PSS u2 I/O EtherNet/IP with CIP Safety Protocol on a Schneider Electric PLC with Control Expert

PILZ
THE SPIRIT OF SAFETY

Product
Type: PSS u2 I/O
Name: PSS u2 P0 F/S EIP2, **328072**
Manufacturer: Pilz GmbH & Co. KG, Safe Automation

Document
Release Number: 01
Release Date: 21 January 2022

Important Note
This document only describes the PSS u2 head module with EtherNet/IP and CIP Safety with order number 328072!

Application Note – 1005579_EN_01

Document Revision History

Release	Date	Changes	Chapter
01	2022-01-21	Creation	all

Validity of Application Note

This present Application Note is valid until a new version of the document is published.
This and other Application Notes can be downloaded in the latest version and for free from www.pilz.com. For a simple search, use our content document (1002400) or the direct search function in the download area.

The Pilz newsletter is free of charge and keeps you up-to-date on all the latest issues and trends in safe automation.

Exclusion of Liability

We have taken great care in compiling our application note. It contains information about our company and our products. All statements are made in accordance with the current status of technology and to the best of our knowledge and belief.
While every effort has been made to ensure the information provided is accurate, we cannot accept liability for the accuracy and entirety of the information provided, except in the case of gross negligence. In particular, all information on applicable standards, safety-related classifications and time characteristics should be viewed as provisional. In particular it should be noted that statements do not have the legal quality of assurances or assured properties.
We are grateful for any feedback on the contents.

January 2022

Industrial Security

To secure plants, systems, machines and networks against cyberthreats it is necessary to implement (and continuously maintain) an overall Industrial Security concept that is state of the art.
Perform a risk assessment in accordance with VDI/VDE 2182 or IEC 62443-3-2 and plan the security measures with care. If necessary, seek advice from Pilz Customer Support.

Abbreviations

Abbreviation / term	Description	Source
AN	**A**pplication **N**ote	www.pilz.com > AN content (1002400)
PNOZ	Pilz E-STOP positive-guided (DE: **P**ilz **NO**T-AUS-**Z**wangsgeführt)	www.pilz.com > PNOZ
PSS	Programmable control system (DE: **P**rogrammierbares **S**teuerungs**s**ystem)	www.pilz.com > PSS
PSS u2	**PSSu**niversal, **2**nd generation	www.pilz.com > PSS u2
POU	**P**rogram **O**rganisation **U**nit	
NC	**N**ormally **C**losed	
NO	**N**ormally **O**pen	

Definition of Symbols

- Information that is particularly important is identified as follows:

CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken.
It also highlights areas within the text that are of particular importance.

INFORMATION

This gives advice on applications and provides information on special features.

Contents

1 Useful documentation

Reading the documentation listed below is necessary for understanding this Application Note. The availability of the software used and its safe handling are also presupposed for the user.

1.1 Documentation from Pilz GmbH & Co. KG

No.	Description	Item No. /Download
1	Pilz international homepage, download section	www.pilz.com > Support > Downloads
2	Software *PASconfig*, Online help Pilz international Webportal > Products and Solution > Controllers > I/O systems > I/O modules PSSuniversal 2 **Software version 5.0.0 available.** Please use the latest version in the link beside. or the Head module under section “Software”	Products and Industries > Controllers > Overview I/O systems www.pilz.com > Download PASconfig **328072** (Order number head module) www.pilz.com > Download 328072
3	System Description PSSuniversal 2	Not yet available.
4	Installation manual PSSuniversal 2	1004152-EN-xx www.pilz.com > Download 1004152
5	Operation manual PSS u2 P0 F/S EIP2 Product modification PSS u2 P0 F/S EIP2 Hardware version 02 EDS file under section ‘Device description file’	1004152-EN-xx www.pilz.com > Download 1005376 Not yet available. **328072** (Order number head module) www.pilz.com > Download 328072
6	Operation manual PSS u2 EF 8DI	1003619-EN-xx www.pilz.com > Download 1003619
7	Operation manual PSS u2 EF 8DO 0.5	1003621-EN-xx www.pilz.com > Download 1003621
8	Operation manual PSS u2 ES 8DID	1003612-EN-xx www.pilz.com > Download 1003612
9	Operation manual PSS u2 ES 8DOD 0.5	1003614-EN-xx www.pilz.com > Download 1003614

- Note
  Please refer to
  - the file *Readme* belonging to the software version under number ‘2’ and
  - the updated document *Product modification* under number ‘5’.

1.2 Documentation from other sources of information

No.	Description	Item No. / Download
1	Schneider Electric Safety Manual - Modicon M580 PAC Controller	www.se.com > Download QGH46982

2 Used hardware and software

2.1 Pilz products

No.	Descriptions	Order number	Version	Number	IP address
1	Hardware head module PSS u2 P0 F/S EIP2	**328072**	02	1	**192.168.10.3**
2	Hardware Terminal block 9-pin, 1 piece PSS u2 T 9 SD (1 pc.) Note: 1 piece is included on the head module	328 830	--	0	--
3	Hardware memory card µSD Memory Card 512MB, industrial version	328835	--	1	--
4	Hardware Backplane 4 Slots PSS u2 B 4	328810	01	2	--
5	Hardware backplane 1 Slot PSS u2 B 1 Note: alternative backplane type (8 pieces necessary)	328811	--	0	--
6	Hardware electronic module PSS u2 EF 8DI	328101	01	2	--
7	Hardware electronic module 2x PSS u2 EF 8DO 0.5	328131	01	2	--
8	Hardware electronic Module PSS u2 ES 8DID	328311	01	2	--
9	Hardware electronic module 2x PSS u2 ES 8DOD 0.5	328401	01	2	--
10	Hardware terminal block 8-pin, 1 piece PSS u2 T 8 (1 pc.) Note: Also available in packs of 10 and 50 pieces.	328840	--	0	--
11	Hardware terminal block 16-pin, 1 piece 8x PSS u2 T 16 (1 pc.) Note: Also available in packs of 10 and 50 pieces.	328850	--	8	--
12	Hardware Ethernet-plug 8-pin RJ45 male connector, straight, in accordance with the standard IEC 60603-7-1, Cat.6a	380401	--	8	--
13	Hardware Ethernet-cable SafetyNET p cable, Standard, 4-wire	380000	--	6 (x1 meter)	--
14	Software *PASconfig*	--	V5.0.0	--	--

2.2 Third-party products

No.	Descriptions	Order number	Version	Number	IP address
1	Hardware Backplane, 8 Slot, Ethernet Schneider Electric, PAC Modicon M580 system	BMEXBP0800	--	1	--
2	Hardware Power supply, Safety, 24/48VDC, Redundant Schneider Electric, PAC Modicon M580 system	BMXCPS4022S	--	1	--
3	Hardware Processor module, Safety SIL3 Schneider Electric, PAC Modicon M580 system	BMEP584040S	--	1	**192.168.10.1**
4	Hardware Processor module, CoProcessor Safety Schneider Electric, PAC Modicon M580 system	BMEP58CPROS3	--	1	--
5	Software *EcoStruxure Control Expert* Schneider Electric	CEXSPSCZXSPMZZ	V14.1	--	--
6	Software *BOOTP/DHCP EtherNet/IP Commissioning Tool* Rockwell Automation	--	V3.05	--	--

2.3 Structure of the application (schematic)

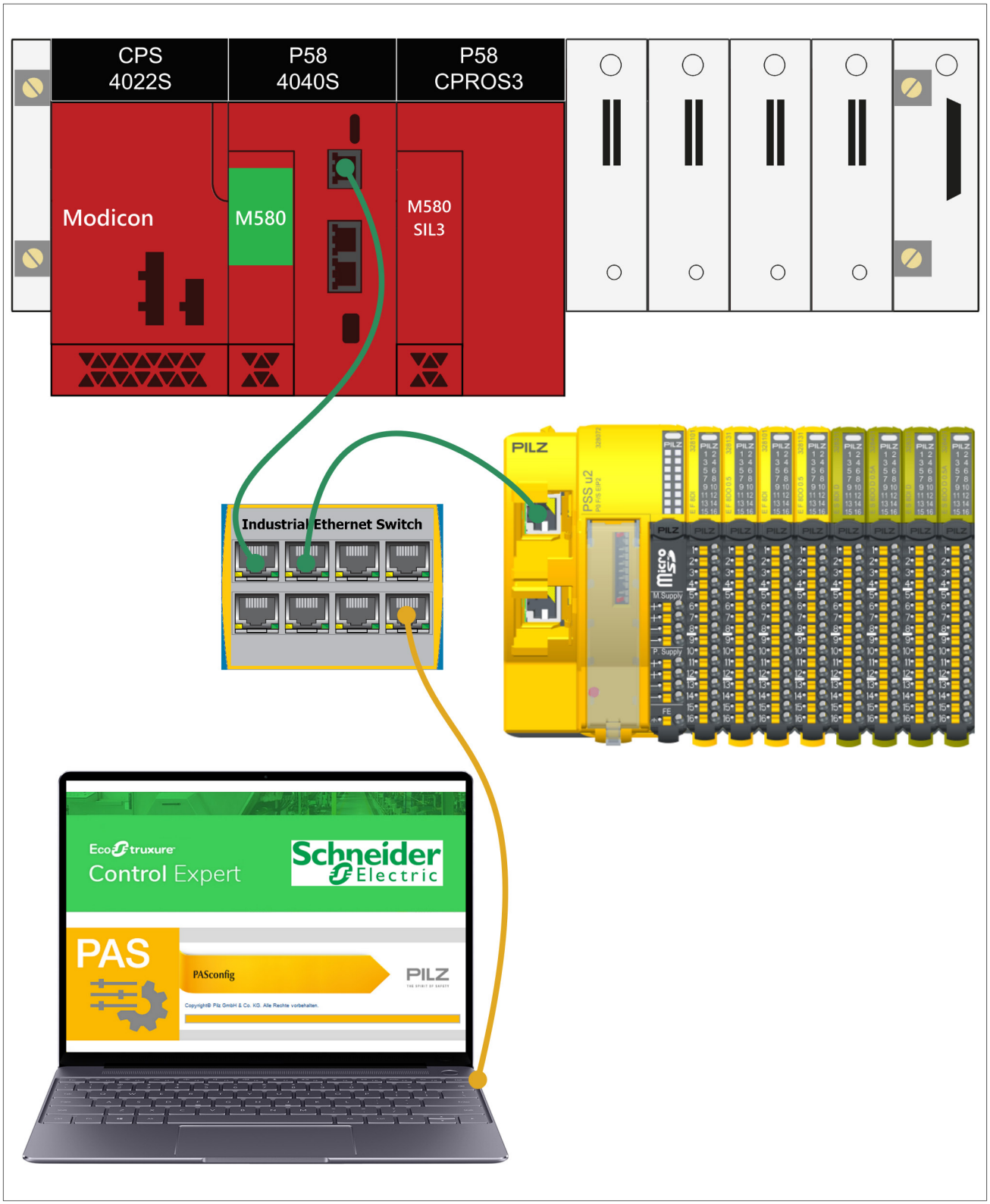


Figure 1: Application – Structure of the hardware (schematic)

3 Preface

This Application Note describes the commissioning of a PSSuniversal 2 Remote I/O system on a current Schneider Electric Modicon M580 PLC. They communicate via EtherNet/IP with the CIP Safety protocol, using the automation software Schneider Electric *EcoStruxure Control Expert*.
In this case, its user program controls the failsafe input and output modules of the PSS u2 electronic modules for the safety functions.
The essential procedure for a successful basic configuration is shown step-by-step, usually with screenshots.

NOTICE

- A detailed explanation of safety functions used in the failsafe application and its evaluation regarding functional safety are not a part of this document.
- This document only describes the procedure for use of the Remote I/O-System PSS u2 with the order number **328072** and is not intended as a technical documentation for general use of the third part software and Controller.
- The Pilz device will only be supported from *PASconfig* version V4.0.0.

4 Technical notes for the Pilz system

A PSS u2 system is a modular system with Ethernet/IP interface (CIP Safety over Ethernet/IP).

The *PASconfig* system software is available for PSS u2 systems. The system software provides support as you select, configure and commission components.

- A PSS u2 system consists of:
  - One head module
  - Backplanes
  - Input/output modules for standard and failsafe applications
  - Terminal blocks

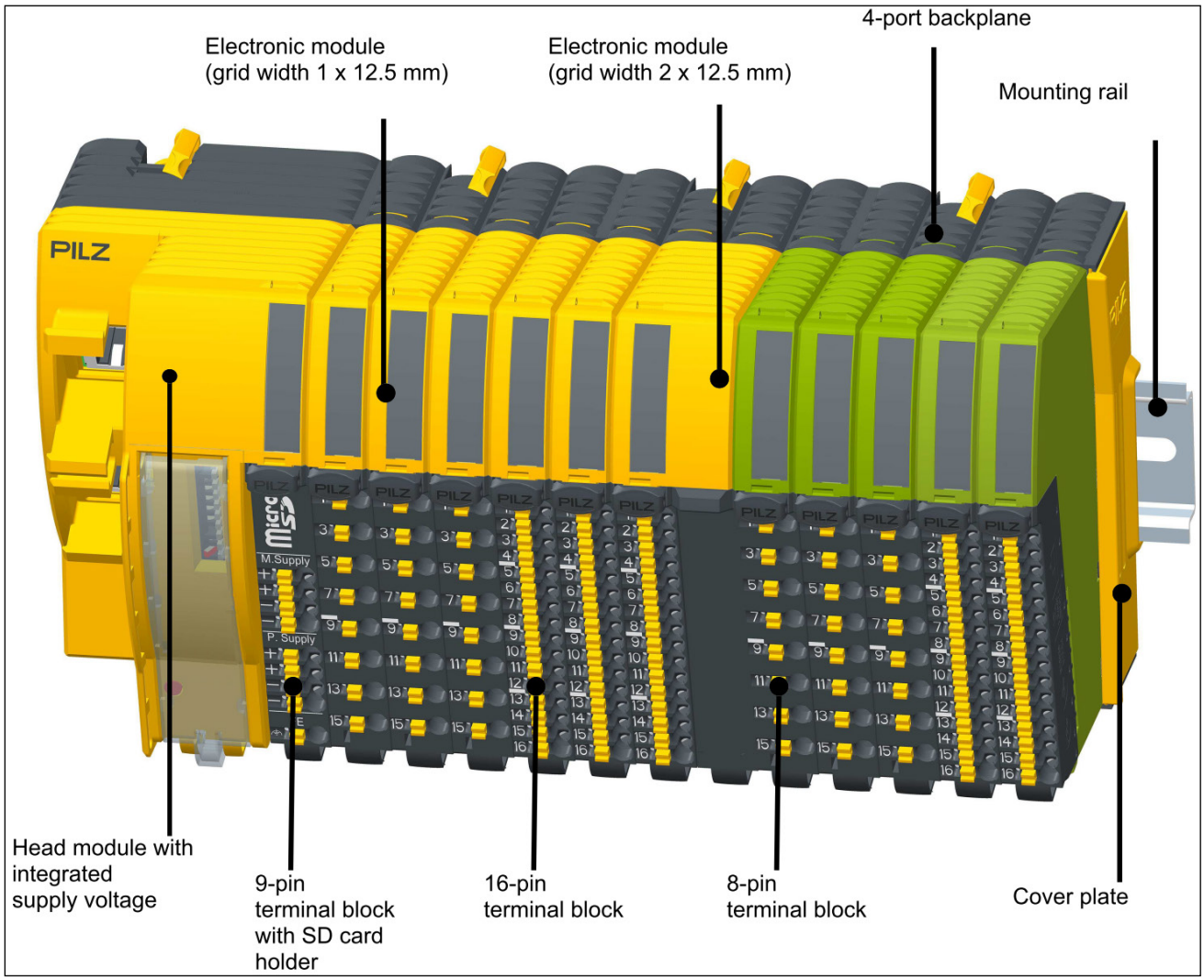


Figure 2: PSS u2 – Modular structure of the PSS u2 system (schematic)

CAUTION!

Risk of material damage:
Backplanes and head module may only be inserted or removed when the supply voltage is switched off.

- Switch off the supply voltage before inserting or removing the backplane or head module.

5 Application description

The aim is to show how a basic EtherNet/IP communication with the CIP Safety protocol and Schneider Electric PAC Modicon M580 system can be built up to from a remote I/O system PSS u2.

- The detailed hardware configuration for the Controller is not part of this Application Note Detailed information on this subject can be found in its manual or online help for the software.
  – see Chapter 1.2 Documentation from other sources of information [📖 6]

6 Hardware configuration

6.1 Used hardware

6.1.1 Pilz devices

- The used Pilz modules are listed in the table of the following link:
  - Chapter 2.1 Pilz products [🕮 7]
- The relevant important documents are named and linked here:
  - Chapter 1.1 Documentation from Pilz GmbH & Co. KG [🕮 6]

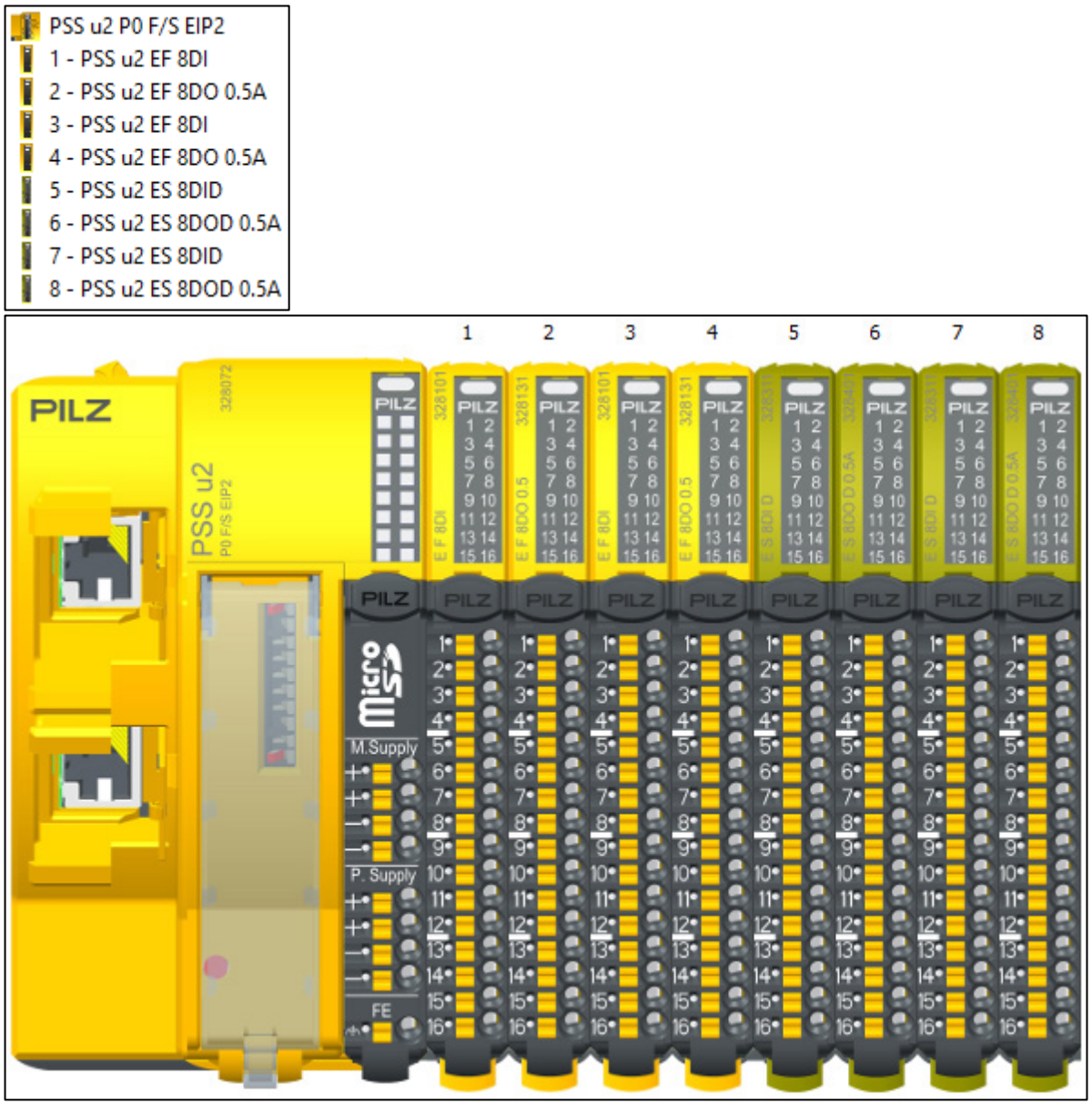


Figure 3: PSS u2 – Hardware » Overview of used modules

6.1.2 Third-party devices

- The used Schneider Electric devices of the PAC Modicon M580 system are listed in the table of the following link:
  - Chapter 2.2 Third-party products [🕮 7]
- The relevant important documents are named and linked here:
  - Chapter 1.2 Documentation from other sources of information [🕮 6]

6.2 Basic properties of the PSS u2 system

6.2.1 Maximum size of the PSS u2 failsafe and standard I/O process image

- Ethernet/IP Adapter:
  - Input/Output: 508 bytes
- CIP-Safety
  - Input/Output: 248 bytes
- Maximum expansion failsafe modules:
  - 24 failsafe input and output electronic modules.

The Ethernet/IP and CIP-Safety connection has a variable process data length, depends on the type of the configured electronic modules.
The description of the process image can be found in the manuals of the electronic modules.

6.2.2 I/O address assignment (byte alignment)

The following two examples show the addresses of the PSS u2 modules, always a full byte per module and function is used.

- PSS u2 ES 4DID
  - The module occupies 2 Bytes in the process image of the standard inputs.

PII		Meaning	State
Byte 0	Bit 0	Input data I0	0: "0"-signal (0 V) at the input 1: "1"-signal (+ 24 V) at the input
	Bit 1	Input data I1	
	Bit 2	Input data I2	
	Bit 3	Input data I3	
	Bit 4 - 7	None	Constant "0"
Byte 1	Bit 0	Valid bit of voltage output S0	0: Error at the voltage output 1: No error at the voltage output
	Bit 1	Valid bit of voltage output S1	
	Bit 2 - 7	None	Constant "0"

- PSS u2 EF 2DO TP 2A
  - The module occupies 1 Byte in the process image of the failsafe outputs.

PIO	Meaning	State
Bit 0	Output data O0	0: "0" signal (0 V) at the output 1: "1" signal (+ 24 V) at the output
Bit 1	Output data O1	
Bit 2-7	None	Constant "0"

  - The same module also occupies 1 Byte in the process image of failsafe inputs.

PII	Meaning	State
Bit 0	Valid bit of output O0	0: Output error 1: The signal in the PIO corresponds to the output signal
Bit 1	Valid bit of output O1	
Bit 2	Open circuit at output O0	0: Open circuit at output 1: No open circuit at output
Bit 3	Open circuit at output O1	
Bit 4-7	None	Constant "0"

Abbreviations:
– "Valid bit of …": Status information for the evaluation of the validity of the assigned process data
– "Open circuit at …": Status information for the evaluation of the open-circuit detection of the assigned output

6.2.3 Failsafe I/O assignment

Combined Input Status (CIS) and Combined Output Status (COS)

- In the process image of the FS inputs, the Combined Input Status (CIS) is used to indicate whether all FS input modules supply valid values. The Combined Input Status is always assigned Byte 0.
  - CIS = 0: Not all FS input modules supply valid values
  - CIS = 1: All the FS input modules supply valid values
- In the process image of the FS inputs, the Combined Input Status (COS) is used to indicate whether all FS output modules supply valid values. The Combined Output Status is always assigned Byte 1.
  - COS = 0: Not all FS output modules deliver valid values
  - COS = 1: All FS output modules deliver valid values

Byte	Bits	Meaning
0	0	Combined Input Status (CIS)
	1…7	Not used
1	0	Combined Output Status (COS)
	1…7	Not used

The following example is based on the following address assignment:

Inputs:

- 1st Byte Combined Input Status
- 2st Byte Combined Output Status
- 3st Byte 1st PSS u2 EF 8DI (slot 1)
- 4st Byte 1st PSS u2 EF 8DI (slot 1)
- 5nd Byte 1st PSS u2 EF 8DO 0.5A (slot 2)
- 6rd Byte 2nd PSS u2 EF 8DI (slot 3)
- 7rd Byte 2nd PSS u2 EF 8DI (slot 3)
- 8th Byte 2nd PSS u2 EF 8DO 0.5A (slot 4)

Outputs:

- 2nd Byte 1st PSS u2 EF 8DO 0.5A (slot 2)
- 4th Byte 2nd PSS u2 EF 8DO 0.5A (slot 4)

NOTICE

The FS process image of outputs must not be empty. If no FS output module is used in the project, the head module will automatically create FS output data. These FS output data must be entered in the Schneider PLC.

- Configuration with the four failsafe input and output electronic modules in this used AN setup:

Slot 1		*Slot 2*		*Slot 3*		*Slot 4*	
PSS u2 EF 8DI		**PSS u2 EF 8DO 0.5A**		**PSS u2 EF 8DI**		**PSS u2 EF 8DO 0.5A**	
Address	Identification	Address	Identification	Address	Identification	Address	Identification
%I2.0	FS input I0	%Q0.0	FS output O0	%I5.0	FS input I0	%Q1.0	FS output O0
%I2.1	FS input I1	%Q0.1	FS output O1	%I5.1	FS input I1	%Q1.1	FS output O1
%I2.2	FS input I2	%Q0.2	FS output O2	%I5.2	FS input I2	%Q1.2	FS output O2
%I2.3	FS input I3	%Q0.3	FS output O3	%I5.3	FS input I3	%Q1.3	FS output O3
%I2.4	FS input I4	%Q0.4	FS output O4	%I5.4	FS input I4	%Q1.4	FS output O4
%I2.5	FS input I5	%Q0.5	FS output O5	%I5.5	FS input I5	%Q1.5	FS output O5
%I2.6	FS input I6	%Q0.6	FS output O6	%I5.6	FS input I6	%Q1.6	FS output O6
%I2.7	FS input I7	%Q0.7	FS output O7	%I5.7	FS input I7	%Q1.7	FS output O7
%I3.0	Valid bit of I0	%I4.0	Valid bit of O0	%I6.0	Valid bit of I0	%I7.0	Valid bit of O0
%I3.1	Valid bit of I1	%I4.1	Valid bit of O1	%I6.1	Valid bit of I1	%I7.1	Valid bit of O1
%I3.2	Valid bit of I2	%I4.2	Valid bit of O2	%I6.2	Valid bit of I2	%I7.2	Valid bit of O2
%I3.3	Valid bit of I3	%I4.3	Valid bit of O3	%I6.3	Valid bit of I3	%I7.3	Valid bit of O3
%I3.4	Valid bit of I4	%I4.4	Valid bit of O4	%I6.4	Valid bit of I4	%I7.4	Valid bit of O4
%I3.5	Valid bit of I5	%I4.5	Valid bit of O5	%I6.5	Valid bit of I5	%I7.5	Valid bit of O5
%I3.6	Valid bit of I6	%I4.6	Valid bit of O6	%I6.6	Valid bit of I6	%I7.6	Valid bit of O6
%I3.7	Valid bit of I7	%I4.7	Valid bit of O7	%I6.7	Valid bit of I7	%I7.7	Valid bit of O7

Figure 4: PSS u2 – Hardware failsafe I/O assignment (AN configuration FS modules)

6.2.4 Diagnostic information

- The status of the I/O modules is:
  - displayed via the "Module status display" and "Terminal status display",
  - this is signalled to the head module and
  - any error is entered in the head module's diagnostic log.

The head module contains a number of status LEDs, which provide information on the status of various system sections.

7 Configuration of the PSS u2 failsafe system

- To create a new configuration, you can:
  [A] Read out the configuration (upload) of the connected PSS u2 system.
  or
  [B] Create a new configuration and select the needed modules by yourself.

7.1 PASconfig – [A] Upload the configuration

- Note: To upload the configuration you need a working connection to a PSS u2 system.
  – see Chapter 7.3 PASconfig – Connection manager [📖 21ff]

- Start function: menu *System* » ‹*Upload system data*› or via icon:

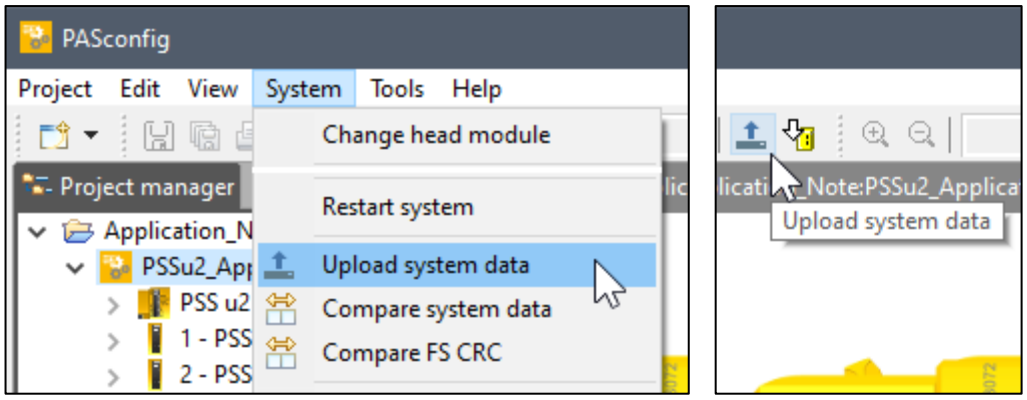


Figure 5: PASconfig – Upload system data » Start function (Part 1)

- *Select* a *connection* and start «*Upload*»:

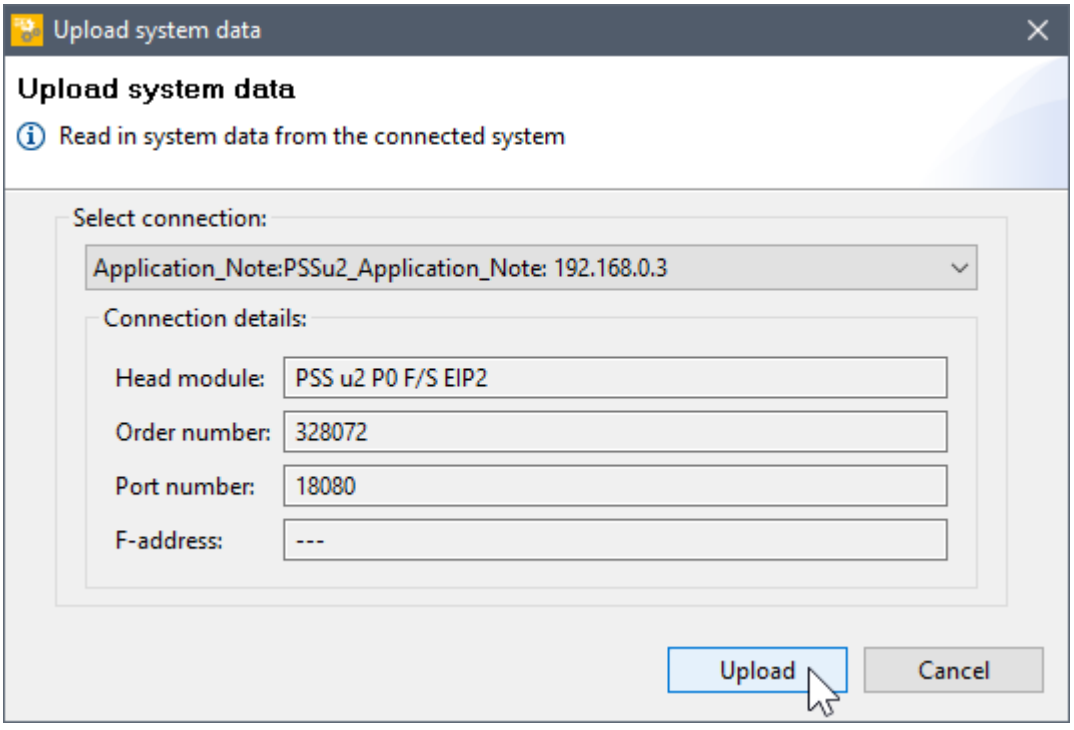


Figure 6: PASconfig – Upload system data » Select connection (Part 2)

Figure 7: PASconfig – Upload system data » Reading in system data ... (Part 3)

- Create a new project or add it to an existing project:

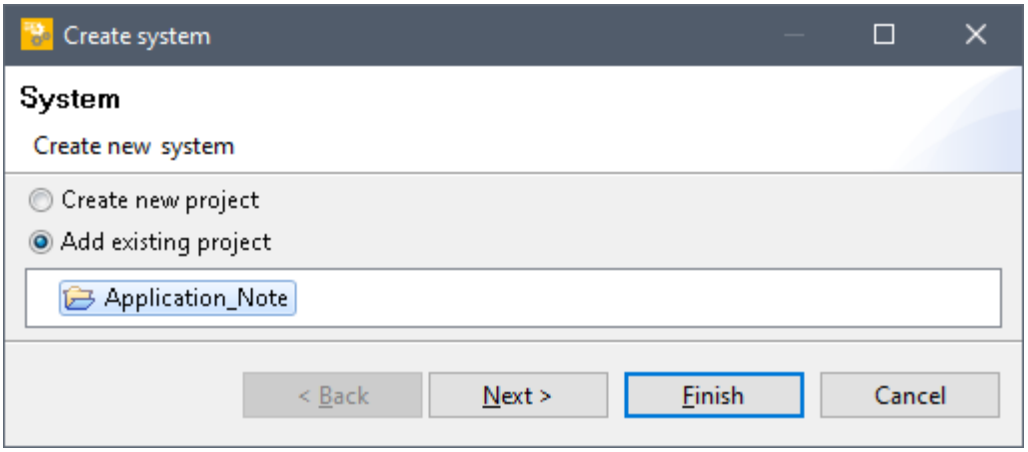


Figure 8: PASconfig – Upload system data » Add existing project (Part 4)

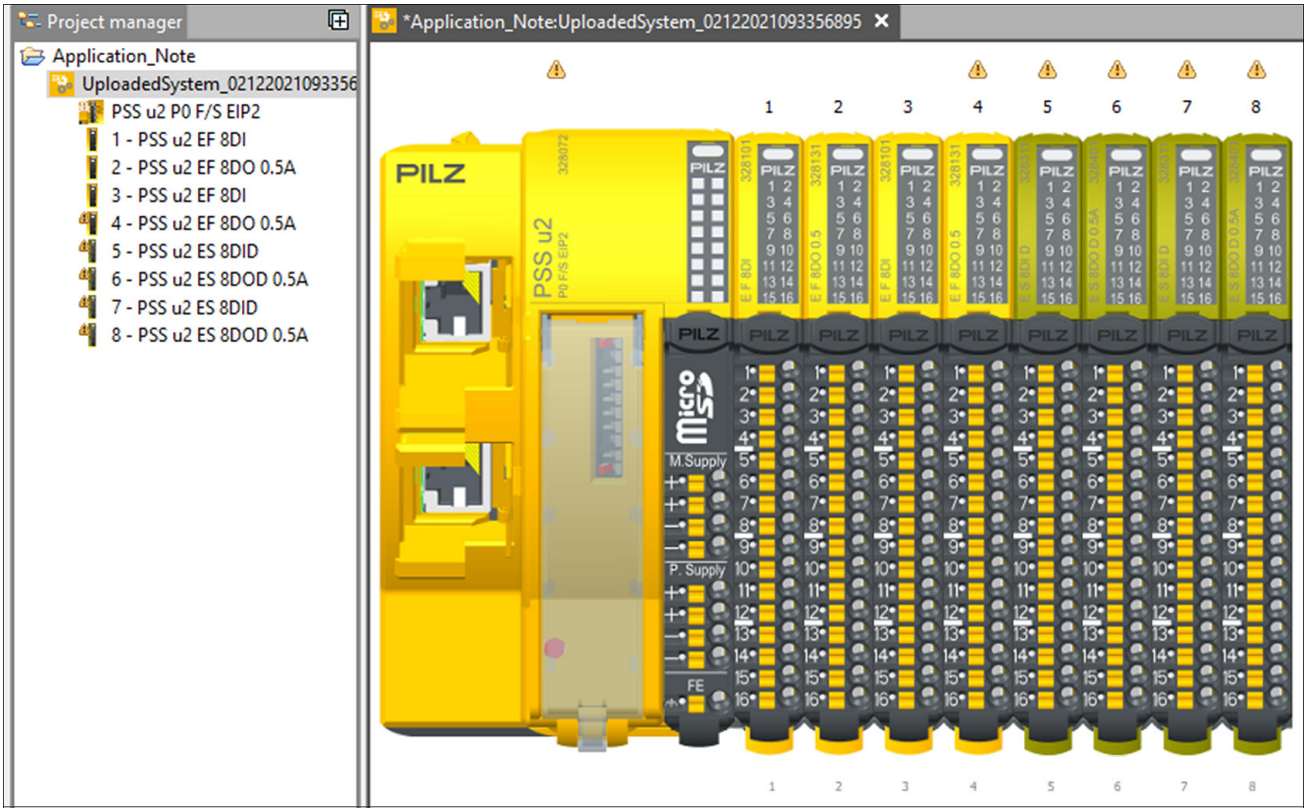


Figure 9: PASconfig – Upload system data » Finalization (Part 5)

- Notes:
  - The properties of the electronic modules now have the default configuration!

Please check this configuration and adapt it to your application, please see on page [🕮 20] Figure 15: PASconfig – Create a new project » Select the needed modules and following hints.

7.2 PASconfig – [B] Create a new configuration

- Create a new project:

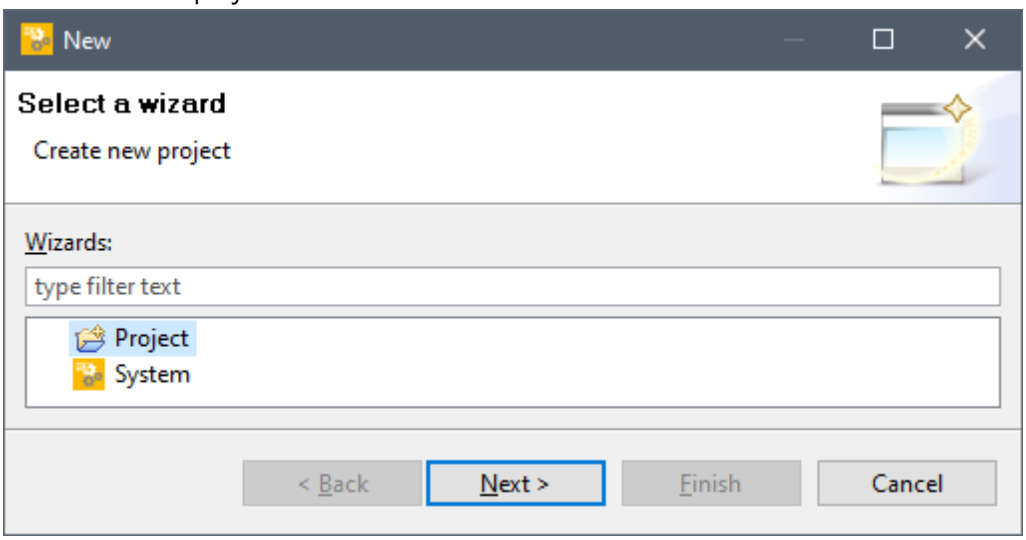


Figure 10: PASconfig – Create a new project » Select an assistant (Part 1)

- Add project data like the '*Project name*' and the '*Author*':

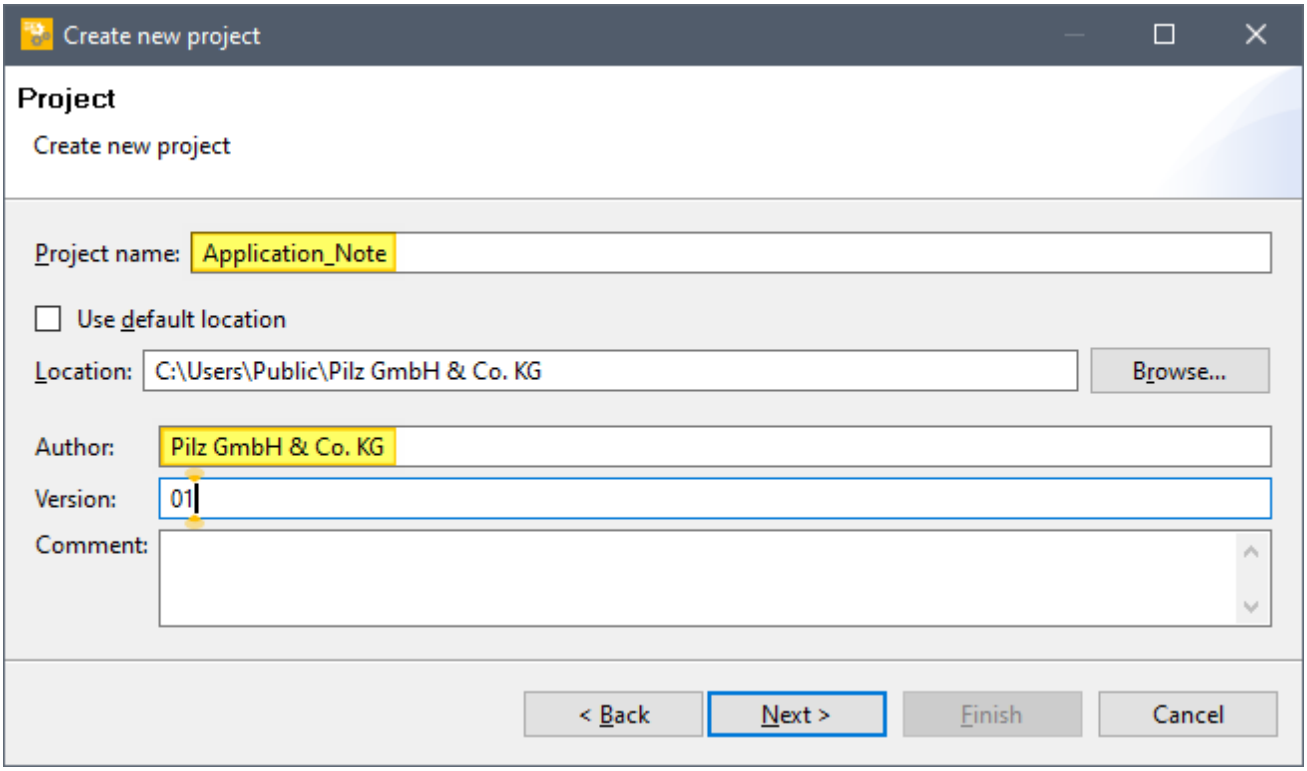


Figure 11: PASconfig – Create a new project » Add project data (Part 2)

- Select the *head module* "*PSS u2 P0 F/S EIP2*" with order number "*328072*":

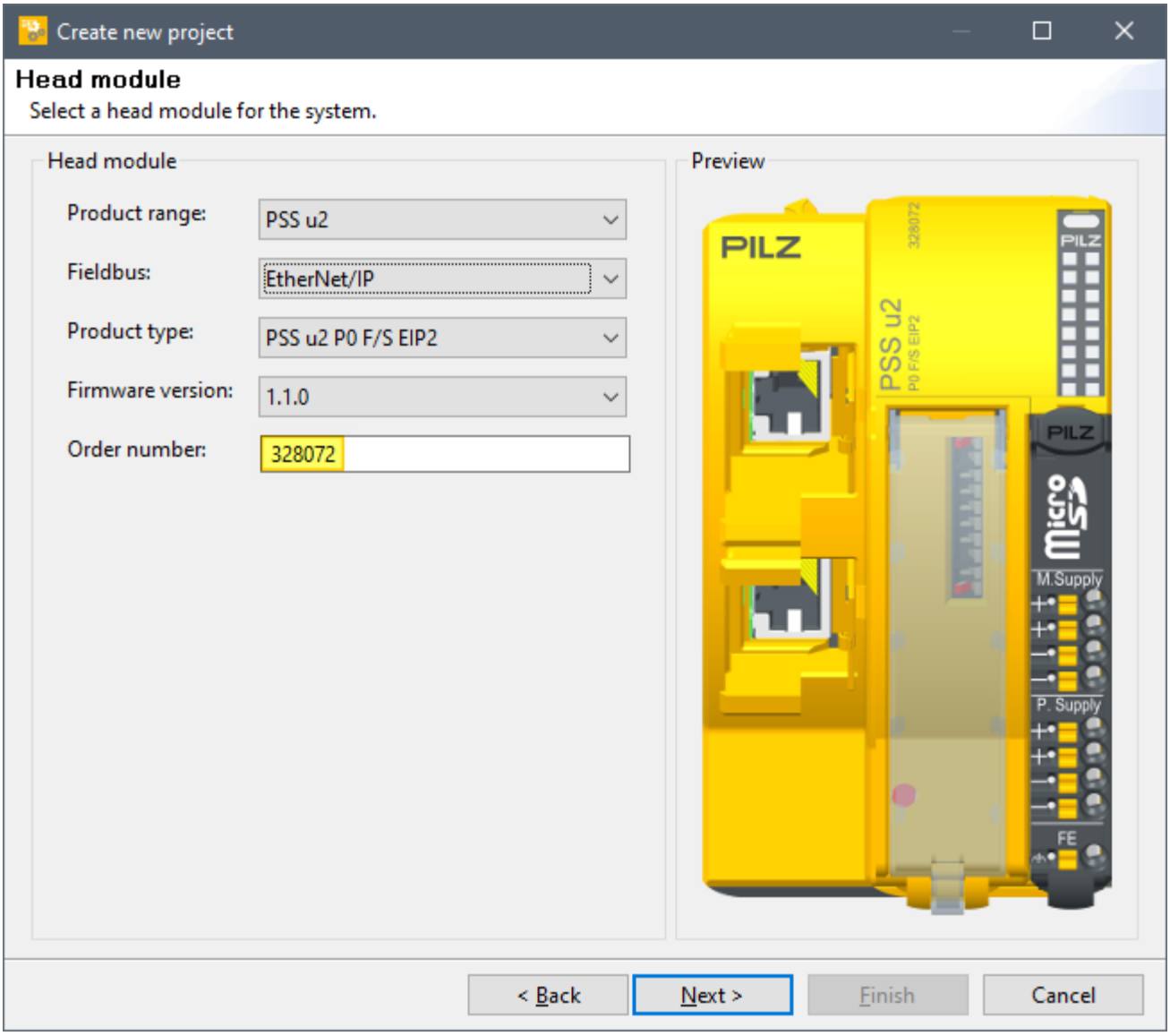


Figure 12: PASconfig – Create a new project » Select head module (Part 3)

- Enter the *name* for the PSS u2 system, here "*PSSu2_Application_Note*":

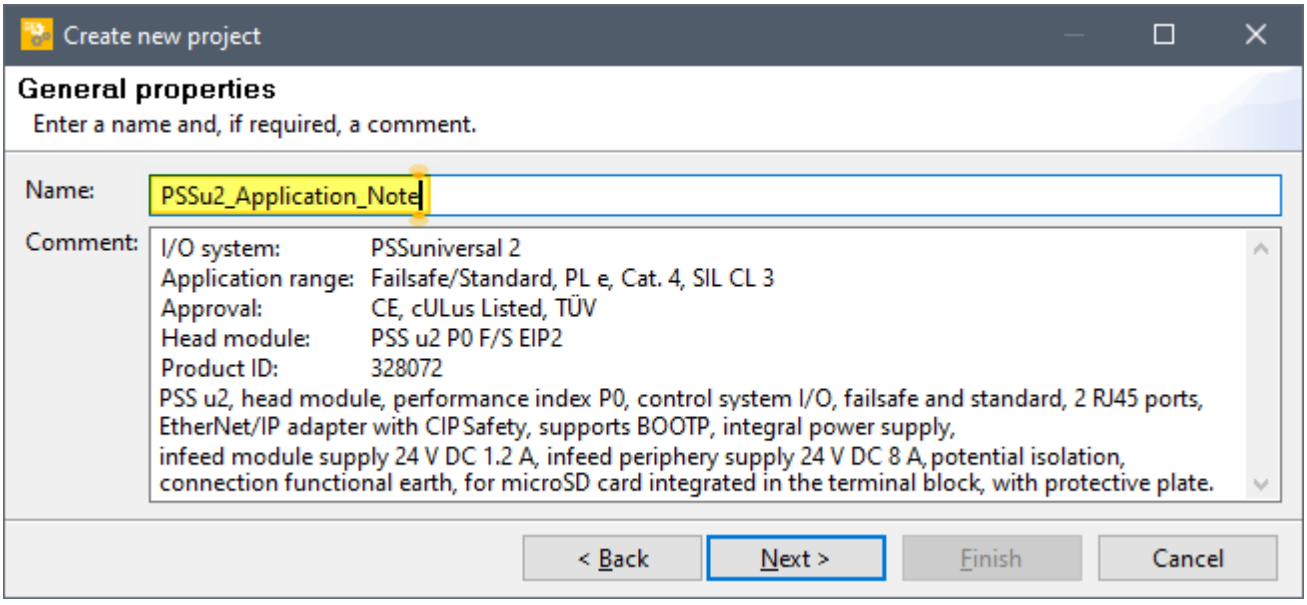


Figure 13: PASconfig – Create a new project » Naming of PSS u2 system (Part 4)

- Enter the '*IP address*' **192.168.0.3**, the default '*Port number*'is "*18080*":

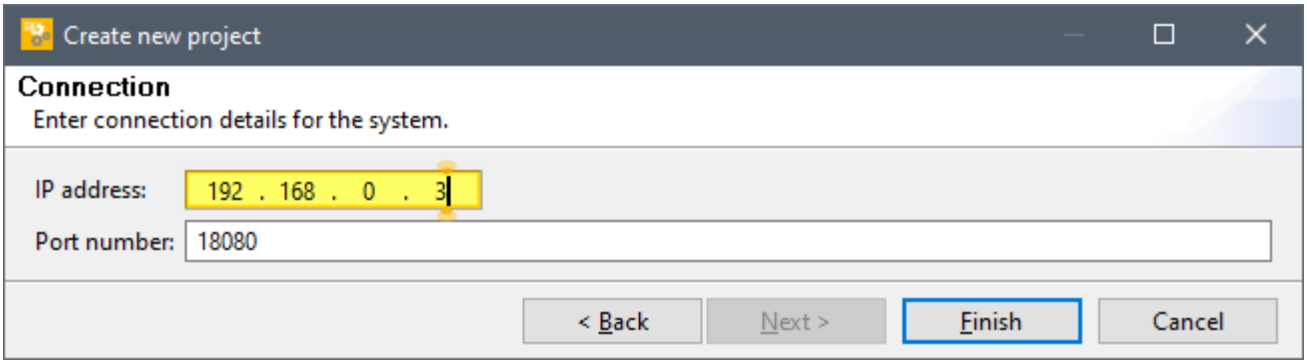


Figure 14: PASconfig – Create a new project » IP address of PSS u2 Head module (Part 5)

- (1) Choose the needed electronic modules in *Palette* on the right and insert them into the middle *Workspace* using drag and drop:

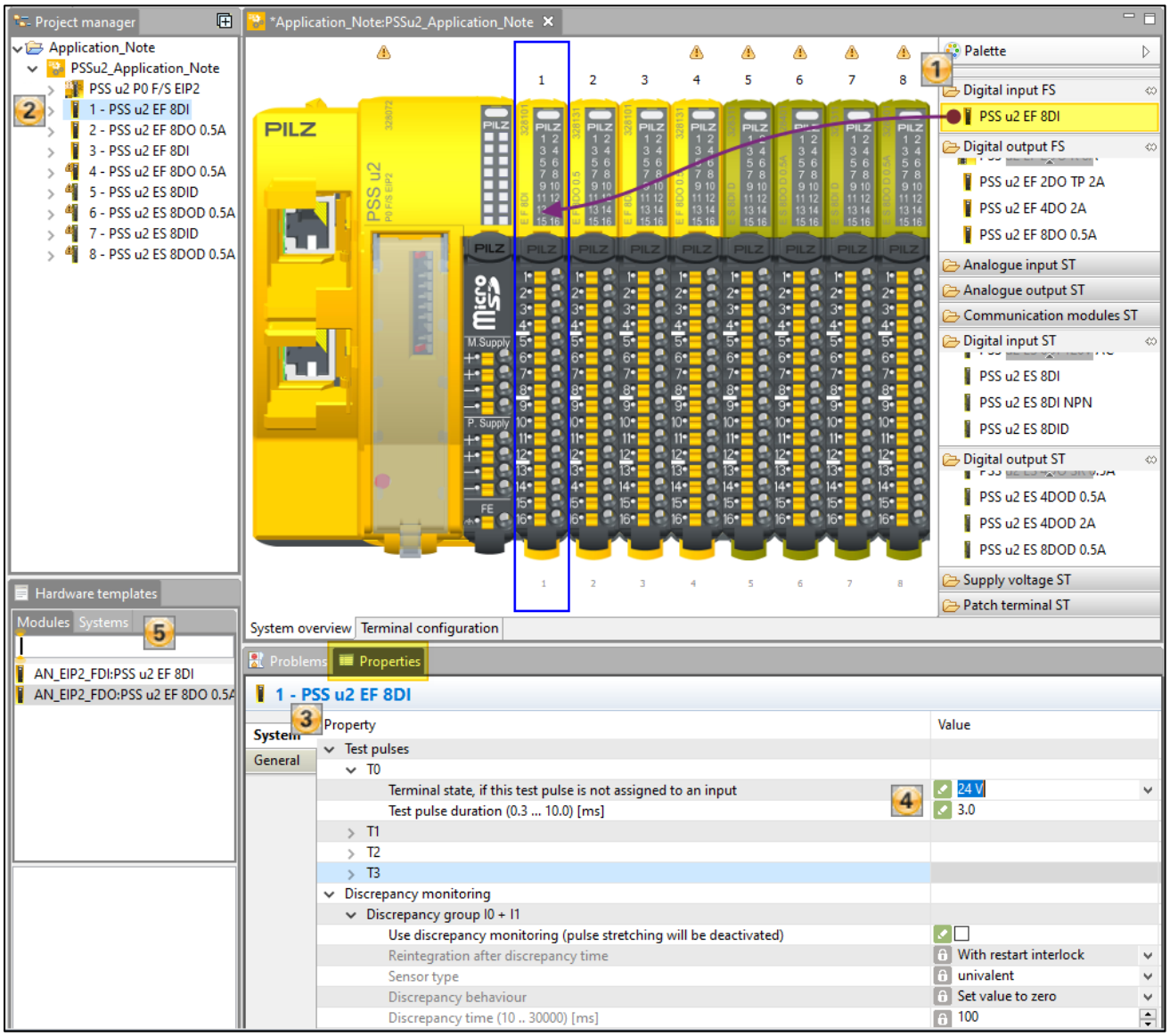


Figure 15: PASconfig – Create a new project » Select the needed modules (Part 6)

- You can now change the properties of each electronic module:
  (2) select an electronic module in the "*Project window*" or the "*Workspace*",
  (3) than select in the "*Information window*" the tab *Properties* and
  (4) edit the parameters of the selected module.

The properties are explained in the Online Help of tool *PASconfig*.

Note on the Figure 15 from the previous page:

- Use **hardware templates** to build a system quicker, using a previously defined configuration. (5) There are two possibilities:
  - a hardware template for an electronic module save and restore the module configuration and
  - a hardware template for a PSS u2 system save and restore the entire system with its complete structure and configuration of all included modules.

- The configuration you just created must be saved.

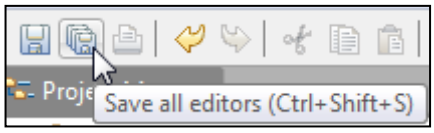


Figure 16: PASconfig – Save configuration » Save all editors

7.3 PASconfig – Connection manager

To perform various online actions, you will need an online connection between the *PASconfig-PC* and the PSS u2 system, e.g. firmware update or download of FS/ST configuration data.

INFORMATION

The PSS u2 system must be directly connected to the PC. Normally, there is a switch on a PLC that automatically connects the network segments to each other.
The used Modicon M580 CPU has several Ethernet ports, hence the important Notes:

- The upper *Service-Port* is primarily used as an access point for systems/PC/HMI for service, diagnostics, monitoring, etc. and the lower two *Dual-Ports* for integration into the device network. Therefore, please check the Schneider Electric guidelines for the exact specific use in the current M580 documentation (system planning guides)!
- For your application, observe the specifications for commissioning, especially with reference to IT security and here in particular the possible deactivation (through incorrect configuration) of the separation of networks with different IP address ranges.

Make sure, that the IP address of the *PASconfig-PC* is in the same subnet as the IP address of the PSS u2 system (see Chapter 7.5 Setting up the IP address of PSS u2 EIP2 head module [📖 25 ff]).

- Note:
  In the following example, it is presumed that the IP address is still **0.0.0.0** and is not already correctly set as in previous Figure 14 [📖 20].

- Start function: menu "*Tools*" » "*Connection manager*":

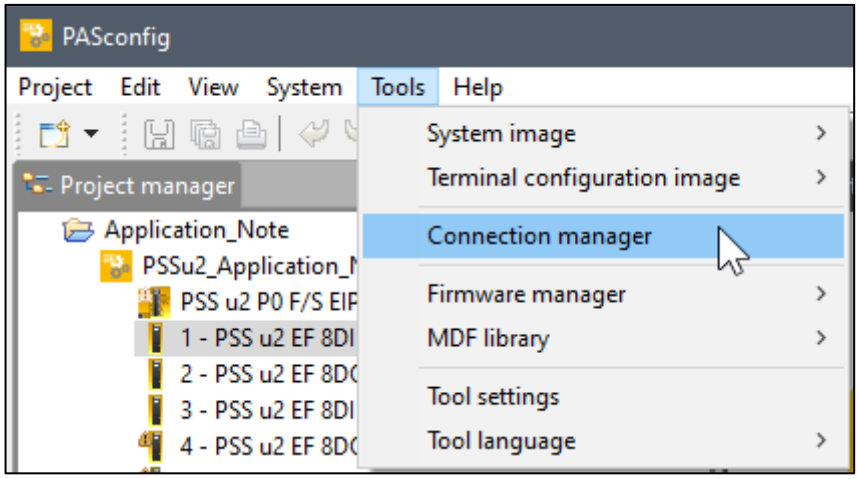


Figure 17: PASconfig – Connection manager » Start function

- Create a new connection or edit an existing one:

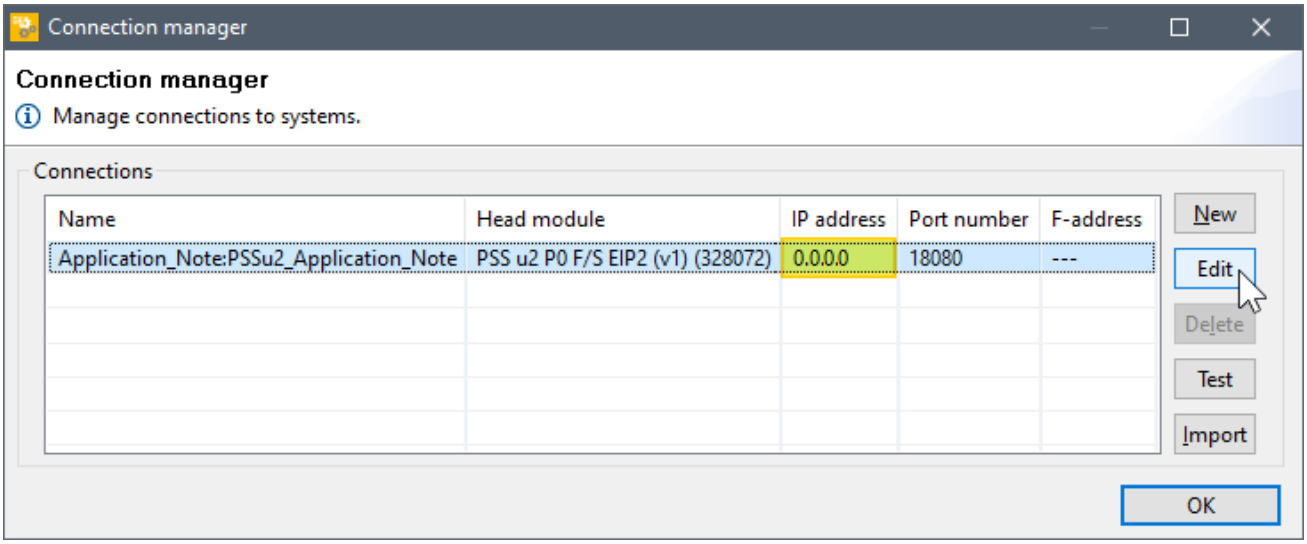


Figure 18: PASconfig – Connection manager » Manage connections

- Enter '*IP address*' **192.168.0.3** of the PSS u2 head module:

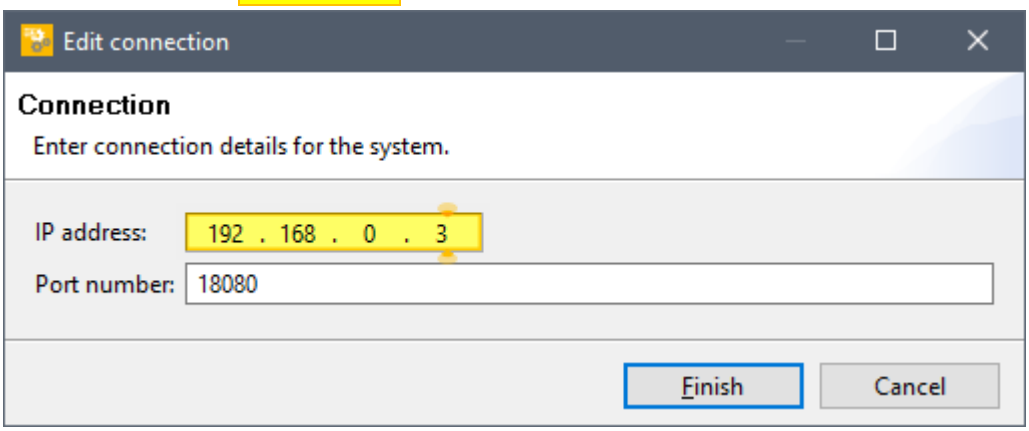


Figure 19: PASconfig – Connection manager » Edit connection

7.4 Size of Process image

The size of the ST and FS process image of each PSS u2 system must be entered in *Control Expert*, see Chapter 7.7.3 Configuring the EtherNet/IP communication[📖 32ff] and Chapter 33 Configuring the CIPSafety communication [📖 33ff].
It can be displayed in *PASconfig* and then entered in *Control Expert*.

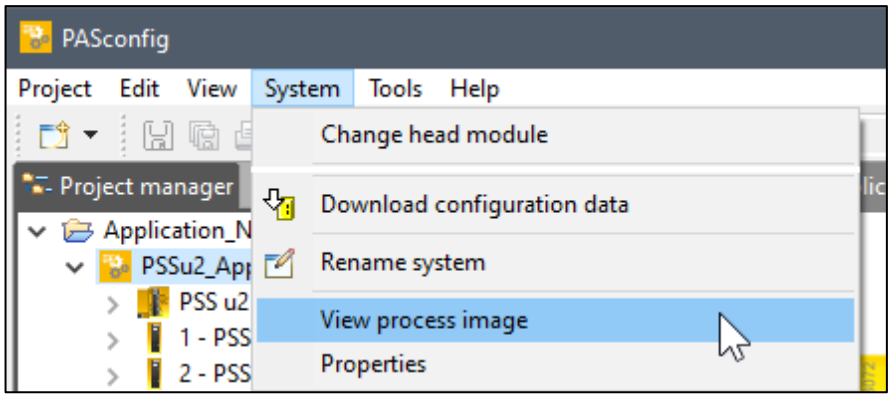


Figure 20: PASconfig – View process image » Start function

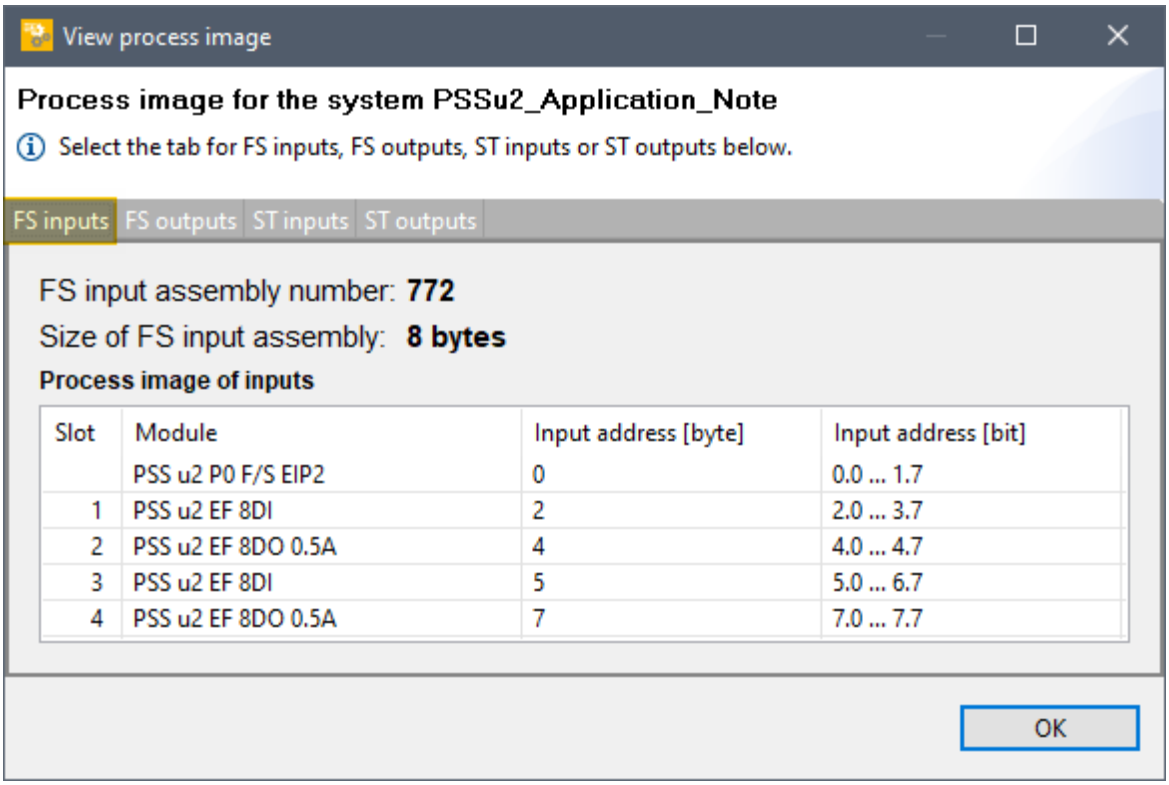


Figure 21: PASconfig – View process image » FS inputs

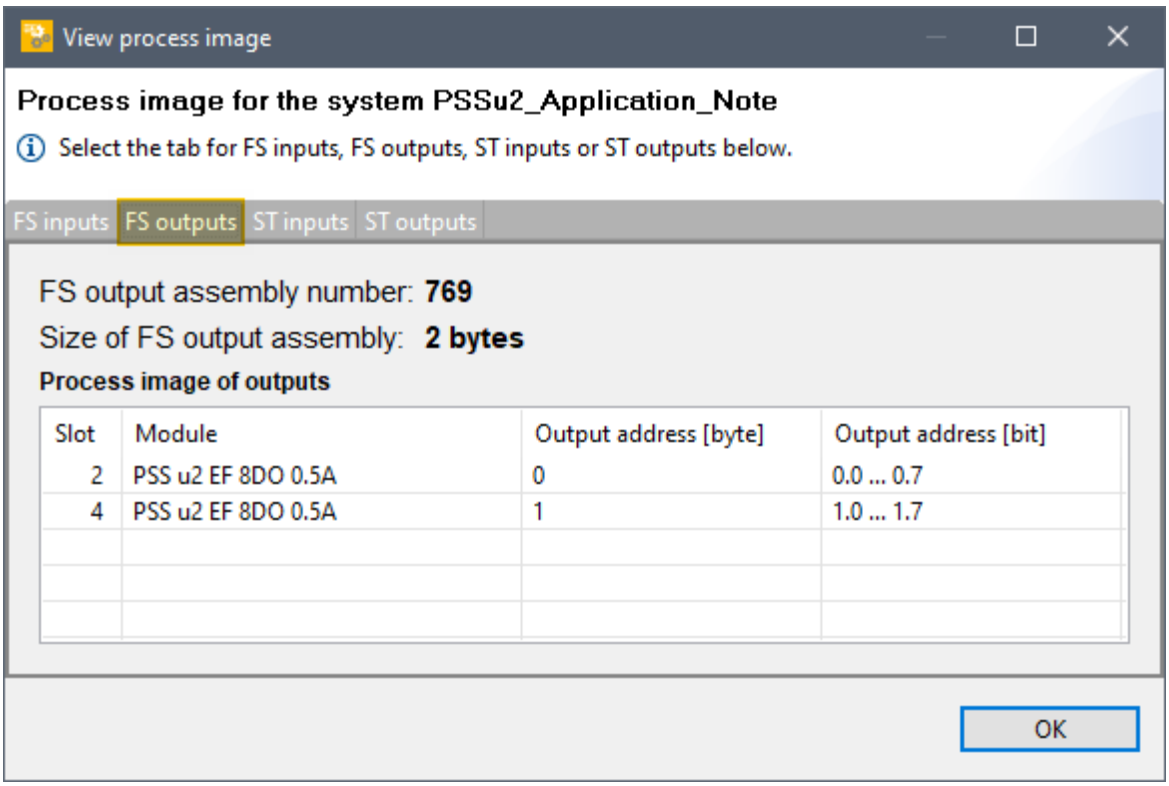


Figure 22: PASconfig – View process image » FS outputs

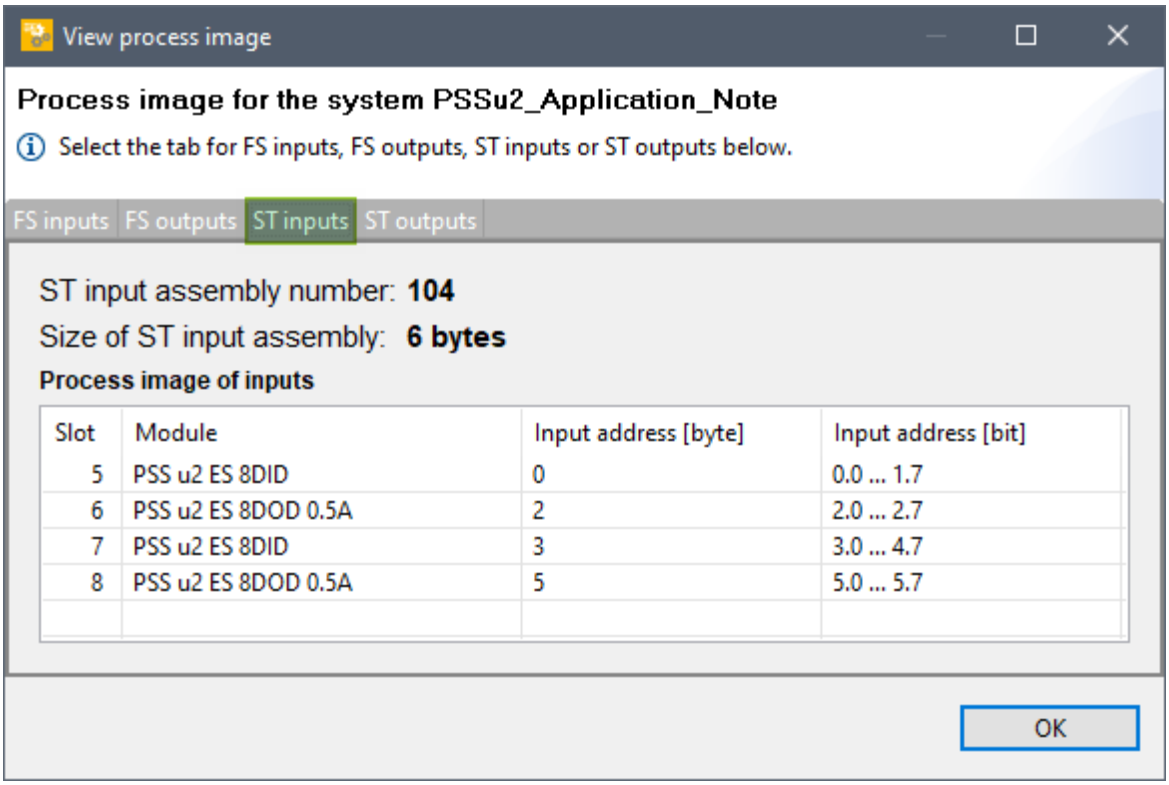


Figure 23: PASconfig – View process image » ST inputs

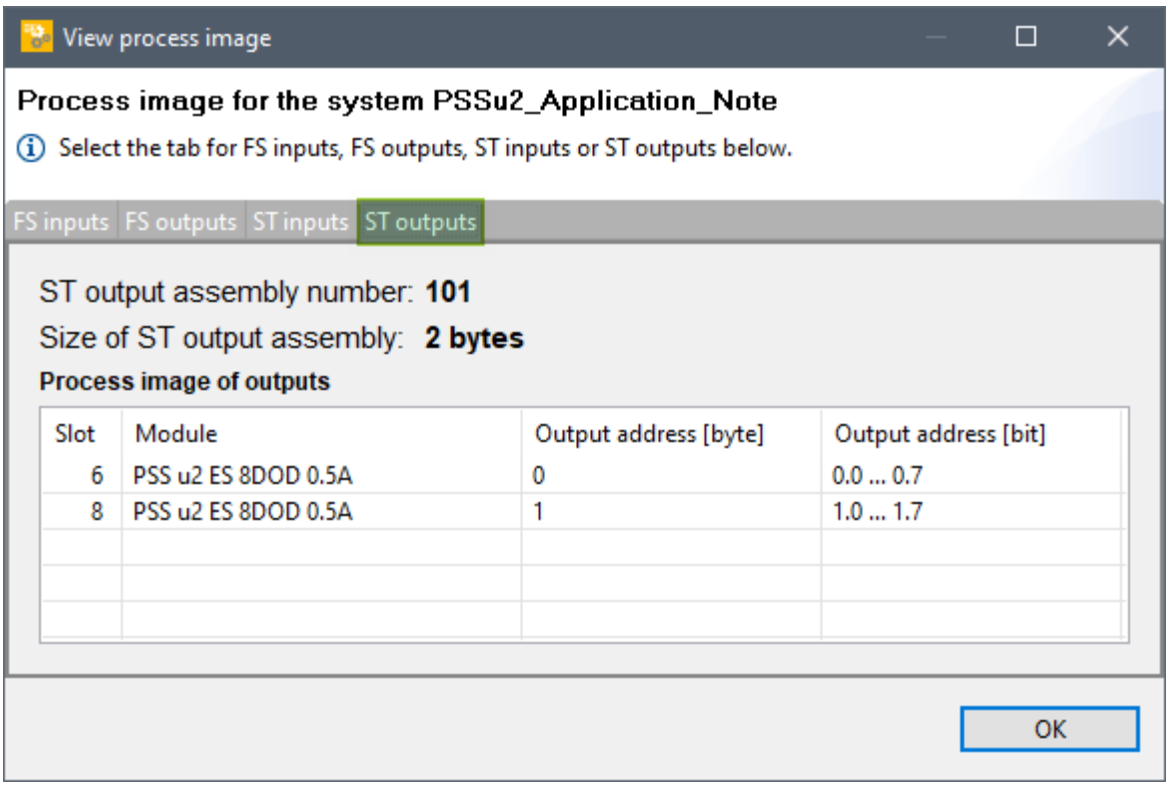


Figure 24: PASconfig – View process image » ST outputs

7.5 Setting up the IP address of PSS u2 EIP2 head module

The IP address can be set using the DIP switch on head module or using tool *PASconfig*.
The DIP switch (hardware) has precedence over the setting in *PASconfig* (software).

7.5.1 Setting up the IP address via DIP switch

The DIP switch only allows the last byte of the IP address "192.168.1.**xxx**" to be set with the subnet mask "255.255.255.0". The last number "**xxx**" is the value that can be set with the DIP switch.

- Note: To apply changes on the DIP Switches a restart of I/O head module is required.

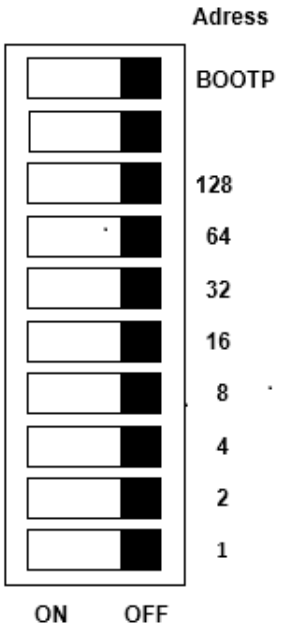
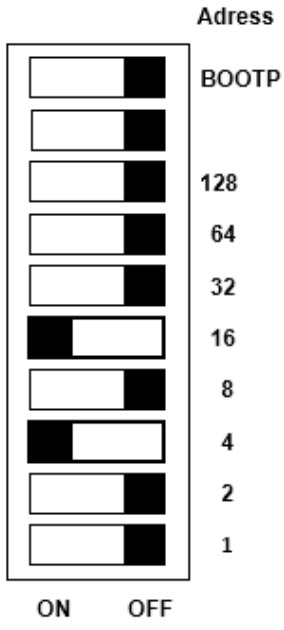
No.	DIP switch	Description
1		IP address can be configured in *PASconfig* (**.0**).
2		IP address is 192.168.1.**20**.

Figure 25: PSS u2 – Hardware » Setting up the IP address via DIP switches (Part 1)

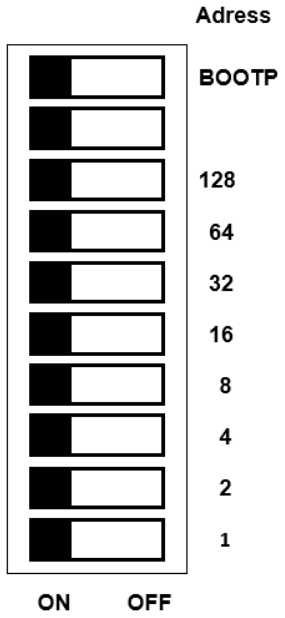
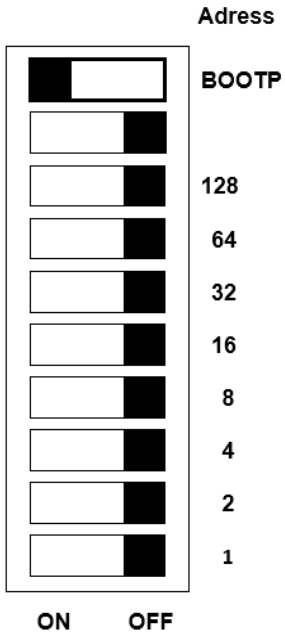
No.	DIP switch	Description
3		IP address can be configured in *PASconfig* (**.255**).
4		IP address can be configured via **Bootstrap Protocol (BOOTP)**.

Figure 26: PSS u2 – Hardware » Setting up the IP address via DIP switches (Part 2)

7.5.2 Assigning the IP-Address with Bootstrap Protocol (BOOTP)

In case BOOTP is selected to assign the IP-address to the PSS u2, there are different tools available. The *BOOTP/DHCP EtherNet/IP Commissioning Tool* from Rockwell Automation is for free of charge:

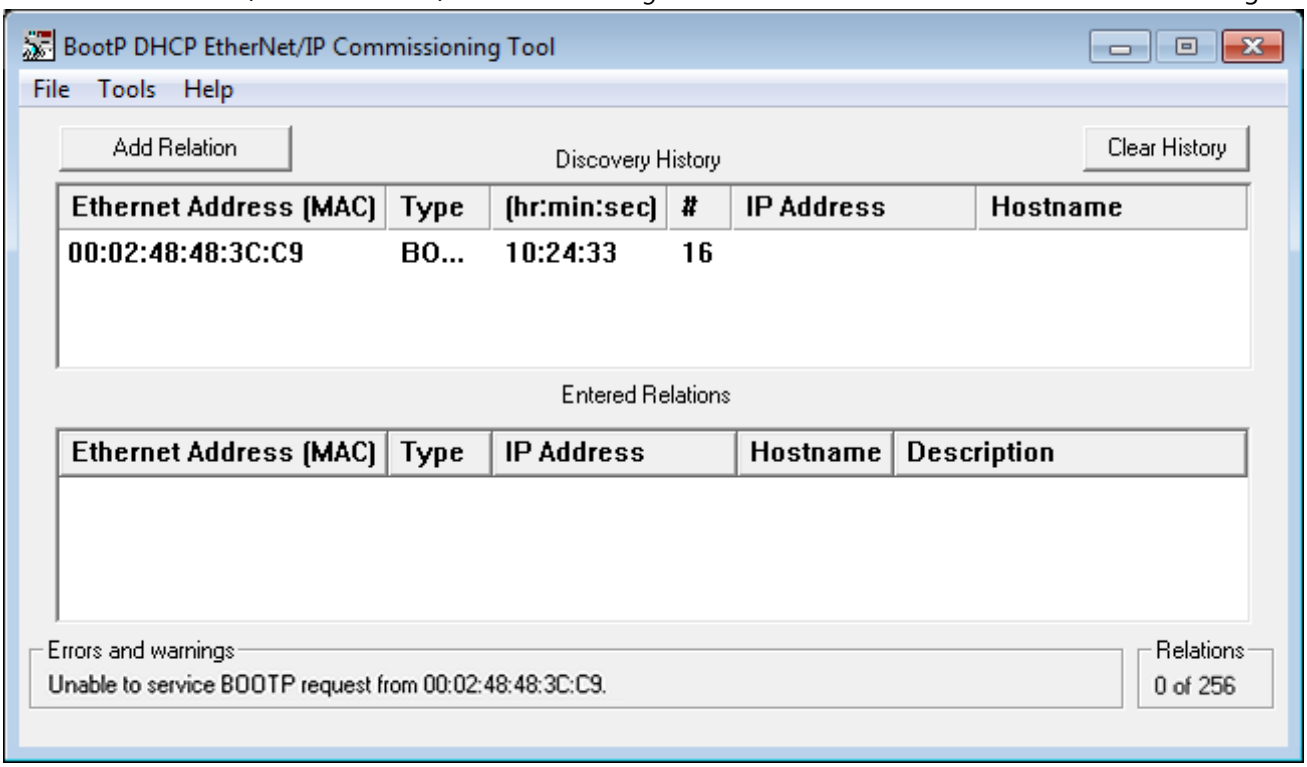


Figure 27: Rockwell – BOOTP DHCP Ethernet/IP Commissioning Tool

Notes:

- The address switch on the PSS u2 must be set accordingly to activate the use of BOOTP, see Figure 26: PSS u2 – Hardware » Setting up the IP address via DIP switches (Part 2) / No. 4 [📖 26].
- BOOTP is active until either the address switch is set to disable BOOTP or an IP-Address is assigned with *PASconfig* as part of the process to set the TUNID (combination of Safety Network Number and IP-Address).

- Steps to set up an IP-address via BOOTP:
  1. On the address switch, the BOOTP switch must be ON, the others all OFF (Figure 26 / No. 4).
  2. Connect your PC with the PSS u2 Head Module
  3. Switch on the PSS u2 Head Module
  4. After a few seconds the connected PSSu2 Head Module is displayed in upper windows section 'Discovery History' (Figure 27) and begin to make requests for an address.
     - The '*Ethernet Address (MAC)*' is lasered on the front of the head module above the DIP switch to the right of the '*Serial number*':

  5. Select the device with the correct MAC Address and press button «Add Relation».

6. Enter the desired IP Address in the subwindow that opens and press «OK»:

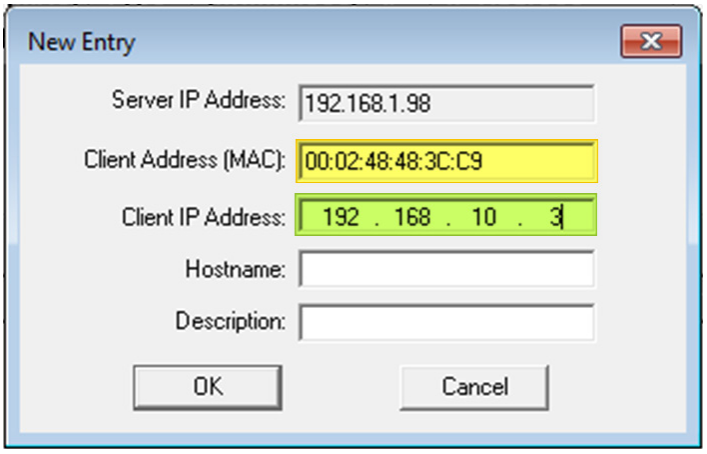


Figure 28: Rockwell – BOOTP DHCP Ethernet/IP Commissioning Tool » Assigning IP-Address

7. The entered unit is now displayed in lower section '*Entered Relations*' of the main window. After the IP address has been successfully assigned to the system, then the tool displays it:

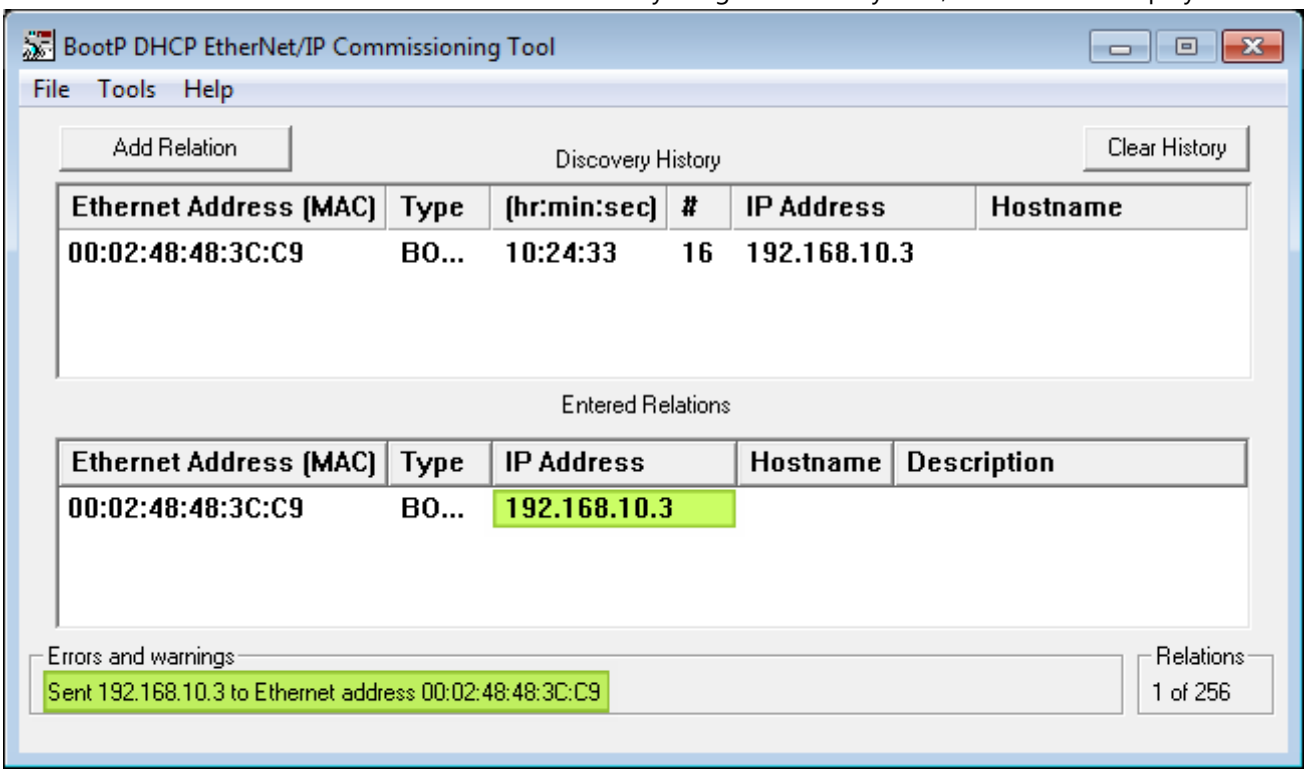


Figure 29: Rockwell – BOOTP DHCP Ethernet/IP Commissioning Tool » Assigned system

8. To finally adopt the IP address to the system:
   - the BOOTP DIP switch must be switched off (Figure 25 / No. 1 [📖 25]) and
   - the IP address with valid Safety Network Number must be entered in *PASconfig*, see Chapter 7.8.1 Configuring the Safety Network Number / IP-Address [📖 35 ff].

INFORMATION

BOOTP will be activated only when the DIP switch is set to BOOTP and no IP address was configured yet in *PASconfig*.

- If BOOTP was activated, the head module with the IP address 0.0.0.0 will start and wait for the IP assignment by BOOTP.
- If an IP address or a safety network number was already set using *PASconfig*, no IP address can be set via BOOTP even when the DIP switch is set to BOOTP.
  To use BOOTP after an IP address was already configured in *PASconfig*, an original rest must be carried out. This will reset the IP address to the default value.

7.5.3 Setting up the IP address via the PASconfig tool

The IP address set in *PASconfig* can only be modified, if the DIP switch is set to 0 or 255.
You can change the head module's IP address in the dialogue box '*Set Target Unique Network Identifier (TUNID)*'.

- Notes:
  - The DIP switch has priority over the setting in *PASconfig* (see Chapter 7.5 Setting up the IP address of PSS u2 EIP2 head module [🕮 25 ff]).
  - The IP address entered in *PASconfig* is only adopted if the DIP switch is set to "0" or "255".
  - Prerequisite: A "*Safety network number*" (SNN) has been entered.

Procedure:

- Select PSS u2 system and
- start function: menu *System* » '*Set Target Unique Network Identifier (TUNID)*':

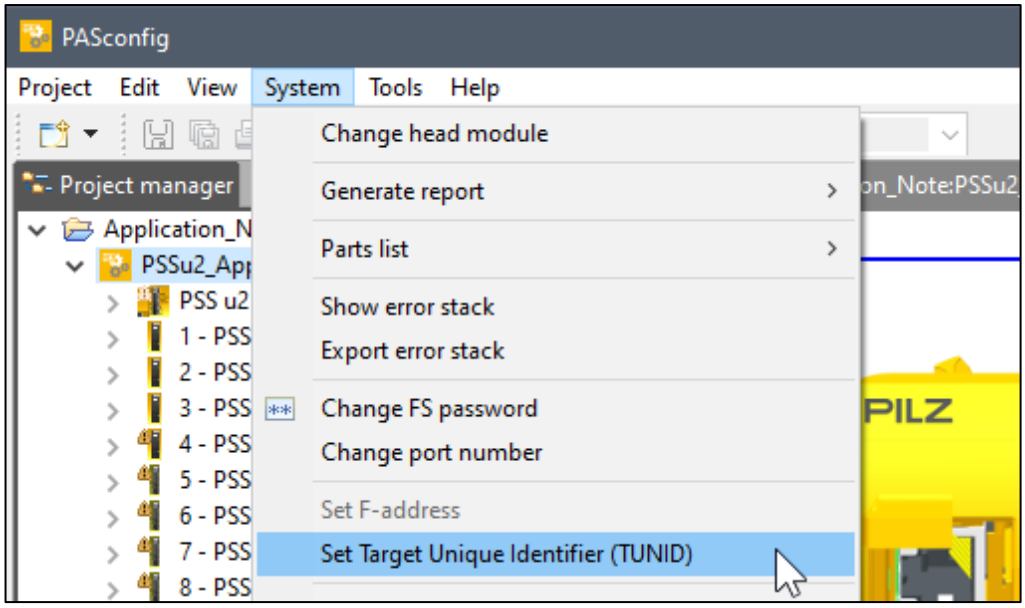


Figure 30: PASconfig – Set IP address » Start function "TUNID" (Part 1)

- Set the '*Safety network number*' (SNN) and enter a new '*IP address*'.
  - Setting the SNN is described in:
    Chapter 7.8.1 Configuring the Safety Network Number / IP-Address [🕮 35 ff]

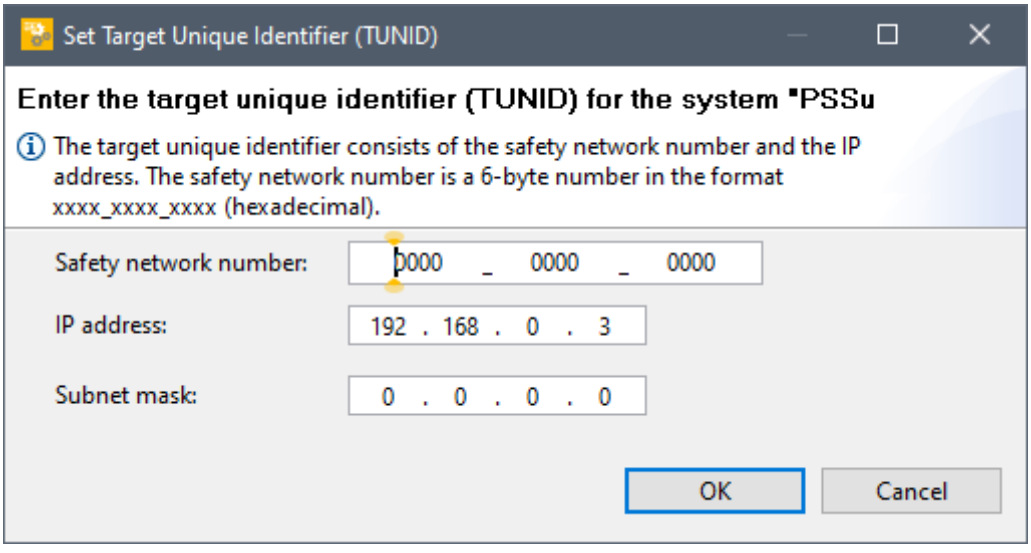


Figure 31: PASconfig – Set IP address » Settings of "SNN" and "IP address" (Part 2)

After the IP address has been entered, the PSS u2 system is restarted.

7.6 EDS file of PSS u2 head module

7.6.1 Download of the EDS file and the 'PASconfig' tool

For the integration of the Pilz Ethernet/IP input/output modules in the software *Control Expert*, the installation of a device description file (EDS file) and the *PASconfig* tool for the configuration of PSS u2-System are necessary.

- Download the current EDS file and the *PASconfig* tool from the Pilz homepage.
  You can find it in the download area (*Support* » *Downloads*) at:
  https://www.pilz.com/en-INT/support/downloads
- Use the order number of the PSS u2-EIP2 head module for the search: '**328072**'

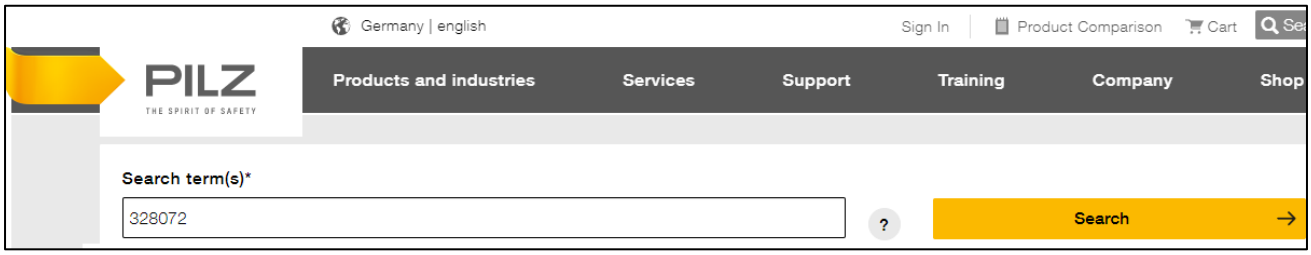


Figure 32: Pilz Homepage (www.pilz.com) – Search for "EDS" and "PASconfig"

- The EDS file can be found in the section "*Device description file*" and the two files for the tool with its '*Readme file*' in the "*Software*" section.

There is currently no registration required to download the EDS file, but for the download the *PASconfig* software, for whose version up to V5.0.0 no license is required yet.

- Log in with your access data at 'Login':

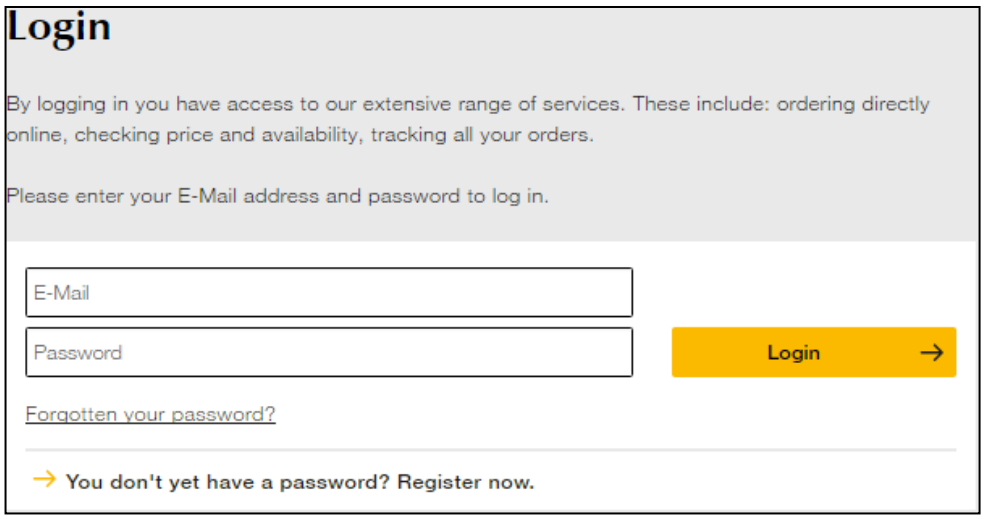


Figure 33: Pilz Homepage (www.pilz.com) – E-Shop Login

- The three ZIP files are downloaded to the computer and have to be unpacked.
- The software *PASconfig* must be installed according to the Schneider software *Control Expert*.

7.7 Configuration of the Schneider PLC

In the Schneider PLC, a connection to the PSS u2 device must be configured. All the information from the network configuration is downloaded onto the Schneider PLC. One parameter of the network configuration, the "*Safety Network Number*", is used in the device configuration again.

When the PSS u2 device configuration is finished, all parameters are loaded onto the PSS u2 device.

If the PSS u2 P0 F/S EIP2 is used the first time, then the EDS file must be installed. This must be done only once, to have the Pilz PSS u2 system available in the Schneider *Control Expert hardware catalogue*. This is described in the next chapter.

7.7.1 Adding an EDS file

To add the PSS u2 P0 F/S EIP2 to the Schneider *Control Expert hardware catalogue*, the EDS file must be installed for the Pilz PSS u2 system.

- This is done the following way:

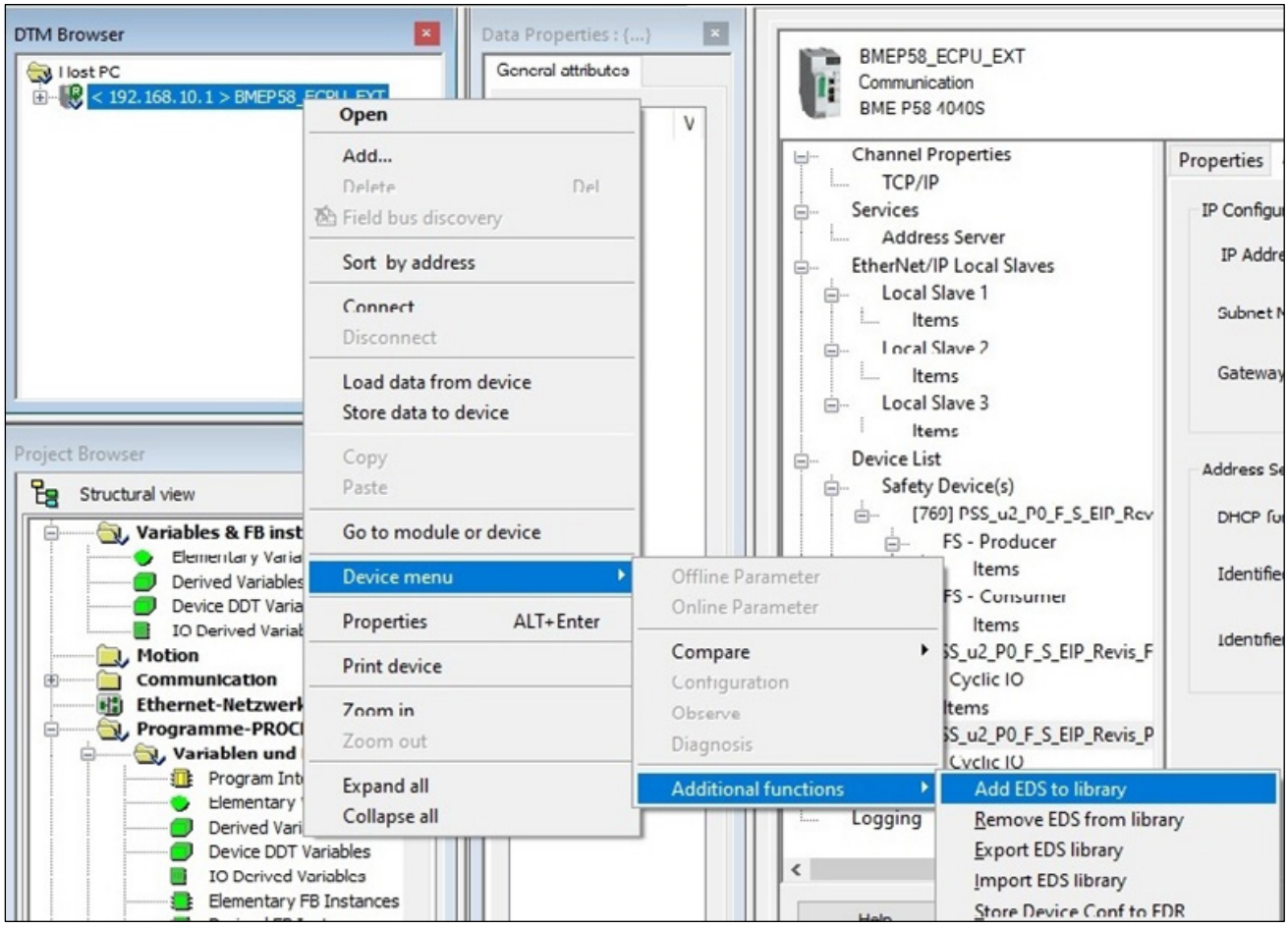


Figure 34: Control Expert – Adding an EDS file

7.7.2 Network configuration with Control Expert

In the window "*DTM Browser*" there is the possibility to add new devices.

- The PSS u2 system must be added:
  1. one time for the *non-safe communication* (EtherNet/IP) and
  2. a second time for the *safe communication* (CIPSafety).

First the configuration steps for the non-safe part are described.
Afterwards the same is done for the safe part.

7.7.3 Configuring the EtherNet/IP communication

- After selecting «*Add*», the following hardware catalogue is shown.
  There the Pilz '*PSS u2 P0 F/S EIP2*' is selected.

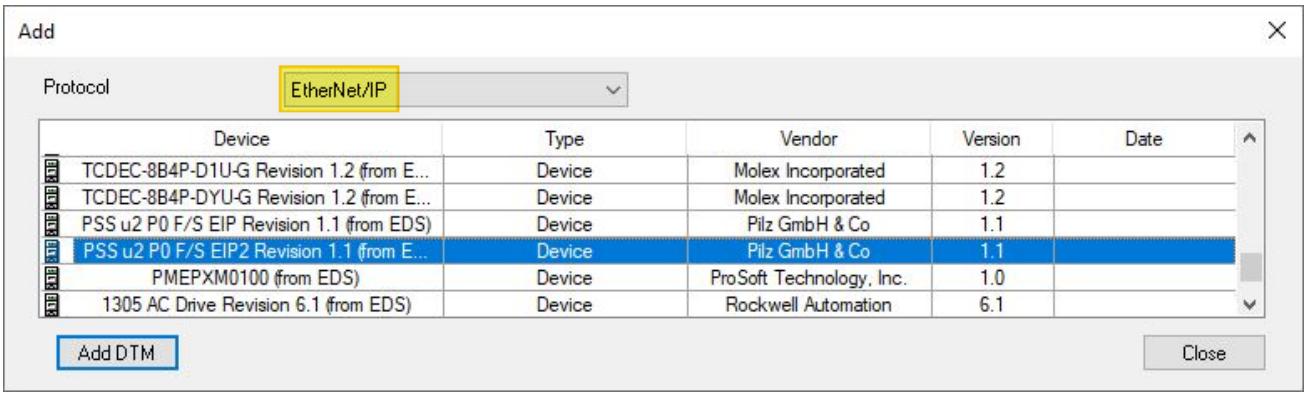


Figure 35: Control Expert – Adding a EtherNet/IP device

Afterwards the PSS u2 is visible as device in the window "*DTM Browser*".

- Then double-click the PSS u2 device to finish the communication settings.

- The data size of the Ethernet/IP communication must be entered.
  The data size depends on the standard electronic modules, which are used in the PSS u2 system, see Chapter 7.4 Size of Process image [🕮 22 ff].

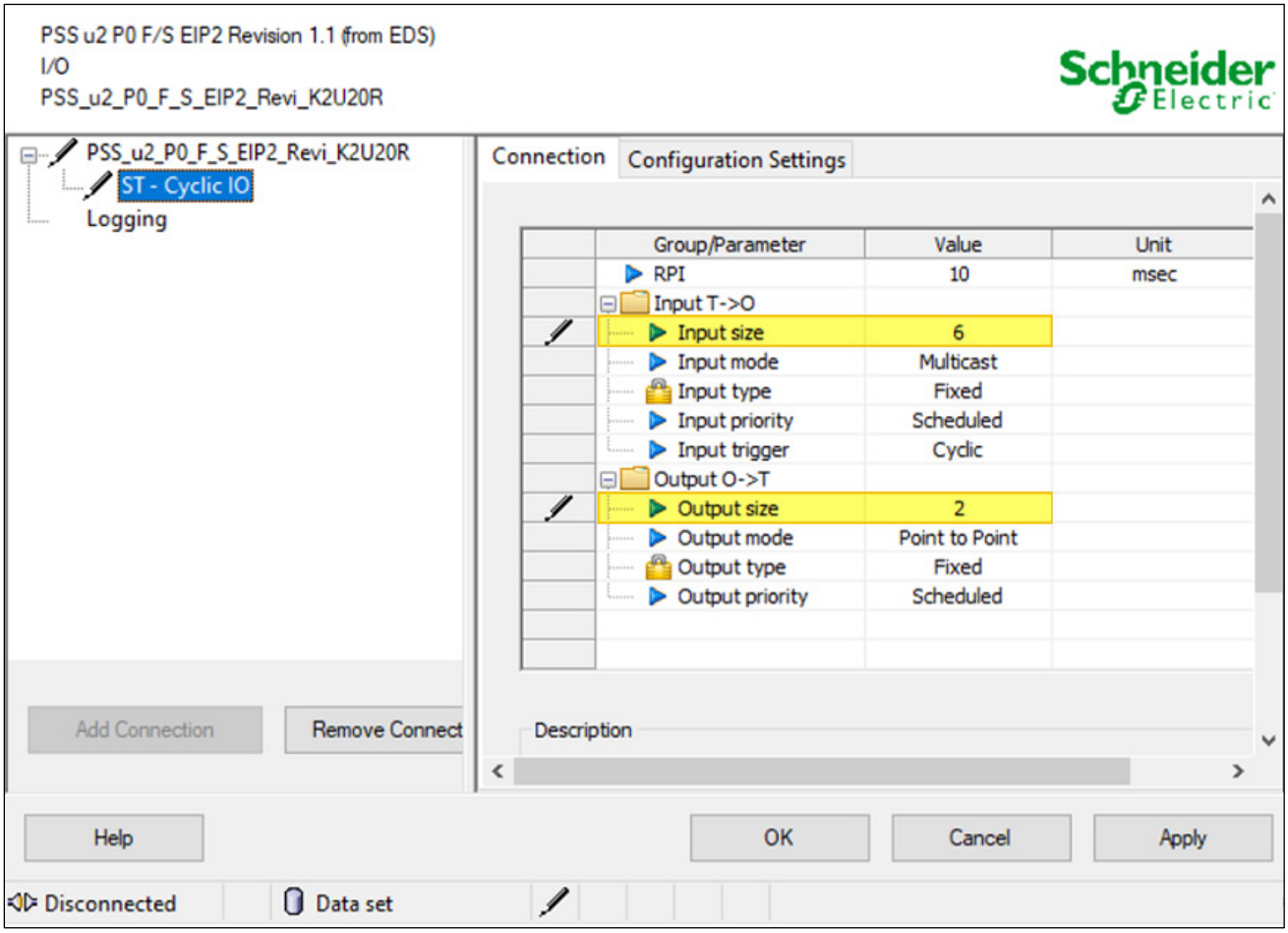


Figure 36: Control Expert – Dialog for the EtherNet/IP communication data sizes

7.7.4 Configuring the CIPSafety communication

- After selecting «*Add*», the following hardware catalogue is shown.
  There the Pilz '*PSS u2 P0 F/S EIP2*' is selected.

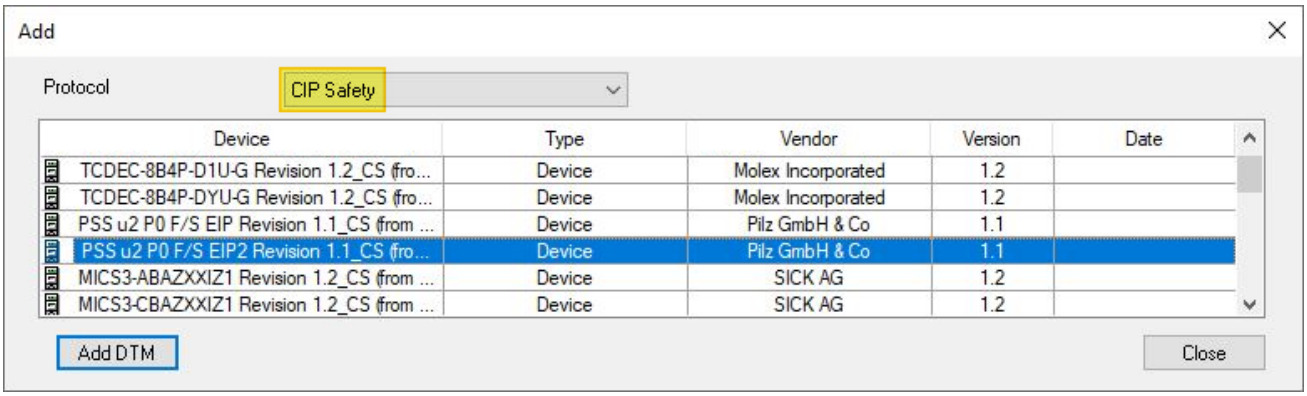


Figure 37: Control Expert – Adding a CIP Safety device

Afterwards the PSS u2 is visible as device in the window "*DTM Browser*".

- Then double-click the PSS u2 device to finish the communication settings.
- The data size of the CIPSafety communication must be entered.
  The data size depends on the failsafe electronic modules, which are used in the PSS u2 system, see Chapter 7.4 Size of Process image [📖 22 ff].

- The "*Safety Network Number*" of the CIPSafety communication must be generated or entered in *PASconfig*, see Chapter 7.8.1 Configuring the Safety Network Number / IP-Address [📖 35 ff].

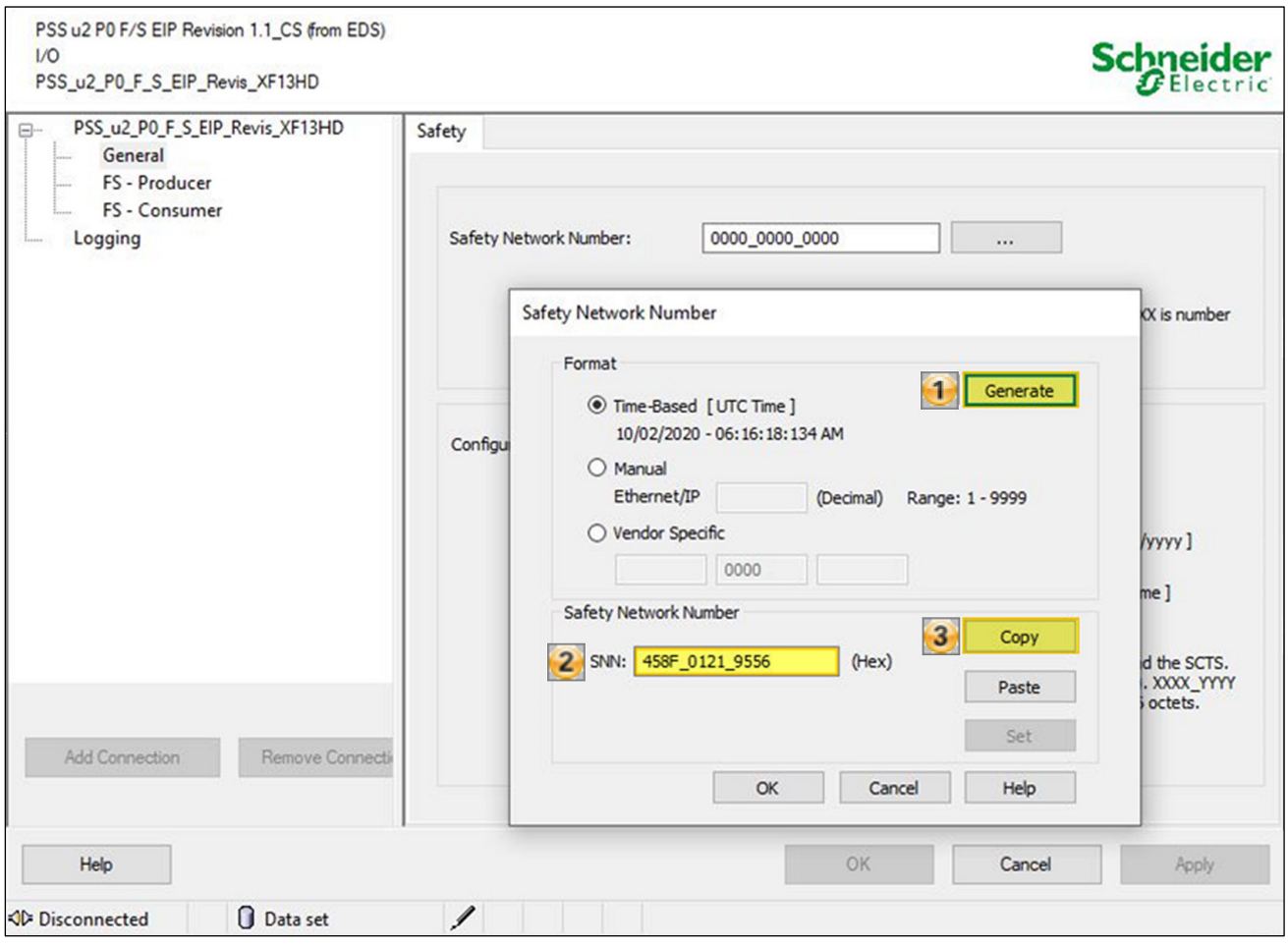


Figure 38: Control Expert – Choose the Safety Network Number

7.7.5 Configuring the IP Address

In the previous chapters the communication parameters for EtherNet/IP and CIPSafety were configured. As both communications are done with the same Pilz device, they both use the same IP-Address.
Per default Control Experts suggests using different IP-Addresses. Now we have to adjust this.
Therefor the overall communications window is opened.
When the same IP-Address is entered, there is a warning (see picture below), which can be ignored.

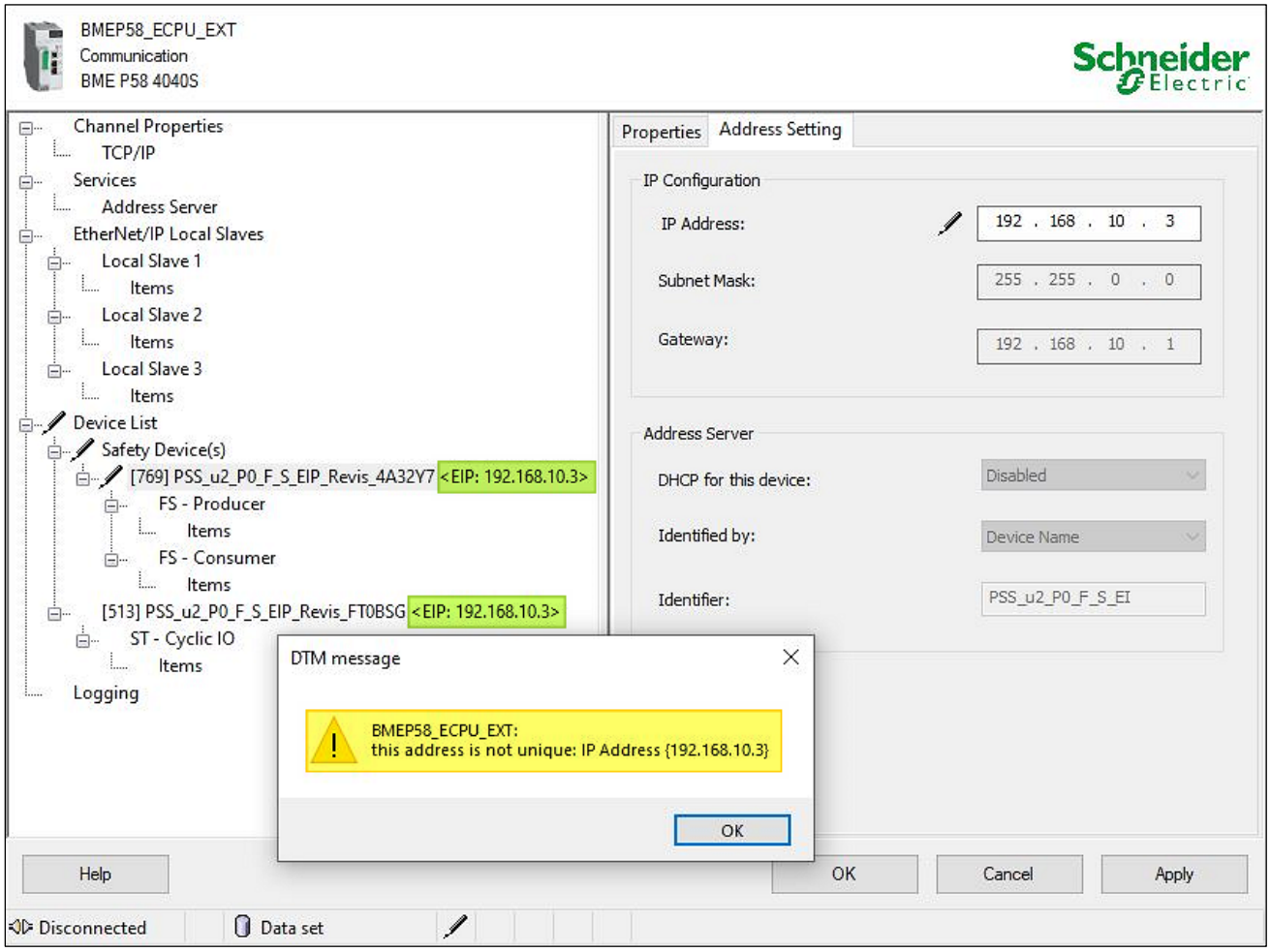


Figure 39: Control Expert – Configuring the IP-Address

7.8 Device configuration with PASconfig

The first part of the configuration was done with *Control Expert*.
Now the second part is finished with *PASconfig*.
To configure the device with *PASconfig*, an ethernet connection between *PASconfig* and the device is necessary. Therefor the IP-Address of the PSS u2 must be set according to the user manual (see Chapter 7.5 Setting up the IP address of PSS u2 EIP2 head module [📖 25]).

With the help of *PASconfig* all the parameters of the electronic modules can be configured and downloaded to the PSS u2 device.

7.8.1 Configuring the Safety Network Number / IP-Address

The Safety Network Number, which was configured inside Control Expert must also be entered in *PASconfig*. This is part of the safety concept. The Safety Network Number and the IP-Address are combined to the *Target Unique Identifier (TUNID)*, which is relevant for the safe communication.

- This dialog is also used to change the IP-Address.

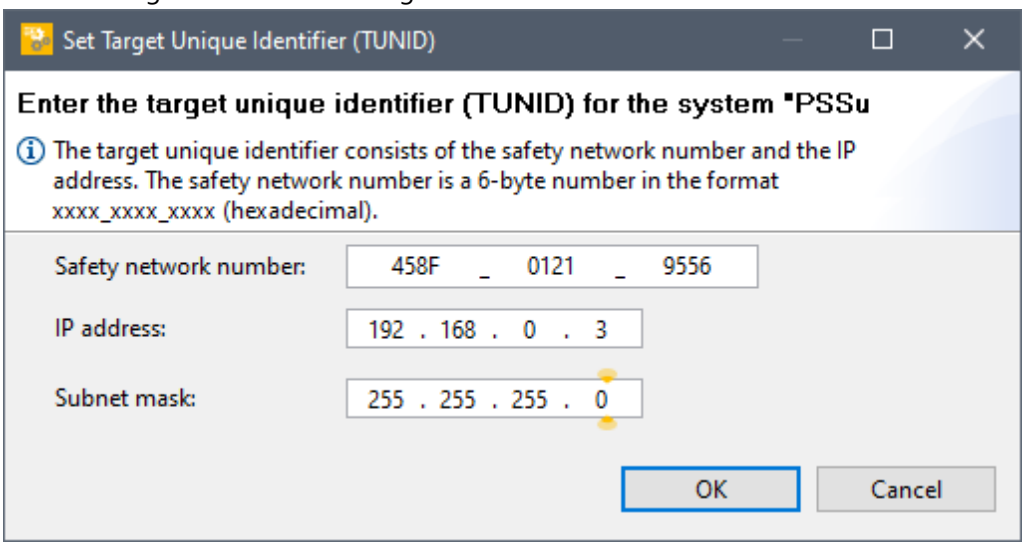


Figure 40: PASconfig – Setting of the Safety Network Number and the IP-Address

8 PSS u2 – Diagnostic information

8.1 Diagnostic information via status LEDs

- The status of the I/O modules is:
  - Displayed via the “Module status display” and “Terminal status display”
  - This is signalled to the head module and
  - Any error is entered in the head module’s diagnostic log.

The head module contains a number of status LEDs, which provide information on the status of various system sections.

The relevant important documents are named and linked here: Chapter 1.1 Documentation from Pilz GmbH & Co. KG [🕮 6].

8.2 Diagnostic information via PASconfig error stack

In *PASconfig* you can read out the Errorstack of the connected PSS u2 system. The error stack contains important information for diagnostics and troubleshooting. The entry at the bottom is the most recent entry.

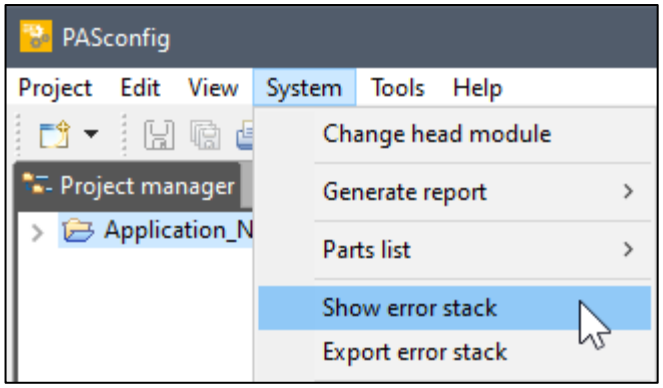


Figure 41: PASconfig – Error stack » Start function ›Show error stack‹

- Expand the entry to see more details and remedy:

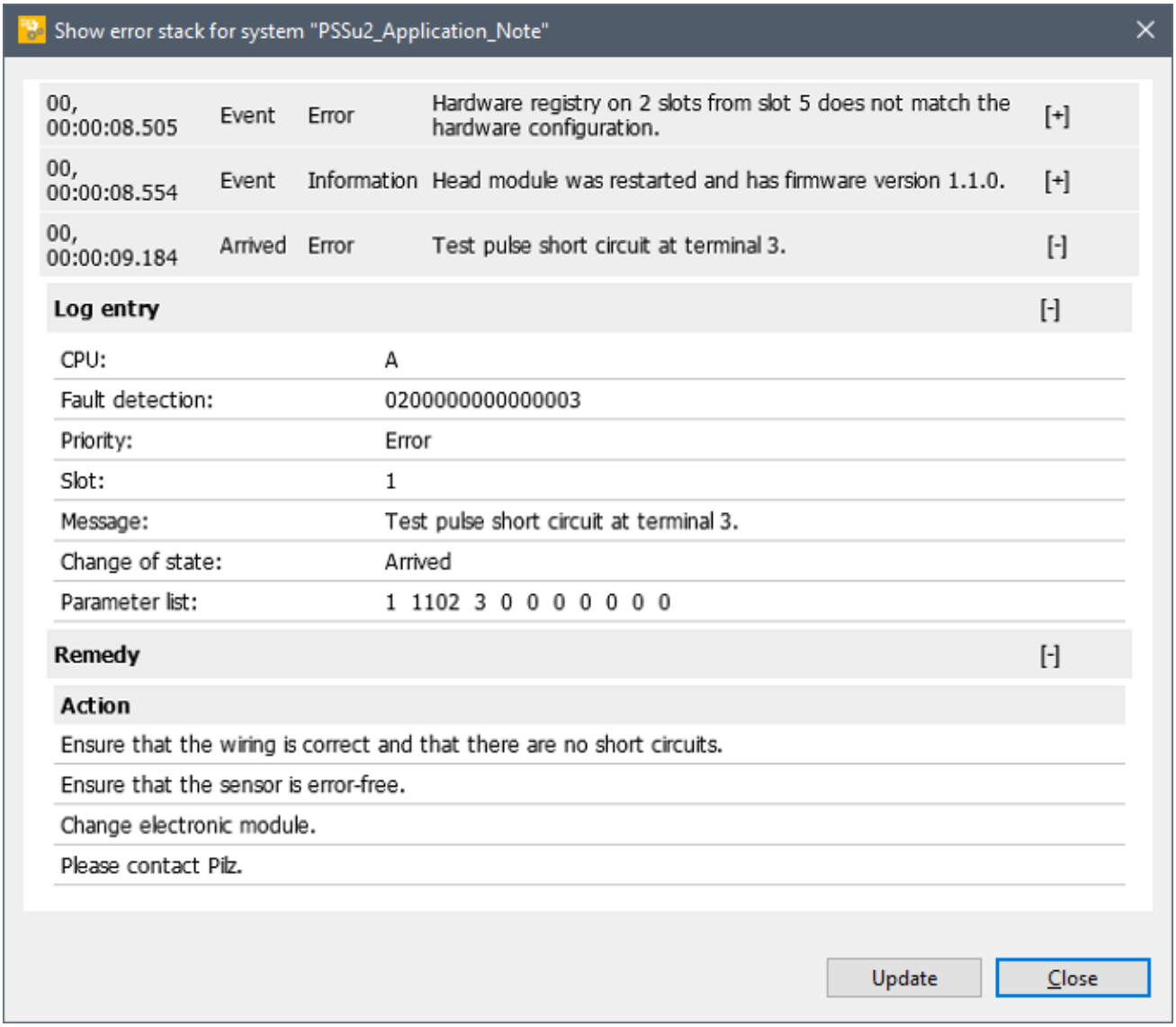


Figure 42: PASconfig – Error stack » Display of table with test pulse error

8.3 Diagnostic via process image

- The following electronic modules provide diagnostic data inside the process image:

Type of signal	List of electronic modules
Digital input	PSS u2 ES 4DID, PSS u2 ES 8DID
Digital output	PSS u2 ES 4DOD 0.5A, PSS u2 ES 4DOD 2A, PSS u2 ES 8DOD 0.5A, PSS u2 ES 16DOD 0.5A
Analog input	PSS u2 ES 4AI I, PSS u2 ES 4AI U
Analog output	PSS u2 ES 4AO U/I
IO Link	PSS u2 ES 4IOL
Power supply	PSS u2 ES PSP

8.4 Diagnostic object

With the use of the "DATA_EXCH" function block, it is possible to request data from a CIP-Object. In the example shown below, the PSS u2 has the IP address *192.168.10.3*.

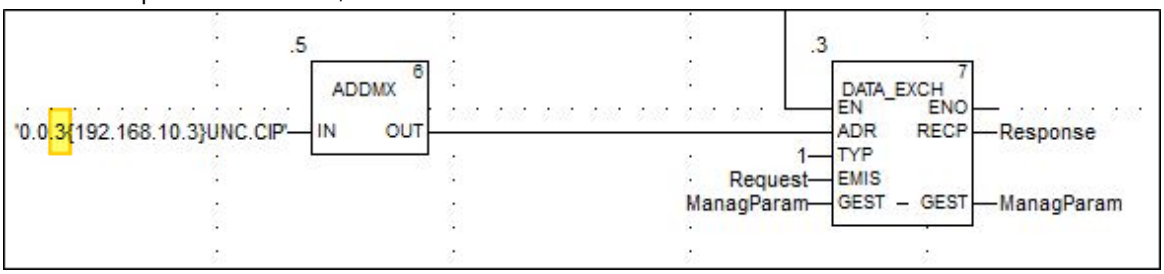


Figure 43: Control Expert – FB DATA_EXCH » Use of the data exchange function block

The "ADR" parameter can be created with the "ADDMX" function block according to the following rules:

Configuring EtherNet/IP Explicit Messaging Using DATA_EXCH

Original instructions

Configuring the Address Parameter

To configure the Address parameter, use the ADDM function to convert the character string, described below, to an address that is input into the ADR parameter of the DATA_EXCH block:

ADDM('rack.slot.channel{ip_address}message_type.protocol'), where:

This field...	Represents...
rack	the number assigned to the rack containing the communication module
slot	the position of the communication module in the rack
channel	the communication channel—set to a value of **0**
ip_address	the IP address of the remote device, for example 193.168.1.6
message_type	the type of message, presented as a three character string—either: • **UNC** (indicating an unconnected message), or • **CON** (indicating a connected message)
protocol	the protocol type—the three character string **CIP**

Figure 44: Control Expert – FB DATA_EXCH » Address parameters from Schneider documentation

To use the ethernet port of the M580-CPU for the communication, the channel field of "ADDMX" must be set to value **3**, see Figure 43: Control Expert – FB DATA_EXCH » Use of the data exchange function block [🕮 38].

The variables, which are used for the "DATA_EXCH" function block, are of the following format and content:

Interface | Variables | Function Blocks

Filter — Name = * — EDT

Name	Type	Value	Comment
ManagParam	ARRAY[0..3] OF INT		
ManagParam[0]	INT		
ManagParam[1]	INT		
ManagParam[2]	INT	5	Timout = 500ms
ManagParam[3]	INT		Data size in byte
Request	ARRAY[0..2] OF INT		
Request[0]	INT	16#0201	GetAttributeAll
Request[1]	INT	16#6420	Class 64h
Request[2]	INT	16#0124	Instance 1
Response	ARRAY[0..20] OF INT		
Response[0]	INT		
Response[1]	INT		
Response[2]	INT		
Response[3]	INT		
Response[4]	INT		

Figure 45: Control Expert – FB DATA_EXCH » Parameters (Part 1)

The diagnostic object with **class id 64h** is described in the user manual (see Chapter 1.1 Documentation from Pilz GmbH & Co. KG [📖 6]).

- To use the DATA_EXCH function block you must configure the usage of dynamic arrays.
  - You find the project settings under: *Tools* » *Project Settings*…
- There are two values to configure:
  1. *Project Settings* » *Scope: 'process'* » *Variables* » *Allow dynamic arrays*:

Project Settings

Scope : process

- Project Settings
  - General
    - Build settings
    - PLC diagnostics
  - Variables
  - Program

Property label	Property value
Allow dynamic arrays (ANY_ARRAY_XXX)	☑
Disable array size compatibility check	☐

Import | Export | Reset All | OK | Apply | Cancel | Help

Figure 46: Control Expert – FB DATA_EXCH » Parameters (Part 2)

2. *Project Settings* » *Scope: 'common'* » *Variables* » *Directly represented array variables*:

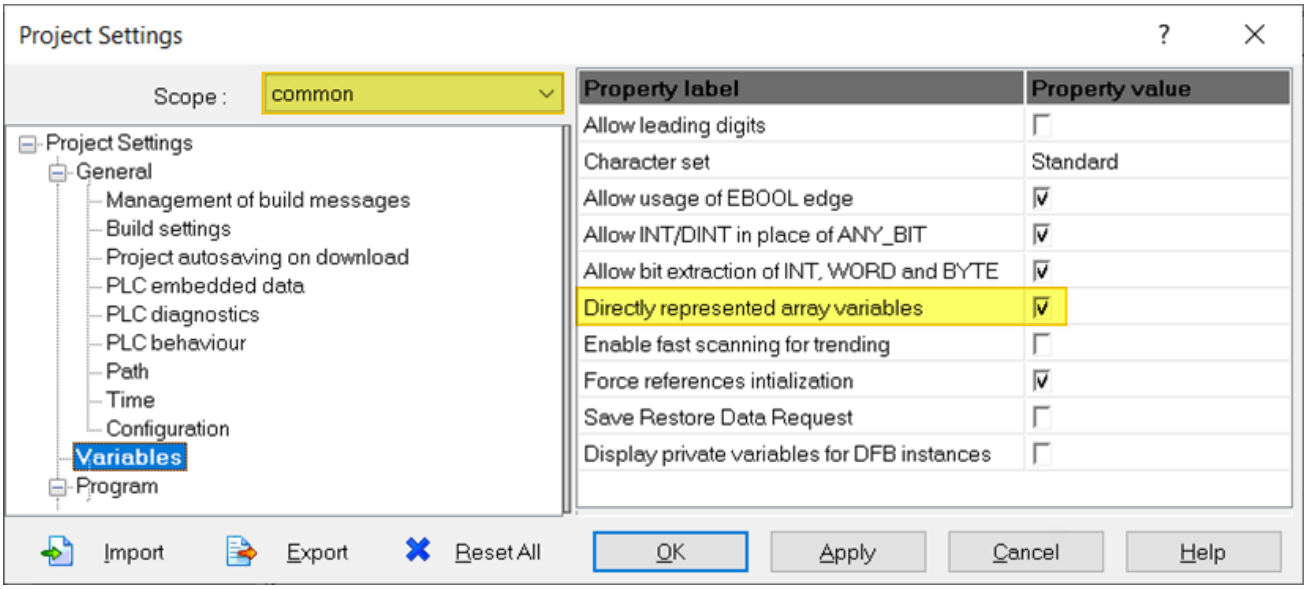


Figure 47: Control Expert – FB DATA_EXCH » Parameters (Part 3)

8.4.1 Extended diagnostic object

In addition to the diagnostic object 64h there is an extended diagnostic object with **class id 65h** available.
To read the data of this object, the following request data is used in DATA_EXCH function block:

Request	ARRAY[0..2] OF INT		
Request[0]	INT	16#0201	GetAttributeAll
Request[1]	INT	16#6520	Class 65h
Request[2]	INT	16#0124	Instance 1

Figure 48: Control Expert – FB DATA_EXCH » Request of object 65h

The extended diagnostic object 65h includes a list of the errors which are currently present in the system. The object has the following format:

Attribute ID	Name	Datatype	Description
1	Number of entries	USINT	Number of entries in the error list (beginning at attribute ID 3)
2	Reserved	USINT	reserved
3	Error list entry	Struct of	Error list entry no.1
	Slot number	USINT	Slot number in the system where the error exists
	Clamp info	SINT	Clamp information: -1: unused 0: entire module is affected 1 ... n: clamp number
	Error code	UINT	Error code
	Error message	SHORT-STRING	Error message in English Size of String: 100 characters
4	Error list entry		Next entry of the error list (if existing)
...	...	...	...

9 Helpful functions for commissioning and maintenance

9.1 Compare CRC for failsafe configuration data

The FS checksum for the PSS u2 system can be checked. If a project has been changed since the last download, this can be determined with this comparison. For this purpose, the device project in the offline project is compared with the one on the head module.

Note:

- The values of the checksums in the figures in this chapter are only examples.
- The CRC can be checked still directly in the tool *PASconfig* in the menu ›System‹:

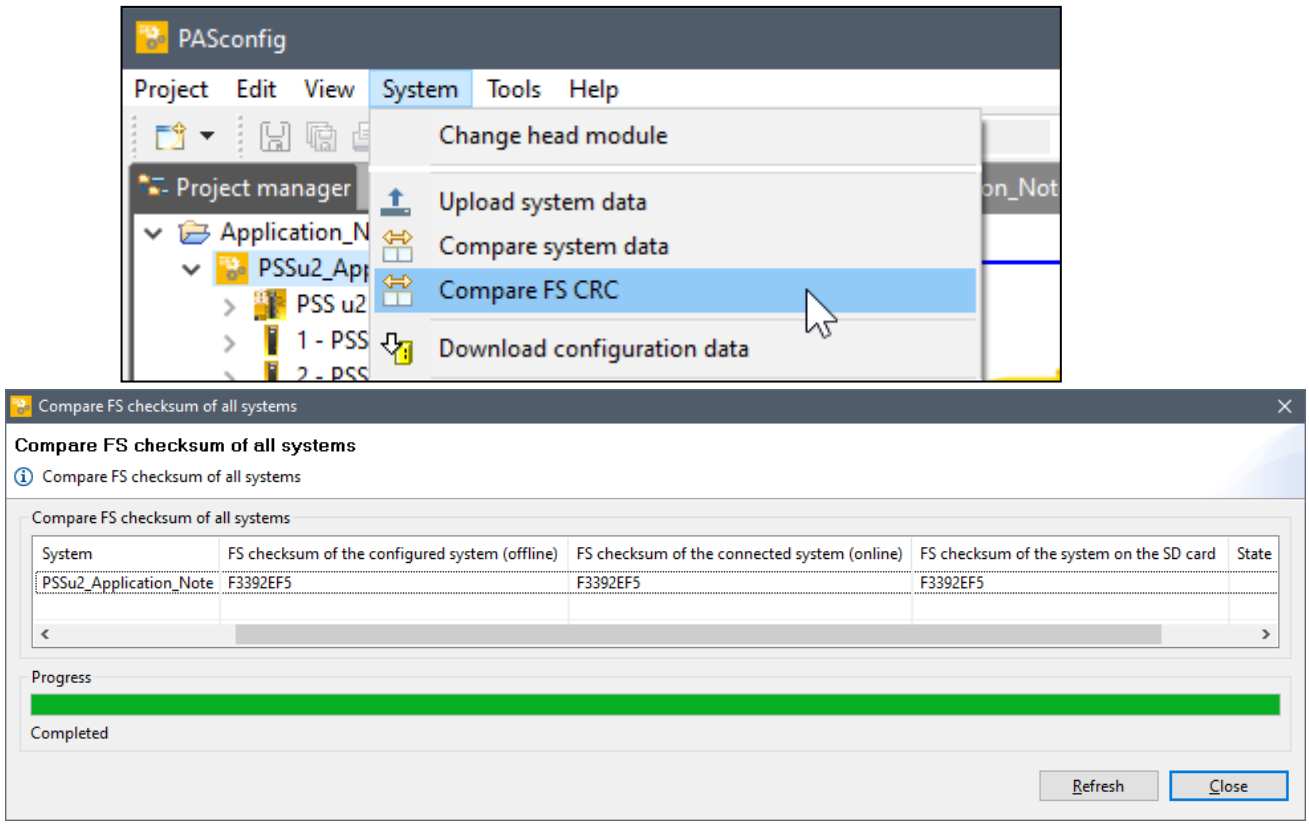


Figure 49: PASconfig – Compare FS CRC (Example)

9.2 Notes on using the MircoSD card and Reset button

9.2.1 Carrying out of a restart (warm reset) by means of the Reset button

- Procedure:
  - Press the Reset button for **less** than 5 seconds.

After execution of a restart/reboot command, the current processing is aborted, and the device is re-initialized. After a restart, the inputs will keep their current input values and substitute values are used for the outputs until the connection to the controller has been re-established.

9.2.2 Device exchange using MicroSD card and Reset button

- A MircoSD card is available as an optional accessory for the PSS u2 head module.
  - see table in Chapter 2.1 Pilz products [📖 7].

In the event of a device failure during operation, all relevant configuration data can be transferred very quickly to a second device using the removable data medium, without the need for software or an online connection (**Device exchange scenario**).

- Prerequisites:
  - On the first PSS u2 head, a MicroSD card must have been plugged in before commissioning.
  - The removable data medium must not be empty or defective.
    - After commissioning, you can use *PASconfig* to check the FS checksum of the system on the microSD card; this must match the FS checksum of the configured system.
      » see Chapter 9.1 Compare CRC for failsafe configuration data [📖 41]
      Important: To ensure that final data is stored on the disk, do not remove the microSD card until the check is complete.
  - The device project on the removable data medium must match the product type.
- Procedure:
  - Press the Reset button for **more** than 5 seconds. The SD LED flashes yellow.
  - Release the Reset button and press and release it again within 10 seconds.
  - The device project is transferred from the removable storage card to the device.

If the required files are not available on the removable storage card, the device exchange scenario is not performed, and an entry is written to the error stack.

NOTICE

If the previously described procedure is executed with the Reset button and no removable storage card is plugged in, an **Original Reset** is performed.

- Effects of the Original Reset:
  - ST and FS configuration data is deleted.
  - Error stack is not deleted
  - The fieldbus device is automatically restarted.

9.3 Wiring of input/output modules

The wiring is **aligned horizontally** on the PSS u2-System, this applies in particular for function expansions. The system can be optimally configured for different requirements from the maximum packing density up to the maximum functional scope.
For reserve or subsequent function expansions (any) slots on the backplane can be left free.
Therefor is no need for a "placeholder module" for PSSuniversal 2.

The following three examples show digital input/output modules for standard applications.

- 1-wire wiring with maximum packing density (Standard, Word alignment):

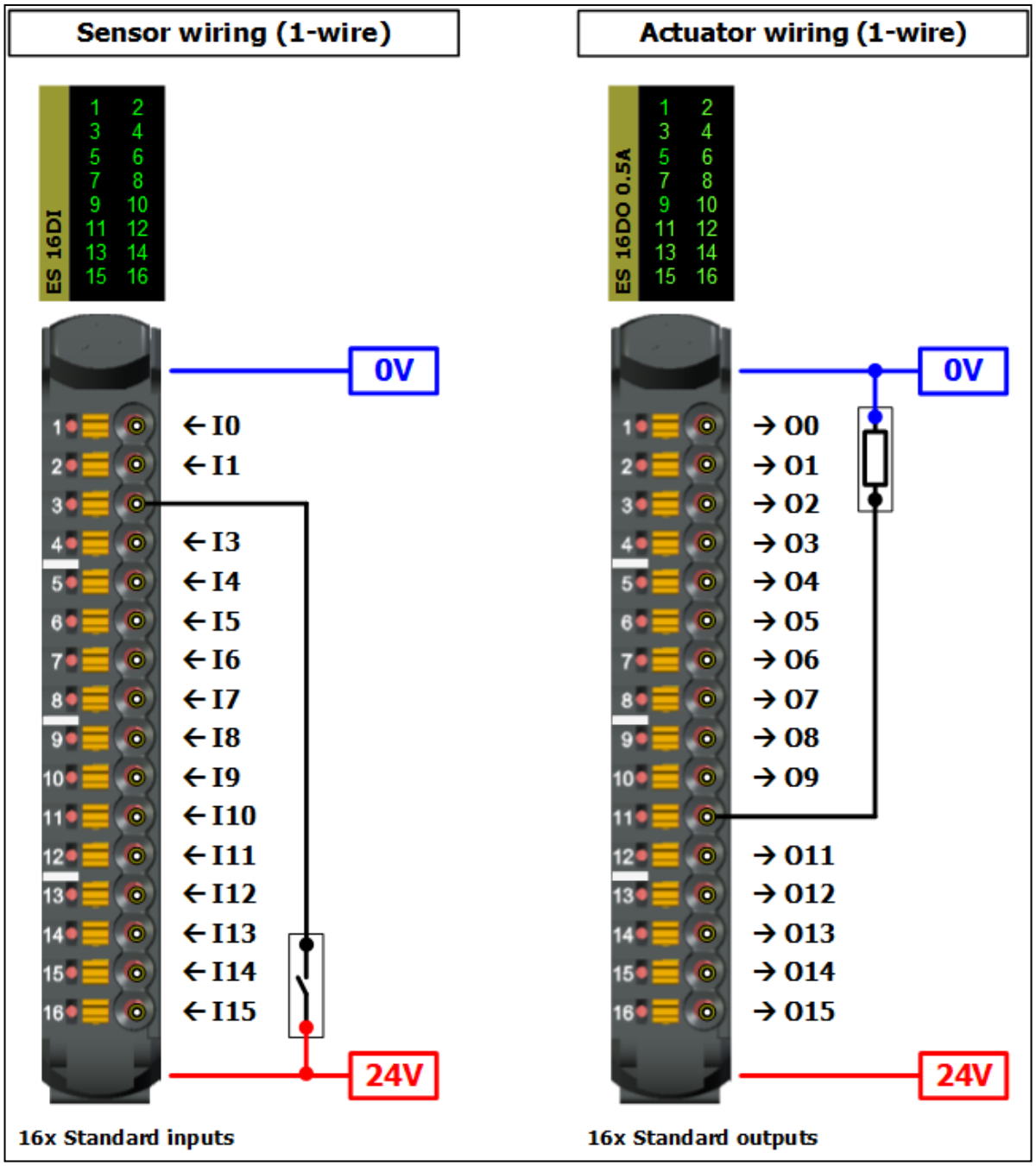


Figure 50: PSS u2 – Wiring » Standard digital (1-wire)

- 2-wire wiring with byte alignment per input/output module (standard):

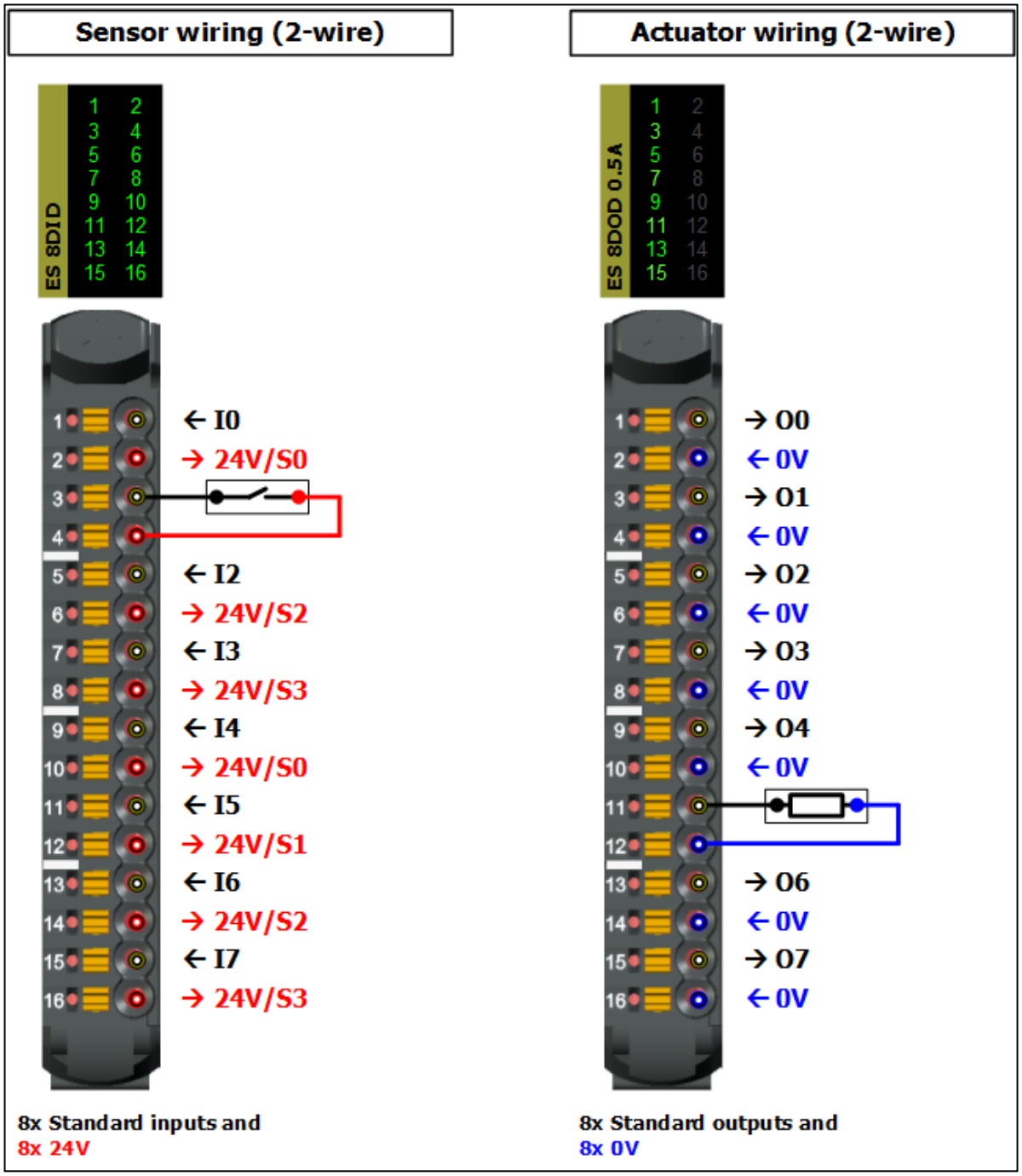


Figure 51: PSS u2 – Wiring » Standard digital (2-wire)

- 3-wire wiring with function expansion (standard):

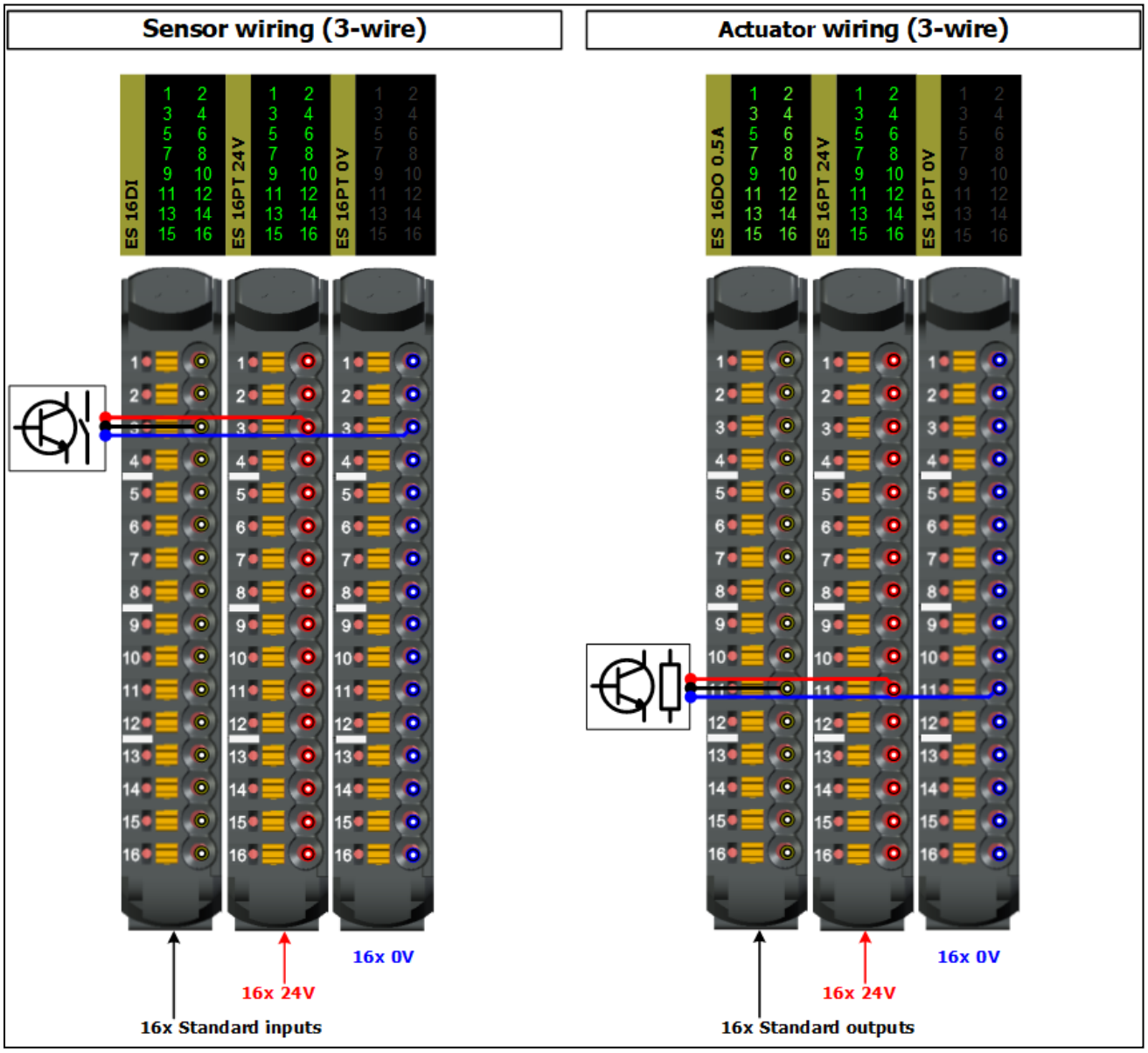


Figure 52: PSS u2 – Wiring » Standard digital (3-wire)

Here is an example with digital input/output modules for failsafe applications.

- 5-wire wiring with function expansion (failsafe):

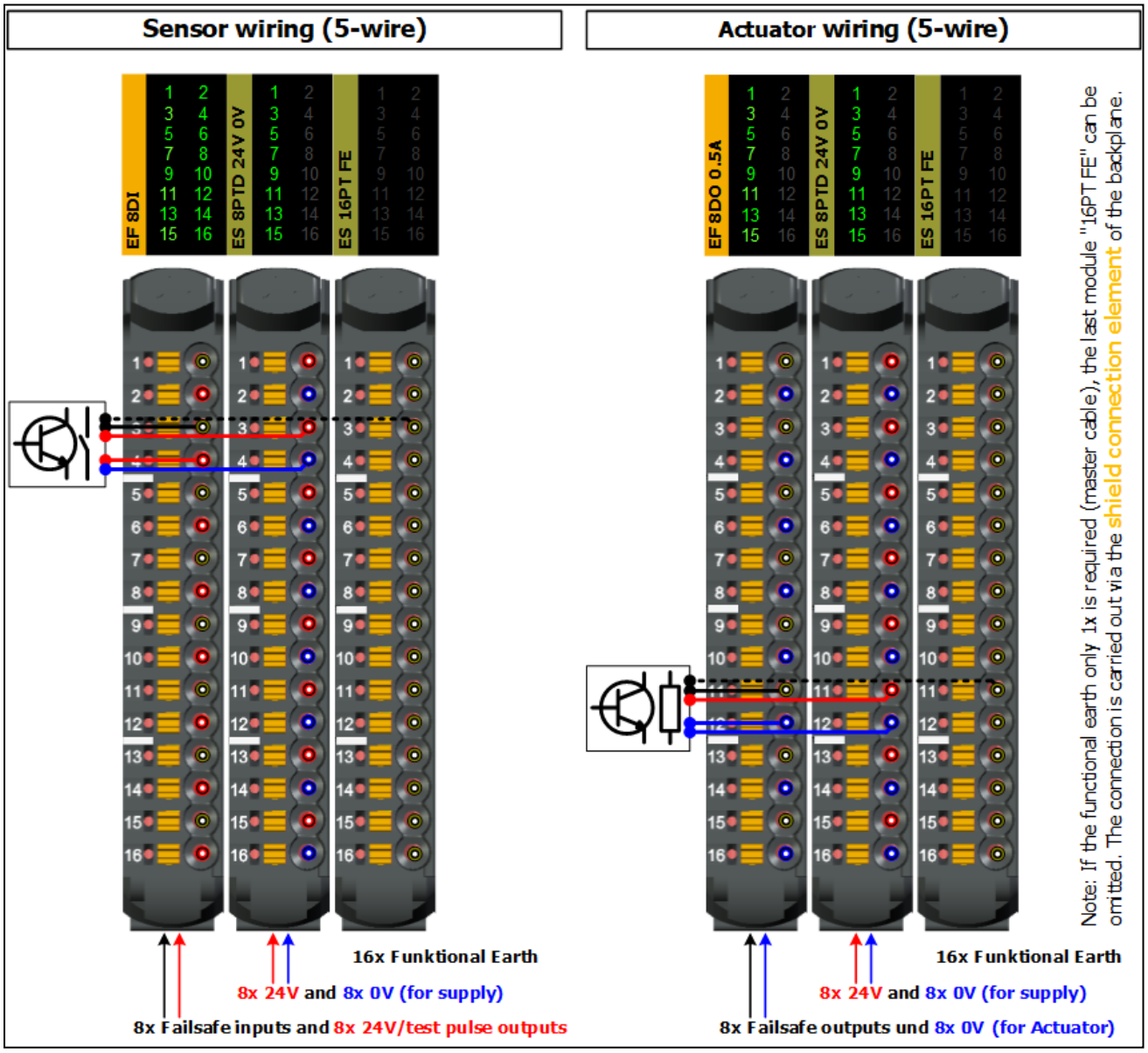


Figure 53: PSS u2 – Wiring » Failsafe digital (5-wire)

- **Shield connection element** for the backplane and head module:

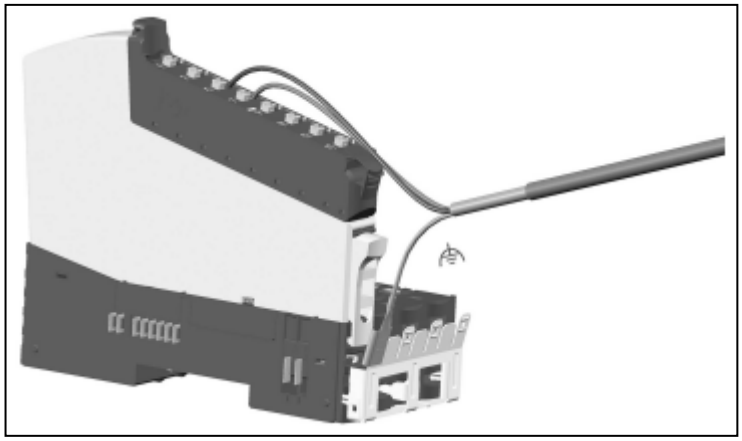


Figure 54: PSS u2 – Wiring » Shield connection element

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Support

Technical support is available from Pilz round the clock.

Americas
Brazil
+55 11 97569-2804
Canada
+1 888 315 7459
Mexico
+52 55 5572 1300
USA (toll-free)
+1 877-PILZUSA (745-9872)

Asia
China
+86 21 60880878-216
Japan
+81 45 471-2281
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Australia
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Europe
Austria
+43 1 7986263-0
Belgium, Luxembourg
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Ireland
+353 21 4804983
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+45 74436332
Spain
+34 938497433
Switzerland
+41 62 88979-32
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+31 347 320477
Turkey
+90 216 5775552
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You can reach our international hotline on:
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Headquarters: Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: info@pilz.com, Internet: www.pilz.com

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