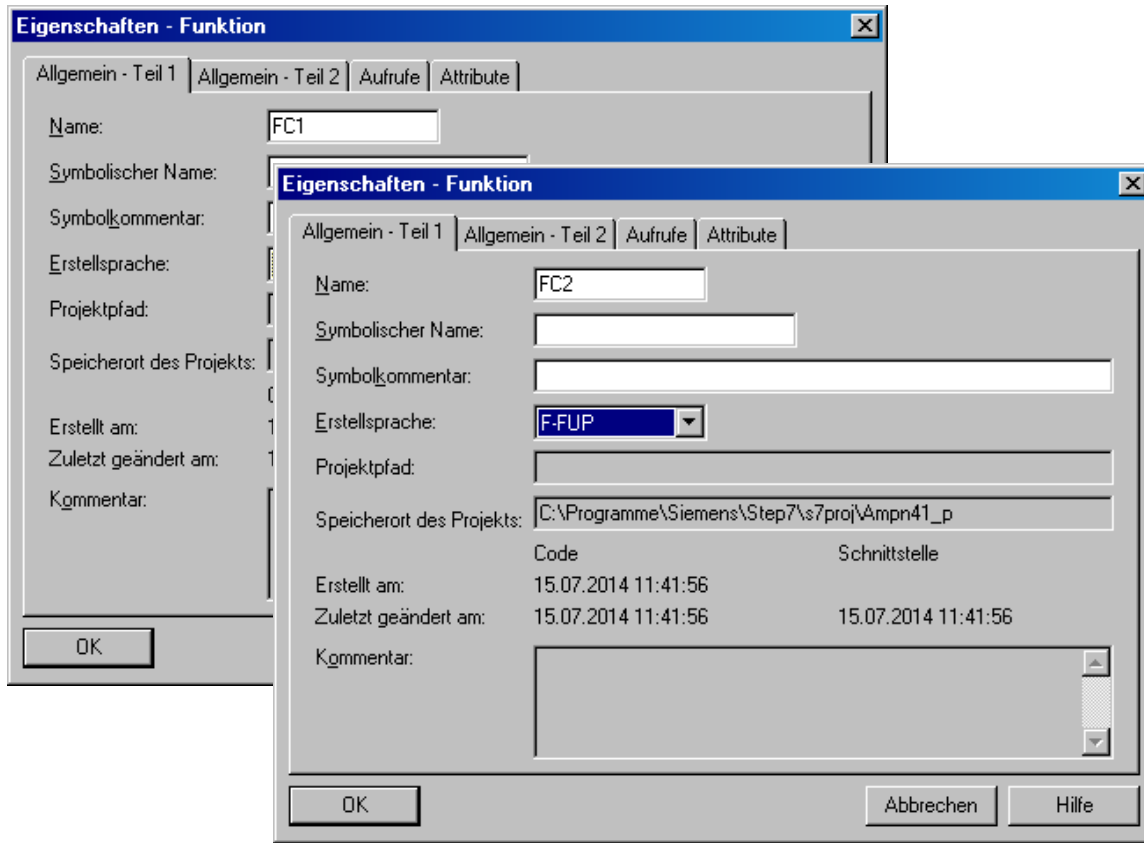
7.4.4 Generating the functions (F-FCs)

Then, the required functions FC1 and FC2 are generated.

- The functions are inserted by right clicking in the project window `Insert new object` → `Function`.

The language for FC1 is `F-CALL`, for FC2 `F-FUP`.





7.4.5 Programming the F-modules

Then programming and adjustment are carried out for the modules OB35, FC1 and FC2.

- The security program can be accessed in OB35 by double-clicking the object name entry OB35 in the project window. The instruction `CALL FC1` must be entered in the window KOP/AWL/FUP which opens. Then save the entry and close the window again.

OB35 : "Cyclic Interrupt"

Kommentar:

Netzwerk 1: Titel:

Kommentar:

CALL FC 1

The variable `ACK_REI` of the F-periphery DB must be connected to the digital entry `E 16.0 RESET` of the digital input assembly for operator acknowledgement of the F-periphery after correcting errors. The function `FC2` must be programmed accordingly for this purpose.

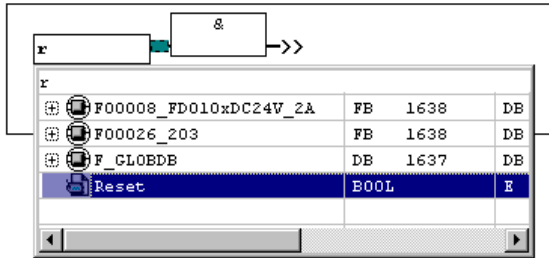
- An And box must be inserted from the symbol bar and the second entry must be assigned the Reset symbol.

FC2 : Titel:

Kommentar:

Netzwerk 1: 1 = Acknowledgement for re-integration

Kommentar:



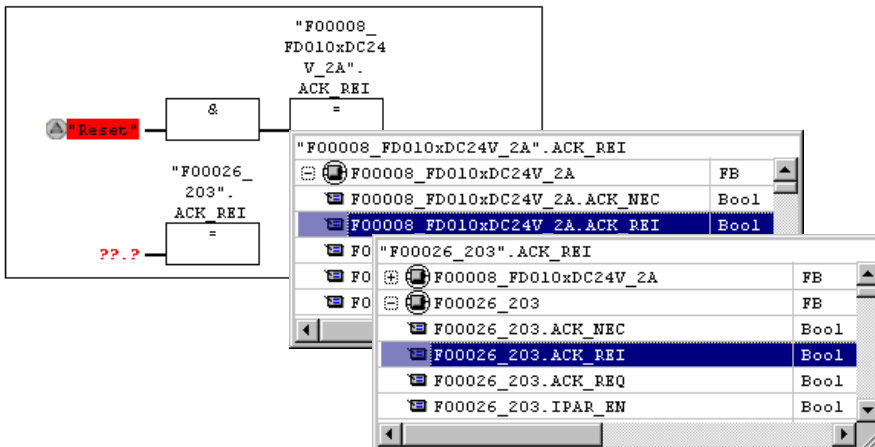
- Two assignments are inserted from the symbol bar, one assignment is assigned to the variable "F00008...".ACK_REI and the other to the variable "F00026...".ACK_REI.

FC2 : Titel:

Kommentar:

Netzwerk 1: 1 = Acknowledgement for re-integration

Kommentar:



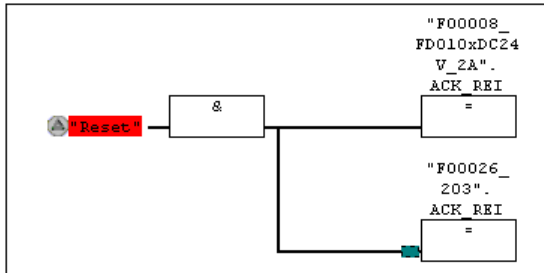
- Then, the Assignment that is not yet interconnected is interconnected to the output of the And-box via a branch. Save the programming and close the window.

FC2 : Titel:

Kommentar:

Netzwerk 1: 1 = Acknowledgement for re-integration

Kommentar:

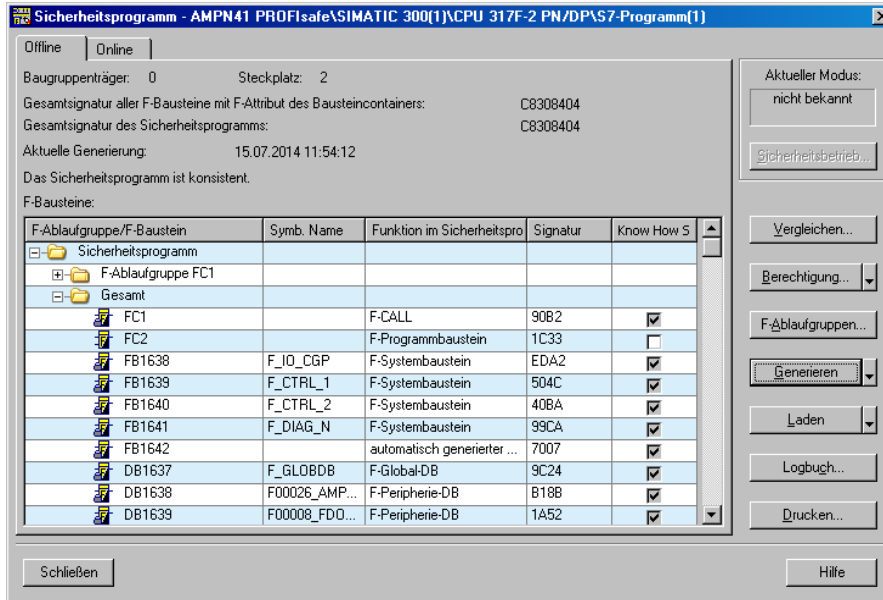


- Determine the run time group using the function FC1. In the field Max cycle time of the F-run time group in ms: enter the value 400 and confirm with OK. Also confirm the window Edit F run time groups which opens by pressing OK.

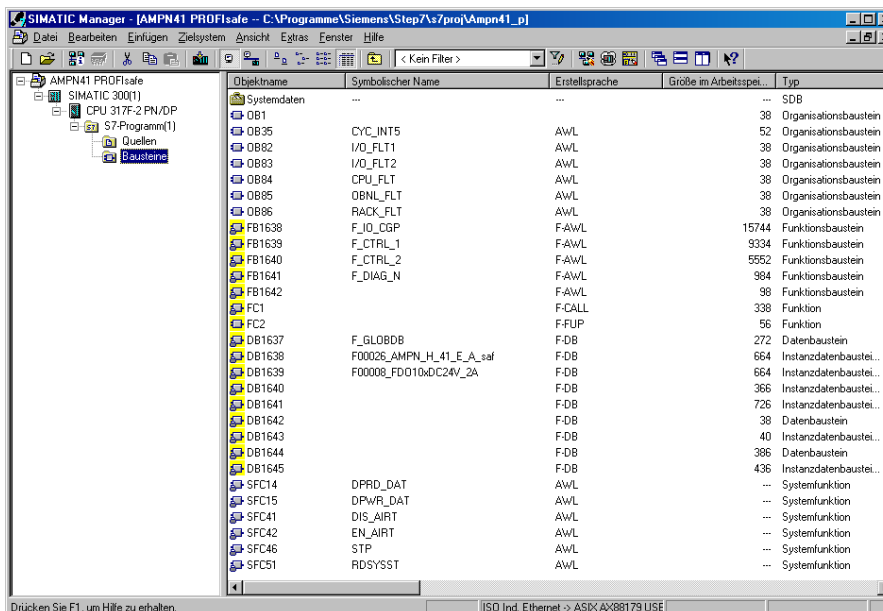
Programming and adjustments are then complete.

7.5 Generating the security program

- To create the security program, enter the dialogue Security program in the SIMATIC MANAGER → using the Extras menu and Edit security program. Press the Generate button to translate and generate the security program.



If the translation is successful, 0 warnings will be displayed. The windows can then be closed. Now, all required modules are displayed in the project window:



7.6 Load security program

After the security program has been generated, it can be loaded to the F-CPU. We recommend transferring the entire security program to the F-CPU in STOP operating mode. This ensures that a consistent security program is loaded. Loading is completed using the menu Extras → Edit security program → and the Load switch.

7.7 Test security program

After creating the security program, a complete functional test must be completed according to the automation task in question.

After changes are made to a security program that has already undergone full functional testing, it is sufficient to just test the changes.

8 Access to the safety-related data channel

Access the safety-related data channel in the module `AMPN(H) 41 E/A safety` via the process map, as for a standard peripheral device. Direct access, however, is not permitted. Access to the safety-related data channel of the measurement system is allowed only from the created F-runtime group.

The actual communication between the F-CPU (process map) and measurement system to update the process map is hidden in the background via the PROFIsafe protocol.

The measurement system covers a larger area of the process map than necessary for the function of the measurement system in the `AMPN(H) 41 E/A safety` module due to the PROFIsafe protocol. The `F-Parameter-Block` contained there in the process map is not considered part of the user data. When accessing the process map in the security program, access is permitted only to the user data itself.

8.1 Output of passivated data (substitute values) in case of an error

The safety function requires, that the substitute value (0) is used when passivating in the safety-related channel in the module `AMPN(H) 41 E/A safety` in the following cases, instead of the cyclically output values. This status is reported via the `F-Periphery DB` with `PASS_OUT = 1`, see below.

- When starting up the F system
- When there are errors in safety-related communication between the F-CPU and measurement system via the PROFIsafe protocol
- When the value set for `iParameters` for the `window increments` has been exceeded, and/or the internally calculated PROFIsafe telegram is faulty
- When the permitted operating temperature range indicated under the relevant article number has been exceeded or has not been met
- When the measurement system is unplugged in RUN mode, the F-Host is reconfigured, and then the measurement system is plugged back in

8.2 F-periphery DBs

During translation in `HW Config`, an `F-Periphery DB` is generated for each F-peripheral device, measurement system and digital output assembly. In relation to the created security program, see chapter 7, this are the modules `DB1638` for the measurement system and `DB1639` for the digital output assembly. The F-periphery DB contains variables that can be analysed in the security program or that can or must be written. The exception is the variable `DIAG`, which can only be analysed in the standard user program.

Changing the initial/actual values of the variables directly in the F-periphery DB is not possible, since the F-periphery DB is `Know-How protected`.

The variables of the measurement system F-periphery DB must be accessed in the following cases:

- Operator acknowledgement of the measurement system after communication errors or after the start-up phase
- When executing the preset function
- When analysing whether passivated or cyclical data is output
- When the cyclical data of the AMPN(H) 41 E/A safety module should be passivated depending on specific states of the security program, such as group passivation

8.2.1 Measurement system F-periphery DB “DB1638” - Overview of variables

Variable	Data type	Function	Access
PASS_ON	BOOL	1 = Passivating the cyclical data of the AMPN(H) 41 E/A safety module via the security program	read/write Default value: 0
ACK_NEC	BOOL	1 = Acknowledgement for Operator acknowledgement, required for F-periphery errors	read/write Default value: 1
ACK_REI	BOOL	1 = Acknowledgement for Operator acknowledgement after communication errors or after the start-up phase	read/write Default value: 0
IPAR_EN	BOOL	Variable for executing the Preset function	read/write Default value: 0
PASS_OUT	BOOL	Passivation output	read
QBAD	BOOL	1 = Substitute values are output	read
ACK_REQ	BOOL	1 = Acknowledgement request for Operator acknowledgement	read
IPAR_OK	BOOL	1 = Executing of the preset function completed successfully	read
DIAG	BYTE	Service information, only available in the standard program	read
QBAD_I_xx	BOOL	1 = Substitute values are output on the input channel	read
QBAD_O_xx	BOOL	1 = Substitute values are output on the output channel	read

8.2.1.1 PASS_ON

The variable `PASS_ON = 1` can be used to passivate the safety-related data of the AMPN (H) 41 E/A safety module, depending on certain states in the security program. Passivation is not carried out directly in the measurement system. Instead, the status of these variables is registered by the FHost and the host then activates passivation first via the data in the security program. The measurement system continues to output cyclical data.

If passivation is completed via `PASS_ON = 1`, the preset function is switched off.

8.2.1.2 ACK_NEC

The official use of this variable would be an operator acknowledgement for the measurement system after F-periphery errors. However, there is no process defined for the measurement system for which this process is permitted. For security reasons, these errors must be corrected first, and then the supply voltage must be switched OFF/ON, see chapter 10.

8.2.1.3 ACK_REI

If the F system detects a communication error for the measurement system, the measurement system is passivated.

For an operator acknowledgement of the measurement system after correcting the error, a positive flank is required on the variable `ACK_REI` of the F-periphery DB, which is linked to the input of the digital output assembly → E 16.0, Symbol name: "RESET"

An operator acknowledgement is required:

- After communication errors
- After the start-up phase

Acknowledgement is only possible if the variable `ACK_REQ = 1`.

An operator acknowledgement must be provided in the security program for each F-periphery via the variable `ACK_REI`. This specification has already been taken into consideration for the measurement system or the digital output assembly.

8.2.1.4 IPAR_EN

The variable `IPAR_EN` is used to execute a preset function.

The process sequence for executing this function is described in chapter 9.

An exact description of when the variable must be set/reset during reconfiguring failsafe DP Normslaves/IO Normdevices is provided in the *PROFIsafe Specification* from V1.20 or documentation on the failsafe *DP Normslave/IO Normdevice*.

NOTE!

`IPAR_EN = 1` does not trigger passivation of the measurement system!
Observe the warnings in chapter 9 with respect to executing the preset.

8.2.1.5 PASS_OUT/QBAD/QBAD_I_xx/QBAD_O_xx

The variables `PASS_OUT = 1` and `QBAD = 1` indicate a passivation of the measurement system.

The F-System sets `PASS_OUT`, `QBAD`, `QBAD_I_xx` and `QBAD_O_xx = 1`, for as long as the measurement system outputs substitute values (0) instead of the cyclical values.

If passivation is carried out via the variable `PASS_ON = 1`, however, only `QBAD`, `QBAD_I_xx` and `QBAD_O_xx = 1` are set. `PASS_OUT` does not change its value in case of passivation via `PASS_ON = 1`. `PASS_OUT` can, therefore, continue to be used for group passivation of further F-periphery devices.

8.2.1.6 ACK_REQ

If the F system detects a communication error for the measurement system, the measurement system is passivated. `ACK_REQ = 1` signals that an operator acknowledgement of the measurement system is required.

The F-System sets the variable `ACK_REQ = 1` once the error has been corrected and operator acknowledgement is possible. After acknowledgement, the variable `ACK_REQ` is reset to 0 by the F-system.

8.2.1.7 IPAR_OK

The variable `IPAR_OK` is used to indicate successful execution of the preset function. The process sequence for executing this function is described in chapter 9. An exact description of how the variable can be analysed during reconfiguring failsafe DP Normslaves/IO Normdevices is provided in the *PROFIsafe Specification* from V1.20 or documentation on the failsafe *DP-Normslave/IO Normdevice*.

8.2.1.8 DIAG

The variable `DIAG` is used to provide non-failsafe 1-byte information regarding errors that have occurred for service purposes. Access in the security program to this variable is not permitted. Encryption and use of this variable are described in the SIEMENS manual **S7 Distributed Safety - Project planning and programming**, document order number: **A5E00109536-04**.

8.3 Access to variables of the F-periphery DBs

During translation in `HW Config`, an `F-Periphery DB` is generated for each F-peripheral device, measurement system and digital output assembly, and a symbolic name is also entered into the symbol table.

The symbolic name is formed from the fixed prefix "F", the initial address of the F-periphery and the `Object` properties in `HW Config` for the name entered for the F-periphery device, a max. of 17 characters.

Variables for the F-periphery DB of an F-periphery device can only be accessed from an F runtime group and only from the F runtime group from which access to the channels of these F periphery devices is provided, if there is access.

The variables of the F-periphery DB can only be accessed by providing the symbolic name of the F-periphery DB and the name of the variable: "Fully qualified DB access"

Ensure that, in the `SIMATIC Manager`, in the `FUP/KOP-Editor` and the menu `Extras` → `Settings...` the option "Cross access from error report" is not activated in the `General` tab. Otherwise, access to variables of the F-periphery DB will not be possible.

8.4 Measurement system - Passivation and operator acknowledgement

8.4.1 After starting up the F system

After starting up the F system, communication between the F-CPU and measurement system via the PROFIsafe protocol must be established. The measurement system is passivated during this time.

While using the substitute value (0, the variables are `QBAD`, `PASS_OUT`, `QBAD_I_xx` and `QBAD_O_xx = 1`.

Operator acknowledgement of the measurement system, e.g. the output of cyclical data to the failsafe outputs, occurs independent from the standpoint of the F-host from the setting for the variable `ACK_NEC`, and automatically at the earliest after the 2nd cycle of the F-runtime group after starting up the F system. Depending on the cycle time of the F-runtime group and PROFINET, operator acknowledgement is only possible after several cycles of the F runtime group.

If it takes longer to establish communication between the F-CPU and measurement system than the monitoring time set for the F-periphery in

HW Config in the Object properties dialogue, then there will be no automatic operator acknowledgement. In this case, operator acknowledgement with a positive flank on the variable `ACK_REI` of the F-periphery DB is required, which is linked to the input of the digital input assembly → E 16.0, Symbol-Name: "RESET".

8.4.2 After communication errors


If the F system detects an error in safety-related communication between the F-CPU and measurement system via the PROFIsafe protocol, then the measurement system is passivated.

While using the substitute value (0, the variables are `QBAD`, `PASS_OUT`, `QBAD_I_xx` and `QBAD_O_xx = 1`.

Operator acknowledgement of the measurement system, e.g. an output of cyclical data to the failsafe outputs, is completed only if:

- There are no more communication errors and the F-System has set the variable `ACK_REQ = 1`.
- An operator acknowledgement with a positive flank on the variable `ACK_REI` of the F-periphery DB has been completed, and is linked to the input of the digital input assembly → E 16.0, Symbol-Name: "RESET".

9 Preset function

	<p>WARNING! ATTENTION!</p> <p>Danger of death, serious physical injury and/or property damage due to uncontrolled start-up of the drive system when executing the preset function.</p> <ul style="list-style-type: none"> • Only execute the preset function when at a standstill, see chapter 5.4.2.4. • The associated drive systems must be locked against automatic start-up. • We recommend securing triggering of the preset by the F-host through further protective measures, such as a key switch, password query, etc. • The process described below must be followed; in particular, the F-Host must analyse status bits in order to determine whether execution was successful or unsuccessful. • After executing the preset function, check the new position.
---	--

The preset function is used to set the current output position value to any position value within the measurement range. This makes it possible to set the displayed position to a machine reference position through purely electronic means.

Executing the preset function is a critical process, since the resulting jump in actual value, for instance when using a controller, may result in uncontrolled machine movements. Therefore, the preset function may only be executed when the system component in question is at a secure standstill. After completing the preset process, check whether the position output by the measurement system matches the position transferred to the measurement system.

The preset function is already locked in the measurement system and can only be activated via the variable `IPAR_EN` in the F-periphery DB `DB1638`. Even if all the pre-conditions are fulfilled from the standpoint of the F-Host, the preset function is only executed if the measurement system's shaft is stopped. A certain amount of flank jitter, however, - for instance due to machine vibrations - is permitted within a tolerance window. This tolerance window can be set via the `iParameters Standstill tolerance preset`, see chapter 5.4.2.4.

9.1 Procedure:

Requirement: The measurement system is engaged in a cyclical data exchange.

- The tabs `Preset Multi-Turn` and `Preset Single-Turn` in the output data of the `AMPN(H)41 E/A safetymodule` are set with the desired preset value.
- The F-host must set the variable associated with control bit 2^0 `iPar_EN` to 1. The rising flank then switches the measurement system to ready to receive.
- A rising flank in bit 2^0 `Preset_Request` in the `Control` tab adopts the preset value. Receipt of the preset value is acknowledged in the `Status` tab by setting the bit 2^0 `Preset_Status`.
- After receiving the preset value, the measurement system checks whether all requirements to execute the preset function are fulfilled. If this is the case, the specified value is written as a new position value. If there is an error, execution is denied and an error message is output via the `Status` tab by setting the bit 2^{15} `Error`.
- After successfully executing the preset function, the measurement system sets the variable associated with status bit 2^0 `iPar_OK` to 1 and thereby indicates to the F-Host that preset execution is complete.
- The F-host must now set the variable associated with control bit 2^0 `iPar_EN` back to 0. The falling flank then also resets the variable associated with status bit 2^0 `iPar_OK` and the bit 2^0 `Preset_Status` in the `Status` tab. The bit 2^0 `Preset_Request` in the `Control` tab must be reset manually.

- Finally, the F-Host must check whether the new position corresponds to the new target position.

10 Troubleshooting and diagnostics

10.1 Visual displays

Assignment and location of status LEDs, see chapter 4.4.2

10.1.1 Device Status

LED	Cause	Corrective action
off	No power supply	Check the power supply, wiring
	Hardware error, measurement system defect	Replace measurement system
Flashing green 3 x 5 Hz	<ul style="list-style-type: none"> The measurement system could not synchronise with the F-Host during the start-up phase, and requests an operator acknowledgement. An error in safety-related communication or a configuration error was detected and has been corrected. 	An operator acknowledgement is required via the security program for the variables provided for this purpose.
to	Measurement system ready for operation	–
red	A safety-relevant error was found, the measurement system was transferred to a failsafe state and outputs its passivated data:	To restart operation of the measurement system after passivation, the error must first generally be corrected, and then the supply voltage must be switched OFF/ON.
	Error in safety-related communication	<ul style="list-style-type: none"> Try to limit the scope of the error using diagnostic variables (control-dependent). Check whether the value set for the parameter <code>F_WD_Time</code> is suitable for the automation task, see chapter 6.2.2 Check whether the PROFINET connection between the F-CPU and measurement system is disrupted.
	The value set for the parameter <code>Window increments</code> was exceeded.	Check whether the value set for the parameter <code>Window increments</code> is suitable for the automation task, see chapter 5.4.2.3
	The permitted operating temperature range was exceeded or was not met.	Suitable measures must be taken to ensure that the permitted operating

LED	Cause	Corrective action
		temperature range can be upheld at all times.
	The measurement system was supplied with >36 V DC for longer than 200 ms.	The measurement system must be promptly shut down and inspected in the factory. When sending in the measurement system, indicate the reasons or circumstances for the over-voltage.
	The internally calculated PROFIsafe telegram is faulty.	Supply voltage OFF/ON. If the error persists after these measures, the measurement system must be replaced.

10.1.2 Bus Status

LED	Cause	Corrective action
off	No errors	–
Flashing red 0.5 Hz	<ul style="list-style-type: none"> • F configuration faulty, e.g. PROFIsafe target address set incorrectly <code>F_Dest_Add</code> • Incorrectly planned <code>F_iPar_CRC</code> value 	<ul style="list-style-type: none"> • Check the PROFIsafe target address set via the hardware switch. Valid PROFIsafe target addresses: 1 – 99, see chapter 5.4.1.6. • The checksum calculated for the set iParameter set is incorrect, or was not taken into account in project planning, see chapter 6
red	No connection to the IO controller	Check the device name, IP address, and subnet mask

10.1.3 PORT1; PORT2

LED	Cause	Corrective action
off	No power supply, or required power supply level not provided	Check the power supply, wiring
	No Ethernet connection	Check cables
	Hardware error, measurement system defect	Replace measurement system
green	Measurement system ready for operation, Ethernet connection formed	

10.2 PROFINET IO diagnostics

PROFINET IO supports a consistent diagnostic concept that facilitates efficient error localisation and correction. When an error occurs, the faulty IO device generates a diagnostic alarm to the IO controller. This alarm opens a relevant program routine in the controller program to react to the error.

Alternatively, diagnostic information can also be read out directly by the IO device via record data and displayed on an IO Supervisor.

10.2.1 Diagnostic alarm

Alarms are part of the acyclic frame transmitted via the cyclical RT channel. They are also designated by the EtherType 0x8892.

The measurement system supports only manufacturer-specific diagnostic alarms that can be identified by the `UserStructureIdentifier` 0x5555. A 4-byte error code (`UserData`) follows this ID. This reports and stores the first error which occurs, then displays it via the LED "Device Status, LED1 Bicolor". The IOPS bit is set to `BAD`.

Since the measurement system can generate hundreds of error codes, these are not listed here. Troubleshooting should be carried out as described in the chapter "Visual displays". If the error cannot be corrected, the error code can be transmitted to Johannes Hübner Gießen with the order number for evaluation.

10.2.2 Diagnosis via record data

Diagnostic data can also be requested with an acyclic reading order `RecordDataRead (DiagnosisData)` if it is stored in the IO device. The IO controller must transmit a reading order with the relevant record index for the requested diagnostic data for this purpose.

The diagnostic information is analysed on different addressing levels:

- AR (Application Relation)
- API (Application Process Identifier)
- Slot
- Subslot

There is a group of diagnostic data sets for each address level.

The exact structure and scope are described in the PROFINET specifications *Application Layer protocol for decentralized periphery and distributed automation*, Order no.: 2.722.

Diagnostic data can also be read out manually, for instance, via the record index 0xE00C, in the same manner as the manufacturer-specific diagnostic alarm. Stored errors are designated with the `UserStructureIdentifier` 0x5555, similar to diagnostic alarms. The error code follows, as indicated above under the diagnostic alarm.

10.3 Data status

Transmitted data is generally assigned a status during cyclical real time communication. Each subslot has its own status information: *IOPS/IOCS*.

This status information indicates whether the data is valid = *GOOD* (1) or invalid = *BAD* (0).

Output data can switch briefly to *BAD* during configuration, when executing the preset function, and during start-up. A “Return of submodule alarm” is transmitted when switching back to the status *GOOD*.

If there is a diagnostic alarm, the status is likewise set to *BAD*, but can only be reset via a re-start.

Example: Input data IO-Device → IO-Controller

VLAN	Ethertype	Frame-ID	Data	IOPS	...	IOPS	...		Cycle	Data Status	Transfer Status	CRC
4	0x8892	2	1..	1		1			2	1	1	4

Example: Output data IO-Controller → IO-Device

VLAN	Ethertype	Frame-ID	IOCS	IOCS	...	Data	IOPS ...	Data... IOPS	Cycle	Data Status	Transfer Status	CRC
4	0x8892	2	1..	1		1 ...		1 ..	2	1	1	4

10.4 Return of Submodule Alarm

The measurement system reports a “Return of submodule alarm” when

- The measurement system can deliver valid data once again for a certain input element without requiring reconfiguration, or
- An output element can process the received data once again.

In this case, the status for the measurement system (submodule) *IOPS/IOCS* switches from “*BAD*” to “*GOOD*”.

10.5 Information & maintenance

10.5.1 I&M0, 0xAFF0

The measurement system supports the I&M function “**I&M0 RECORD**” (60 Byte), similar to PROFIBUS “Profile Guidelines Part 1”.

I&M functions specify the manner in which the device-specific data must be stored uniformly in the IO device, according to a type plate.

The I&M record can be read out via an acyclic reading order.

The record index is 0xAFF0, the reading order is transmitted to module 1 / submodule 1.

The received 60 bytes are composed as follows:

Contents	Number of bytes
Manufacturer-specific (block header type 0x20)	6
Manufacturer_ID	2
Order_ID	20
Serial no. (internal)	16
Hardware revision	2
Software revision	4
Revision number	2
Profile ID	2
Profile-specific type	2
I&M Version	2
I&M Support	2

11 Functional safety

11.1 Safety parameters

Determined parameters according to DIN EN ISO 13849-1:

Architecture	Category	PL	MTTF _D [a]	Service life
1oo2 (2-channel)	3	d	297.9	20 years

The safety parameters of the overall system are provided in the configuration manual.

11.2 Reliability parameters for the SPB

Parameters set according to IEC 61508 and DIN EN 62061:

PFD _{AV}	PFH [FIT]	DC _{avg} [%]	SIL CL
3.17E-05	0.18	96.0	2 (high demand)

Calculations for the safety parameters of the overall system are provided in the configuration manual.

11.3 Information on functional safety

11.3.1 Safety function principle

System safety is ensured in that:

- The USL internally compares the positions recorded by the two channels in a two-channel process, determines the speed in a two-channel process and transmits secure data to the PROFINET IO in the PROFIsafe protocol.
- The USL switches the PROFIsafe channel to error status if a channel comparison fails, or in case of other errors detected by internal diagnostic mechanisms.
- The USL configuration and execution of the preset function are ensured accordingly.
- The controller also checks whether the received position data is within the position window expected by the controller. unexpected position data includes, for instance, jumps in position, drag error deviations and incorrect direction of travel.
- The controller initiates safety measures defined by the system manufacturer if errors are detected.
- The system manufacturer ensures by properly installing the USL that the measurement system is always driven by the axis to be measured, and is not overloaded.
- The system manufacturer completes a secure test during commissioning and each time a parameter is changed.

11.3.2 Safe state

If a safe position cannot be output due to an error detected by the measurement system, the PROFIsafe data channel is automatically switched to a failsafe state. In this state, PROFIsafe outputs so-called “passivated data”. See also section 8.1.

Passivated data is:

- PROFIsafe data channel: All outputs are set to 0.
- PROFIsafe status: Error bit 2¹ Device_Fault is set.
- PROFIsafe-CRC: valid

When passivated data is received, the F-Host must transfer the system to a safe state. This error state can only be exited by correcting the error and then switching the supply voltage off and back on again.

The process data channel addressed via PROFINET-IO is not necessarily affected by this. If the internal diagnostics in the master channel do not detect an error, process data will continue to be output. This data, however, is not secure in the sense of a security standard.

11.3.3 Required security reviews / measures

Measures during commissioning, changes	Error reaction F-Host
Application-dependent configuration or determination of required <code>iParameters</code> , see chapter 5.4.2.	–
When parameters are changed, check whether the measure is executed as desired.	STOP

Review by F-Host	Error reaction F-Host
Cyclical consistency check of current safety-related data from the <code>AMPN(H) 41 E/A safety</code> module with previous data.	STOP
Travel curve calculation and monitoring using the cyclical data from the <code>AMPN(H) 41 E/A safety</code> module.	STOP
Monitoring of cyclical data from the <code>AMPN(H) 41 E/A safety</code> module or process data from the <code>AMPN(H) 41 E/A safety</code> module.	Receipt of passivated data → STOP
Timeout: Monitoring of the measurement system answer time. For reviewing, for instance, broken cables, voltage drops, etc.	STOP

12 Inspections

12.1 Maintenance information

The SPN is maintenance-free.

13 Transportation, packaging and storage

13.1 Transportation safety information

!	<p>CAUTION! Property damage due to improper transportation! These symbols and information on the packaging must be observed: Do not throw, risk of breakage, protect against wetness</p>
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13.2 Incoming goods controlling


The delivery must be checked promptly for transportation damage and to ensure it is complete upon receipt.

If there is transportation damage, the carrier must be informed directly upon delivery (take photos as evidence).

13.3 Packaging (disposal)

Packaging will not be taken back, and must be disposed of according to applicable statutory specifications and local regulations.

13.4 Storing packages (devices)

	<p>Protect against wetness! Protect packages against wetness, store in a dry and dust-free location.</p>
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In case of long storage times (> 6 months), we recommend packaging the devices in protective packaging (with desiccants).

13.5 Returning equipment (repair/goodwill/warranty)

Service requests (repair/goodwill/warranty) can be initiated directly via the following online form:

<https://www.huebner-giessen.com/en/service-support/service/>

There you will also find contact details for our service, as well as questions and answers regarding the processing.

Devices that have come into contact with radioactive radiation or materials will not be taken back.

Devices that have come into contact with biological or chemical substances that could be hazardous to health must be decontaminated before they are returned.

A clearance certificate must be enclosed.

13.6 Disposal

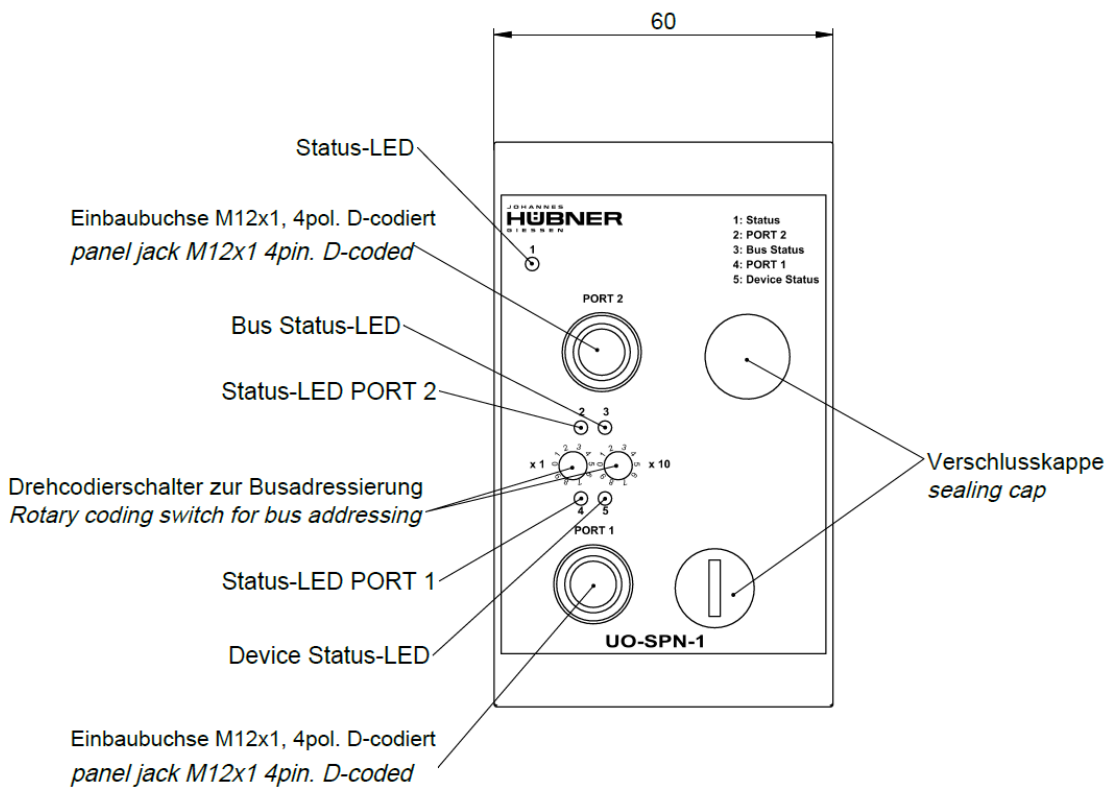
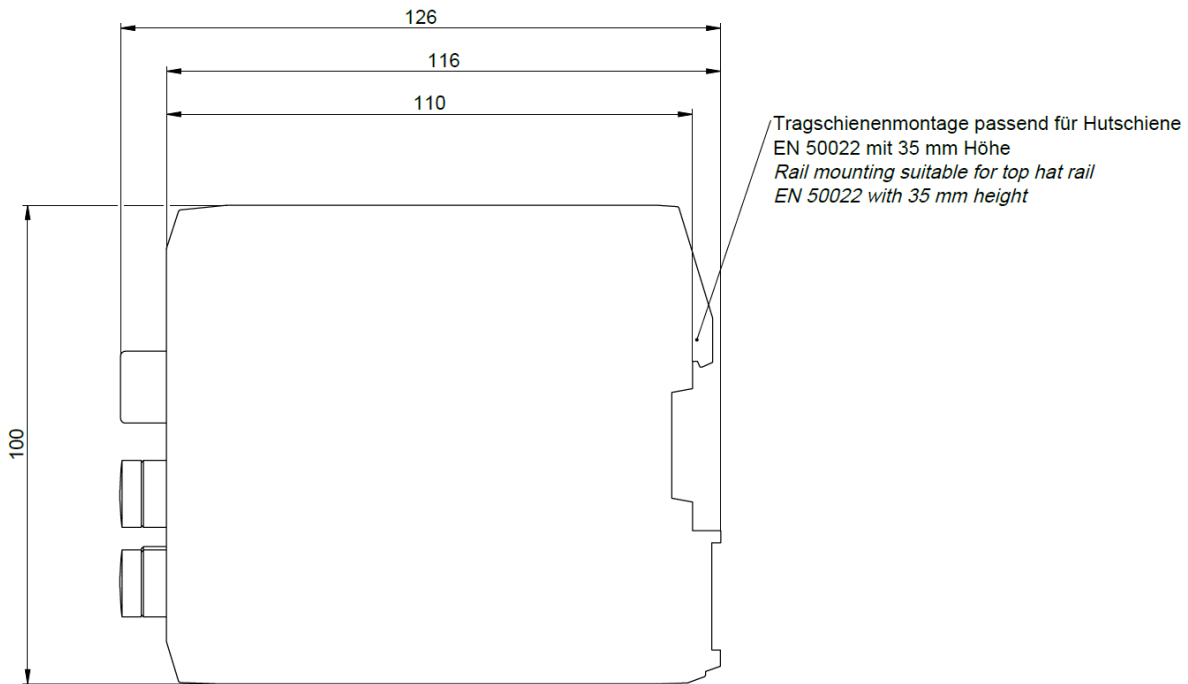
The manufacturer is not obligated to take back the devices.

The module must be treated as special electronic waste, and must be disposed of according to specific national law.

Local municipal authorities or speciality disposal companies can provide information on environmentally appropriate disposal.

14 Documents

14.1 Dimensional drawing



14.2 Wiring diagram

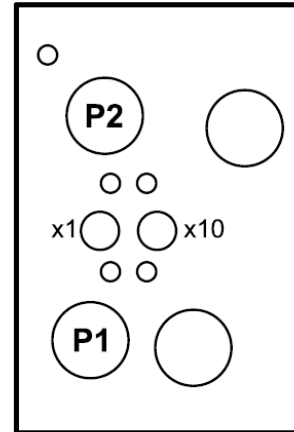
Steckerzuordnung
connector assignment

Kabelspezifikation / Cable specification

Datenleitung / *Data cable*

Kabelspezifikation: min. 0,25mm², paarig verseilt und geschirmt

Cable specification: min. 0.25mm², stranded in pairs and shielded



M12-Stecker		Anschlussplan		PN165-413		
<i>M12 plugs</i>		<i>Connection diagram</i>		<i>PN165-413</i>		
PROFINET / PROFINET						
P2	Buchse, M12x1, 4 polig Socket, M12x1, 4 pole D-coded		PORT 2			
			1	TxD+	Sendedaten + <i>Transmission Data +</i>	
			2	RxD+	Empfangsdaten + <i>Receive Data +</i>	
			3	TxD-	Sendedaten - <i>Transmission Data -</i>	
			4	RxD-	Empfangsdaten - <i>Receive Data -</i>	
			Gewinde <i>Thread</i>		Schirmung <i>Shielding</i>	
P1	Buchse, M12x1, 4 polig Socket, M12x1, 4 pole D-coded		PORT 1			
			1	TxD+	Sendedaten + <i>Transmission Data +</i>	
			2	RxD+	Empfangsdaten + <i>Receive Data +</i>	
			3	TxD-	Sendedaten - <i>Transmission Data -</i>	
			4	RxD-	Empfangsdaten - <i>Receive Data -</i>	
			Gewinde <i>Thread</i>		Schirmung <i>Shielding</i>	