PDP67 I/O PROFINET with PROFIsafe Profile on a SIMATIC S7-1500 with TIA Portal

PILZ
THE SPIRIT OF SAFETY

Product

Type:	PDP67 I/O
Name:	PDP67 PN 6FDI 6FDIO 2FDOTP, 4R000001
Manufacturer:	Pilz GmbH & Co. KG – Safe Automation

Document

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Document Revision History

Release	Date	Changes	Chapter
01	11/03/2022	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.

March 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	
TIA	**T**otally **I**ntegrated **A**utomation (SIMATIC)	
TCI	**T**ool **C**alling **I**nterface (SIMATIC)	
PN	**P**ROFI**N**ET, **Pro**cess **Fi**eld **Net**work	en.wikipedia.org > PROFINET
PROFIenergy	Technology from PROFINET	en.wikipedia.org > PROFIenergy
PROFIsafe	Technology from PROFINET	www.profibus.com > PROFIsafe
PROFINET IRT	Technology from PROFINET: **I**sochronous **R**eal **T**ime	
FDI	**F**ailsafe **D**igital **I**ntput	
FDO	**F**ailsafe **D**igital **O**utput (single pole)	
FDIO	**F**ailsafe **D**igital **I**ntput **O**utput (single pole)	
FDOTP	**F**ailsafe **D**igital **O**utput (with) **T**wo **P**oles (also: failsafe digital dual-pole output)	
SDO	**S**tandard **D**igital **O**utput (single pole)	
HiZ	High-Impedance	
NC	**N**ormally **C**losed	
NO	**N**ormally **O**pen	
OC	**O**pen **C**ircuit	

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 and readme file Pilz international Webportal > Products and Industries > Controllers > I/O systems **Support for PDP67 only starts from PASconfig version V5.1.0.** Please use the latest version at the link beside. or the device under section 'Software'	Products and Industries > Controllers > Overview I/O systems www.pilz.com > Download PASconfig **4R000001** (Order number device) www.pilz.com > Download 4R000001
3	System Description PSSuniversal 2	Not yet available.
4	Installation manual PSSuniversal 2	1004152-EN-xx www.pilz.com > Download 1004152
5	Operation manual PDP67 PN 6FDI 6FDIO 2FDOTP2A Product modification PDP67 PN 6FDI 6FDIO 2FDOTP2A Hardware version 01 GSD file under section 'Device description file'	1005181-EN-xx www.pilz.com > Download 1005181 Not yet available. **4R000001** (Order number device) www.pilz.com > Download 4R000001
6	Application Note 'PSSu 312043 Profinet with Simatic S7' Document for PSSu system (1st Generation) with SIMATIC **STEP 7 Classic**	1001907-EN-xx www.pilz.com > Download 1001907
7	Application Note 'PSS u2 Profinet S7 TIA' Document for PSS u2 system with head module **PSS u2 P0 F/S PN**	1004479-EN-xx www.pilz.com > Download 1004479
8	Application Note 'PSS u2 328062 Profinet with Simatic S7' Document for PSS u2 system with head module **PSS u2 P0 F/S PN2**	1005258-EN-xx www.pilz.com > Download 1005258

- 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	PI Portal (PROFIBUS and PROFINET International)	https://www.profibus.com/
2	Siemens Homepage, Safety integrated	new.siemens.com > Safety Integrated
3	Siemens Homepage, SCE Training Curriculums (*TIA*)	new.siemens.com > MCMS/SCE
4	SIMATIC Industrial Software SIMATIC Safety - Configuring and Programming Programming and Operating Manual	54110126; 04/2021 support.industry.siemens.com > 54110126
5	Application example Emergency stop up to SIL 3 / PL e with a failsafe S7-1500 controller	21064024, 05/2017 support.industry.siemens.com > 21064024
6	Application example Monitoring the feedback circuit in the safety program	21331098, 08/2019 support.industry.siemens.com > 21331098
7	Siemens Homepage, PROFINET network analyzer PRONETA	https://www.siemens.com/proneta

2 Used hardware and software

2.1 Pilz products

No.	Descriptions	Order number	Version	Number
1	Product type: *PDP67 PN 6FDI 6FDIO 2FDOTP* Hardware Decentralised field device Failsafe and standard, IP67, PROFINET IO DEVICE with PROFIsafe, Conformance Class C (CC-C), PROFIenergy, IRT/RT, data set I&M 0 and 1-4, digital inputs and outputs, integrated webserver	4R000001	01	1
2	Product type: *µSD Memory Card 512MB M12A* Hardware Memory card (nickel-plated brass casing) Accessory, microSD, industrial version	4R000002	– –	(1) optional
3	Product type: *Cable/FC/M12-5SMX/M12-5SFX/A/003/0Q34/BK* Hardware field connection cable (assembled) M12 plug to M12 socket, 5-pin, A-coded, PUR black, drag chain compatible, IOL-S compatible, 5× 0.34 mm², 3 m	C1000016	– –	(N) depending on sensor or actuator
4	Product type: *Cable/FC/XXX-XXXX/M12-5SFX/A/003/0Q34/BK* Hardware field connection cable (assembled) Open cable end to M12 socket, 5-pin, A-coded, PUR black, drag chain compatible, IOL-S compatible, 5× 0.34 mm², 3 m	C1000039	– –	(N) depending on sensor or actuator
5	Product type: *RJ45 Connector* Hardware Ethernet-Plug Male RJ45, 8-pin, straight, in accordance with the standard IEC 60603-7-1, Cat.6a	380401	– –	2 for PU cable to PC
6	Product type: *SafetyNET p Kabel* Hardware Ethernet-Kabel (sold by the meter) Cat5e (100mBit/s), PUR, Gelb RAL1003, 2x2x0,35	380000	– –	1 (x1 meter) for PU cable to PC
7	Product type: *Cable/PN/M12-4SMX/M12-4SMX/D/003/Q324/GN* Hardware Ethernet cable (assembled) M12 plug to M12 plug, 4-pin, PUR shielded green (Profinet), Cat5e, drag chain compatible, 3 m	C1000006	– –	(1) for IP67 wiring
8	Product type: *Cable/PN/RJ45-4SM/M12-4SMX/D/003/Q324/GN* Hardware Ethernet cable (assembled) RJ45 plug to M12 plug, 4-pin, PUR shielded green (Profinet), Cat5e, drag chain compatible, 3 m	C1000001	– –	(1) for IP20 connection
9	Product type: *Cable/PW/M12-5SMX/M12-5SFX/L/0,5/1Q50/BK* Hardware power supply cable (assembled) M12 plug to M12 socket, 5-pin, L-coded, PUR black, drag chain compatible, 5× 1.5 mm², 3 m	C1000011	– –	(1) for IP67 wiring
10	Product type: *Cable/PW/M12-5SFX/XXX-5XXX/L/003/1Q50/BK* Hardware power supply cable (assembled) M12 socket to open cable end, 5-pin, L-coded, PUR black, drag chain compatible, 5× 1.5 mm², 3 m	C1000027	– –	(1) for IP20 connection
11	Product type: *PASconfig* System software for decentralised fieldbus devices	– –	5.1.0	– –
12	Product type: *Acc/MA/label plates/IP67* Accessories Plastic labelling plates, PU 10 pieces	C1000033	– –	(1) optional
13	Product type: *Caps for IP67 moduls* Accessories End caps for M12 ports, A- and D-coded, IP67, black, PU 4 pieces	328324	– –	(1) optional
14	Product type: *Acc/MA/caps L-coded/M12* Accessories, End caps for M12 ports, L-coded, IP67, grey, PU 2 pieces	328328	– –	(1) optional

- Notes:
  - An overview of available accessories can be found in the operating manual of the instrument under the chapter ***Order reference*** (www.pilz.com > Download OM document no. 1005181).
  - Here are already extensive accessories for IP65/67/68 from the ***PDP67 and PSS67 assortment*** in Pilz eshop: O.No. 3802xx , O.No. 3803xx , O.No. 3807xx , O.No. 6302xx , O.No. 6303xx .

2.2 Third-party products

No.	Descriptions	Order number	Version	Number
1	Product type: *PS 60W 120/230VAC/DC* Hardware Power Supply	6ES7 507-0RA00-0AB0	V1.0	1
2	Product type: *CPU 1518F-4 PN/DP* Hardware PLC	6ES7518-4FP00-0AB0	V2.6	1
3	Product type: *DI 32xDC 24V HF* Hardware Digital input module SM 521	6ES7521-1BL00-0AB0	V1.0	1
4	Product type: *DQ 32xDC 24V/0,5A ST* Hardware Digital output module SM 522	6ES7522-1BL00-0AA0	V2.0	1
5	Product type: Front connector, Screw-type technology, 40-pole Accessories for Periphery Modules	6ES7592-1AM00-0XB0	– –	2
6	Product type: *SIMATIC STEP 7 Professional* Software	– –	V15.1	– –
7	Product type: *SIMATIC STEP 7 Safety* Software	– –	V15.1	– –
8	Product type: *PRONETA Basic* Software	– –	V3.05	– –

2.3 Structure of the application (schematic)

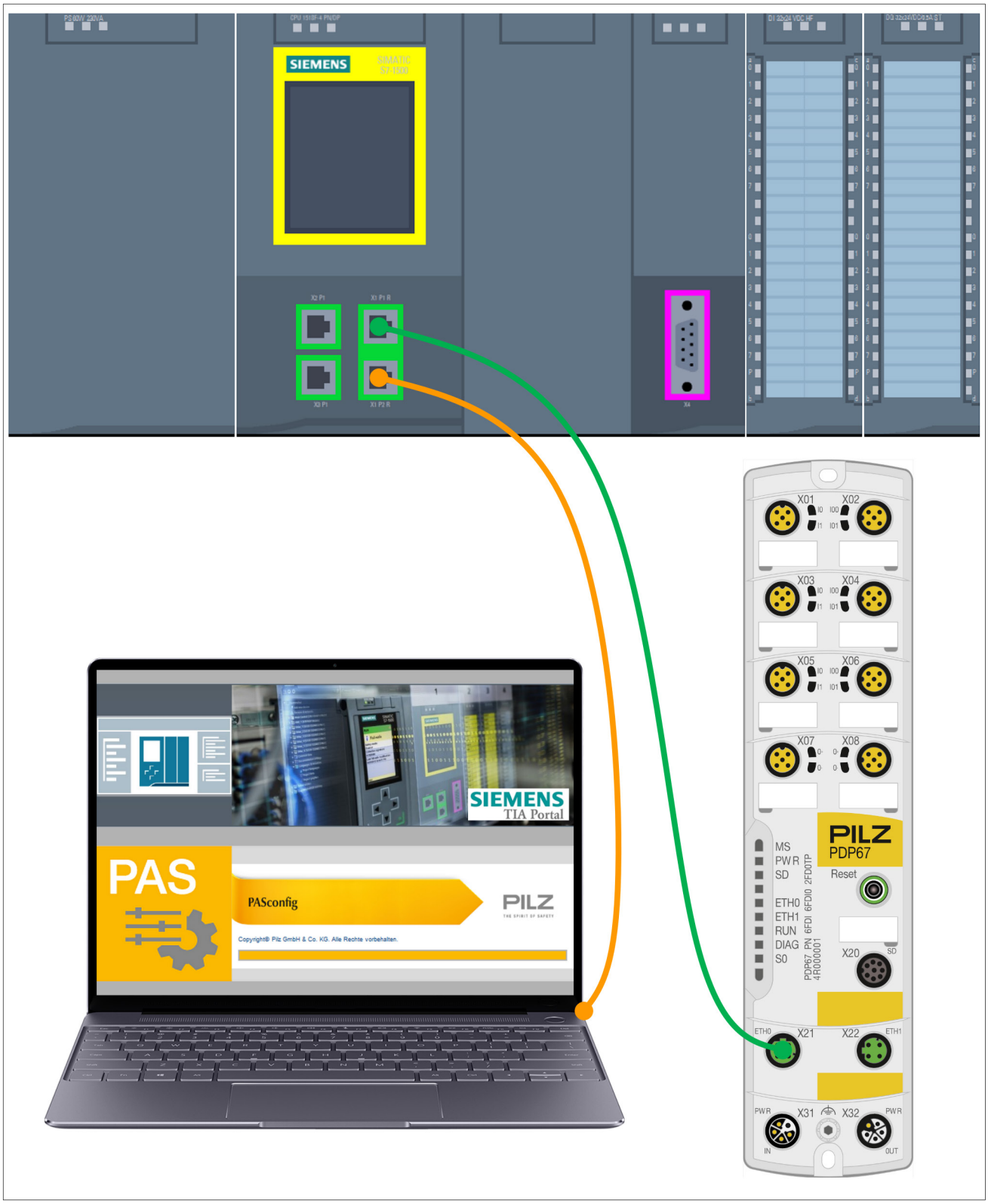


Figure 1: Application – Structure of the hardware (schematic)

3 Preface

This Application Note basically describes the commissioning of a PDP67 Remote I/O devices system on a current SIMATIC F-CPU, using the automation software *TIA Portal*.
Both devices communicate with each other via PROFINET/PROFIsafe.
In this case, the user program of the F-CPU controls the failsafe input and output modules of the PDP67 electronic modules for the safety functions.
The essential procedure for a successful basic configuration is shown step-by-step, usually with screenshots.

NOTICE

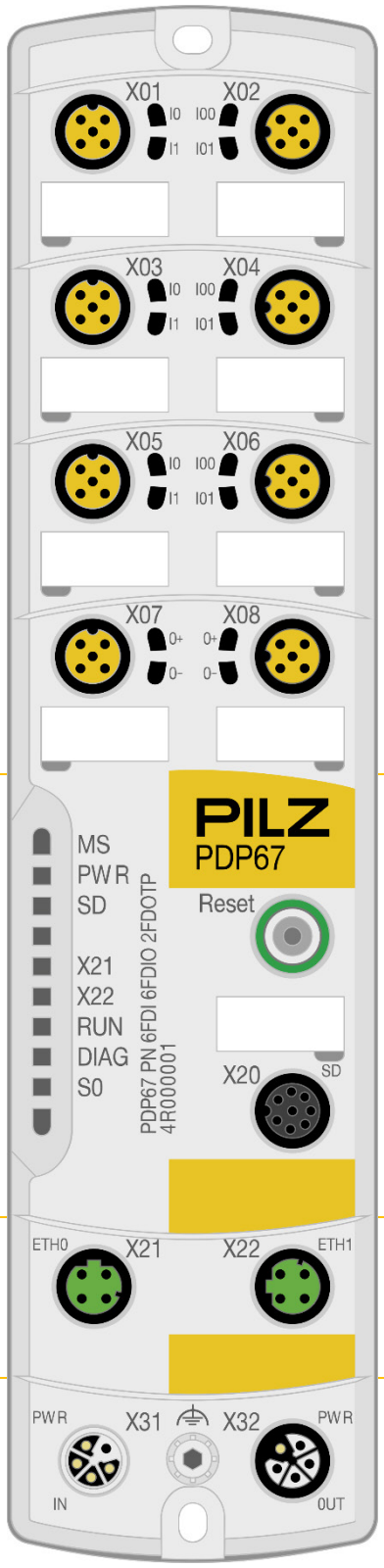
- A detailed explanation of safety functions used in the failsafe application and its evaluation regarding functional safety are not a part of this document.
- This document only describes the procedure for use of the Remote I/O-device PDP67 with the order number **4R000001** and is not intended as a technical documentation for general use of the SIMATIC STEP 7 Professional for Siemens *TIA Portal*.
- The Pilz device will only be supported from *PASconfig* version V5.1.0.

4 Technical notes about the Pilz PDP67 device

A PDP67 device is a decentralised fieldbus device with PROFINET interface with PROFIsafe.

The *PASconfig* system software is available for Pilz decentralized field devices.
This tool provides support as you select, configure and commission components.

A PDP67 device consists of:



- the upper area of the digital input/output modules for failsafe and standard applications with:
  - the I/O ports (M12, A-coding) for:
    - Failsafe inputs (FDI: *X01...X06*)
    - Failsafe outputs, single-pole (FDO: *X02, X04, X06*)
    - Failsafe outputs, two-poles (FDOTP: *X07, X08*)
    - Standard outputs, single-pole (SDO: *X01...X06*)
  - the status LEDs for the I/O signals
  - the assembly stations for the Labelling strips
  - There are several special features:
    - The electrical pin assignment is AIDA compliant.
    - All inputs and outputs can be activated / deactivated and configured singly (bit by bit).
    - A pulse stretching can be set for inputs and a switch-off delay for outputs, the default values are '0' in each case.
    - The FDIO ports *X02, X04, X06* can be configured port by port as Failsafe Digital Inputs (FDI) or single pole Failsafe Digital Outputs (FDO).
    - The ports *X01...X06* can each be configured as single-pole standard digital outputs (SDO); in which case the failsafe functions are limited.

- the device area with:
  - the reset button, Port *Reset*
  - the memory interface, port *X20*
  - the status LEDs for the device
  - the installation place for the Label strips (Equipment ID)

- the fieldbus connection on ports *X21/X22* with:
  - the Ethernet ports (M12, D-coding, ETH0/ETH1)
  - the status LEDs for *X21* and *X22* in the device area

- the power supply on ports *X31/X32* with:
  - the supply port (M12, L-coding, 16A, male)
  - the distribution port (M12, L-coding, 16A, female)
  - the *PWR* status LED in the device area
  - the connection for the functional earth ⏚

Figure 2: PDP67 – Modular structure of the PDP67 device

5 Application description

The aim is to show how a basic PROFINET/PROFIsafe communication and Siemens S7-1500 PLC can be built up to form a remote I/O device PDP67.

For this fieldbus communication, the standard default parameters from the *TIA portal* are used. Only the parameters for the addressing of the devices are adjusted.

The detailed hardware configuration for the S7-CPU is not part of this Application Note.

- Detailed information on this subject can be found in the manual or online help for the *TIA Portal*.
  - 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]

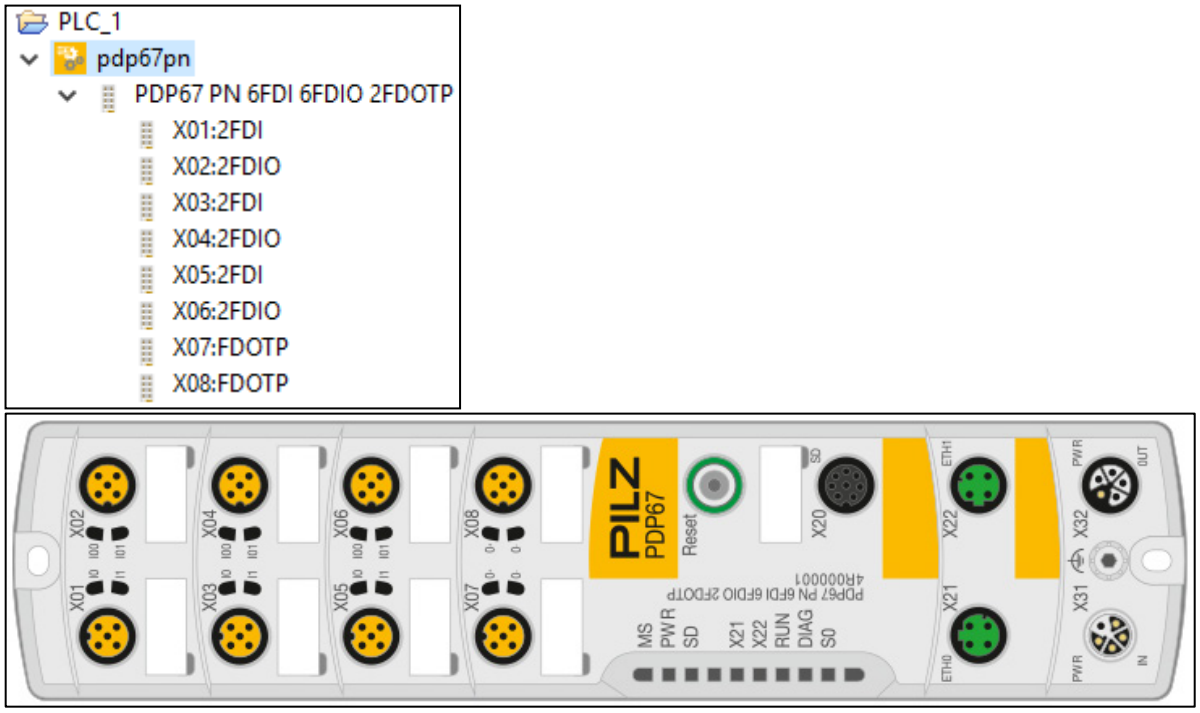


Figure 3: PDP67 – Hardware » Overview of used modules

6.1.2 Siemens devices

- The used SIMATIC devices are listed in the table of the following link:
  - Chapter 2.2 Third-party products [📖 8]
- 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 PDP67 device

6.2.1 Variable I/O address assignment

The following examples show the main configuration options of the PDP67 device, the first being the preconfigured default setting. The I/O functions can be parameterized port by port but can also be activated or deactivated and modified singly bit by bit.

Configuration example 1 :	12 FS-DI	---------	---------	2 FS-DOTP
Configuration example 2 :	6 FS-DI	---------	6 FS-DO	2 FS-DOTP
Configuration example 3 :	6 FS-DI	6 ST-DO	---------	2 FS-DOTP
Configuration example 4 :	|6 FS-DI|	6 ST-DO	6 FS-DO	2 FS-DOTP
Configuration example 5 :	|12 FS-DI|	12 ST-DO	---------	2 FS-DOTP
Configuration example 6 :	4 FS-DI	4 ST-DO	2 FS-DO	2 FS-DOTP
Configuration example 7 :	1 FS-DI	1 ST-DO	1 FS-DO	1 FS-DOTP

*) The examples 1...6 are each maximum constellations with different signal types, the last one a possible minimum configuration with one signal per type.

- Important note:
  The effects of the device configuration in the *PASconfig* tool on the ***real existence of the I/O addresses at the I/O ports***, which are listed below in the tables, is shown with an example in Chapter 9.3 Display of the actual mapping of the I/O addresses to the I/O ports [📖 44 ff.], the special feature in the examples 4 & 5 with 2 FDI and 2 SDO signals per FDI(O) port under Figure 81: PDP67 – Wiring » Pin assignment X01...X08 (M12, female, A coded) [📖 55].

6.2.2 PDP67 failsafe and standard I/O process image

- The I/O address ranges consist of:
  (see also Chapter 8.2.2 Adding the I/O containers of the PDP67 device [📖 28])
  - **10/11 Input bytes** with:
    - **6 bytes failsafe input data**
    - **1 byte PROFIsafe Status**
    - **3/4 bytes PROFIsafe CRC (container for module/channel granular passivation, slot 11)**
  - **6/7/8/9 Output bytes** with:
    - **2 bytes failsafe output data**
    - **1 byte PROFIsafe Control**
    - **3/4 bytes PROFIsafe CRC (container for module/channel granular passivation, slot 11)**
    - **2 bytes standard output data (optional, ST container, slot 10)**
- The FS process image of the PDP67 device consists of:
  - 6 bytes for the failsafe inputs and
  - 2 bytes for the failsafe outputs.

Signal type	Byte.Bit : Port.Signal(Socket:Pin)	Byte.Bit : Port.Signal(Socket:Pins)
FDI ---------- _ _	0.0 : P01.I0(X01:4) 0.1 : P01.I1(X01:2) 0.2 : P03.I0(X03:4) 0.3 : P03.I1(X03:2) 0.4 : P05.I0(X05:4) 0.5 : P05.I1(X05:2) 0.6 / 0.7 : not used (value =0)	--
FDI ---------- _ _	1.0 : P02.I0(X02:4) 1.1 : P02.I1(X02:2) 1.2 : P04.I0(X04:4) 1.3 : P04.I1(X04:2) 1.4 : P06.I0(X06:4) 1.5 : P06.I1(X06:2) 1.6 / 1.7 : not used (value =0)	--
Valid of FDI ---------- _ _	2.0 : Valid bit of P01.I0(X01:4) 2.1 : Valid bit of P01.I1(X01:2) 2.2 : Valid bit of P03.I0(X03:4) 2.3 : Valid bit of P03.I1(X03:2) 2.4 : Valid bit of P05.I0(X05:4) 2.5 : Valid bit of P05.I1(X05:2) 2.6 / 2.7 : not used (value =0)	--

Signal type	Byte.Bit : Port.Signal(Socket:Pin)	Byte.Bit : Port.Signal(Socket:Pins)
Valid of FDI ---------- – –	3.0 : Valid bit of P02.I0(X02:4) 3.1 : Valid bit of P02.I1(X02:2) 3.2 : Valid bit of P04.I0(X04:4) 3.3 : Valid bit of P04.I1(X04:2) 3.4 : Valid bit of P06.I0(X06:4) 3.5 : Valid bit of P06.I1(X06:2) 3.6 / 3.7 : not used (value =0)	--
Valid of FDOTP OC of FDOTP ---------- FDOTP	4.0 : Valid bit of P07.O0(X07:3,4) 4.1 : Valid bit of P08.O0(X08:3,4) 4.2 : Open circuit at P07.O0(X07:3,4) 4.3 : Open circuit at P08.O0(X08:3,4) 4.4 / 4.5 / 4.6 / 4.7 : not used (value =0)	0.0 : P07.O0(X07:3,4) 0.1 : P08.O0(X08:3,4) 0.2 / 0.3 / 0.4 / 0.5 / 0.6 / 0.7 : not used (value =0)
Valid of FDO ---------- FDO	5.0 : Valid bit of P02.O0(X02:4) 5.1 : Valid bit of P02.O1(X02:2) 5.2 : Valid bit of P04.O0(X04:4) 5.3 : Valid bit of P04.O1(X04:2) 5.4 : Valid bit of P06.O0(X06:4) 5.5 : Valid bit of P06.O1(X06:2) 5.6 / 5.7 : not used (value =0)	1.0 : P02.O0(X02:4) 1.1 : P02.O1(X02:2) 1.2 : P04.O0(X04:4) 1.3 : P04.O1(X04:2) 1.4 : P06.O0(X06:4) 1.5 : P06.O1(X06:2) 1.6 / 1.7 : not used (value =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

- The ST process image of the PDP67 device consists of:
  - 2 bytes for the standard outputs.

Signal type	Byte.Bit : Port.Signal(Socket:Pin)	Byte.Bit : Port.Signal(Socket:Pin)
– – ---------- SDO	--	0.0 : P01.O0(X01:1) 0.1 : P01.O1(X01:5) 0.2 : P03.O0(X03:1) 0.3 : P03.O1(X03:5) 0.4 : P05.O0(X05:1) 0.5 : P05.O1(X05:5) 0.6 / 0.7 : not used (value =0)
– – ---------- SDO	--	1.0 : P02.O0(X02:1) 1.1 : P02.O1(X02:5) 1.2 : P04.O0(X04:1) 1.3 : P04.O1(X04:5) 1.4 : P06.O0(X06:1) 1.5 : P06.O1(X06:5) 1.6 / 1.7 : not used (value =0)

INFO

The PDP67 device has I/O modules with different address requirements for:

- ST container for standard process data on slot 10 (preset)

Module	Rack	Slot	I address	Q address
Container for ST output process data_1	0	10		11...12

- FS container for PROFIsafe process data with channel-granular passivation according to PROFIsafe specification version 2.6 on slot 11 (preset)

Module	Rack	Slot	I address	Q address
Container for PROFIsafe process data with channel-granular passivation_1	0	11	4...14	4...10

- FS container for PROFIsafe process data with modular-granular passivation according to PROFIsafe specification version 2.4 on slot 11 (optional)

Module	Rack	Slot	I address	Q address
Container for PROFIsafe process data with modular-granular passivation_1	0	11	4...13	4...9

7 Configuration of Siemens S7 F-CPU

7.1 Creation of new TIA project

- First you start the software *TIA Portal* and create a new project:

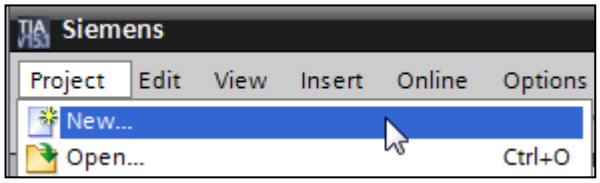


Figure 4: TIA – Create a new project (Part 1, Start)

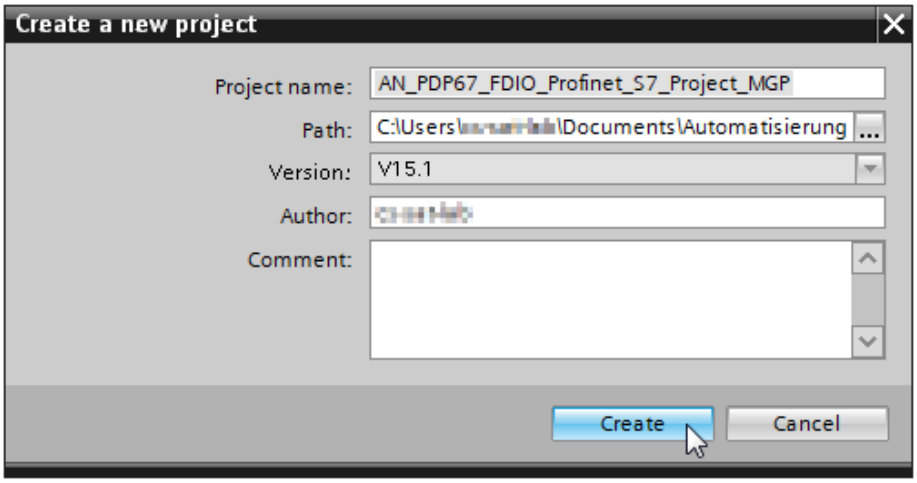


Figure 5: TIA – Create a new project (Part 2, Creation)

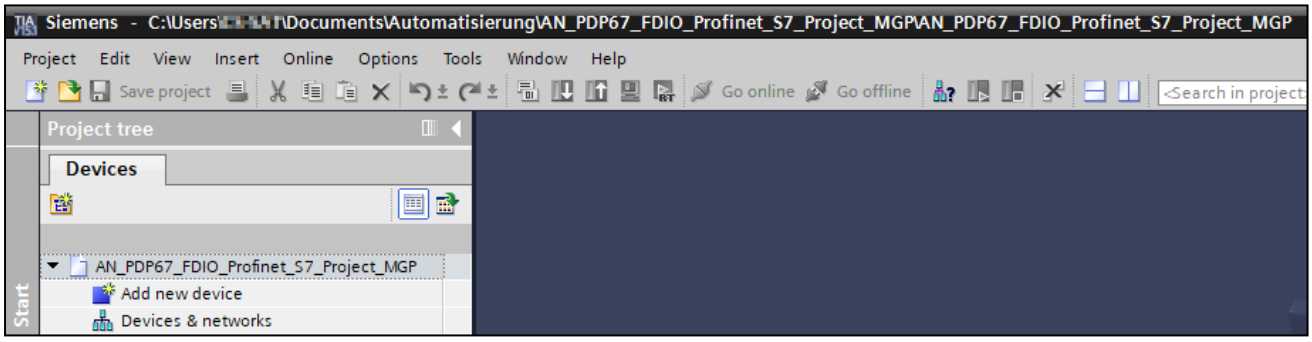


Figure 6: TIA – Create a new project (Part 3, Finalization)

7.2 Select and configure the S7 F-CPU

- Selecting and configuring the S7 F-CPU:

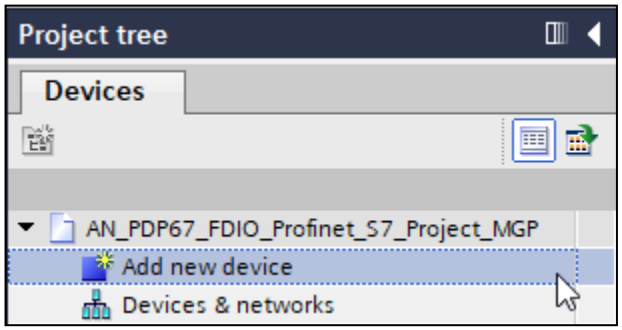


Figure 7: TIA – Add new device (Part 1, Start)

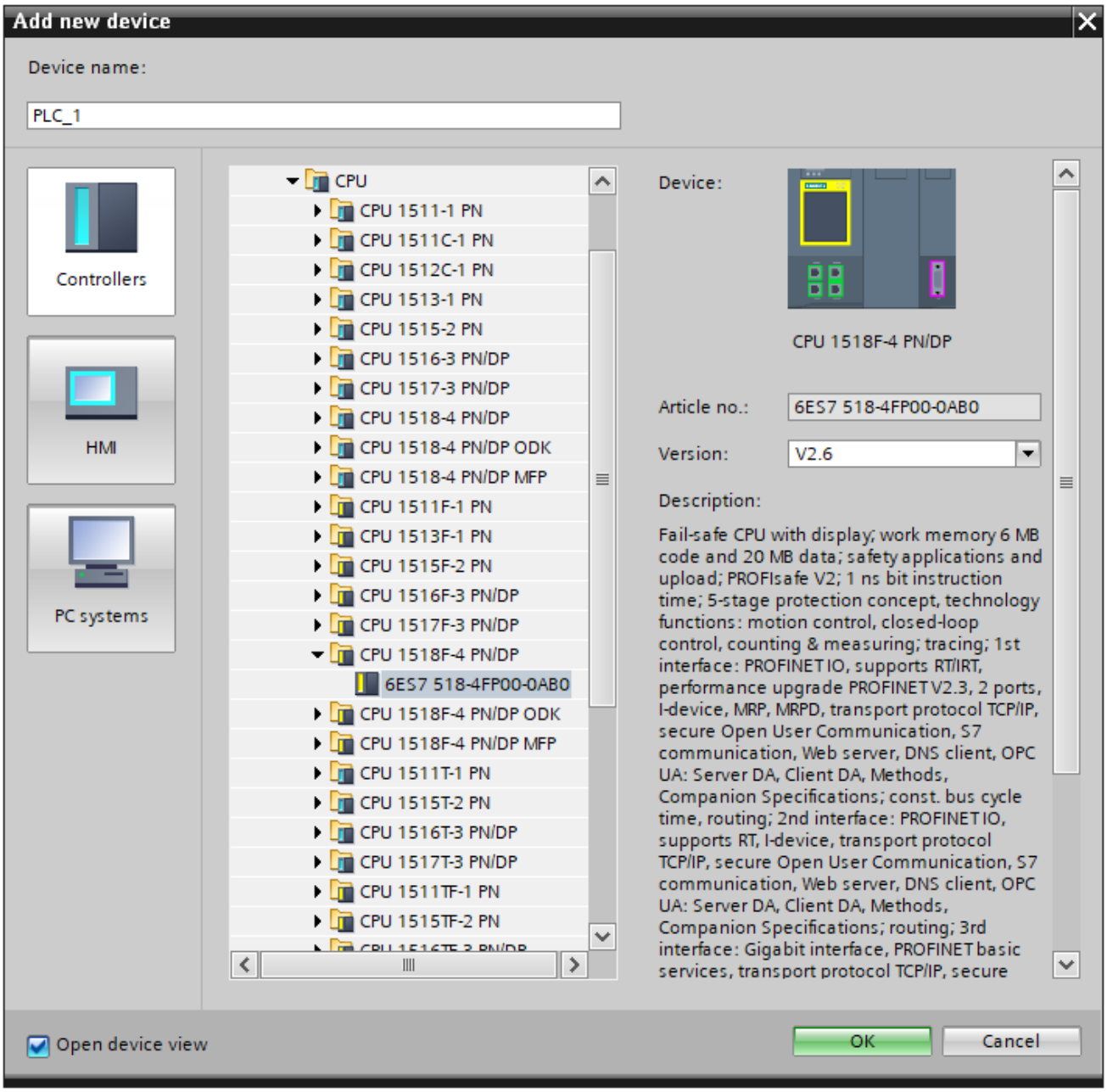


Figure 8: TIA – Add new device (Part 2, PLC 'CPU 1518F-4 PN/DP')

- Switch to "Device view" (if not previously selected) and select the device ***PLC_1***:

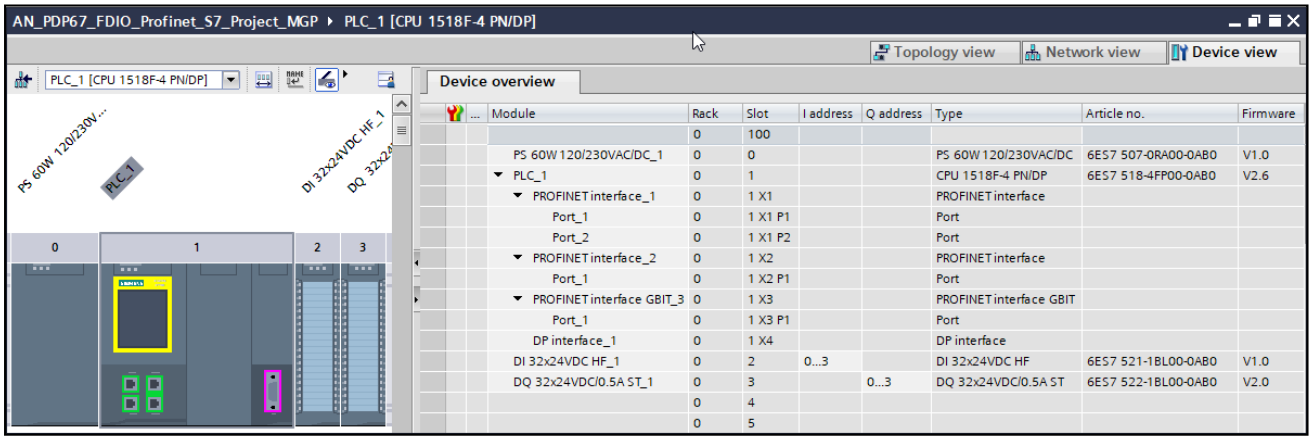
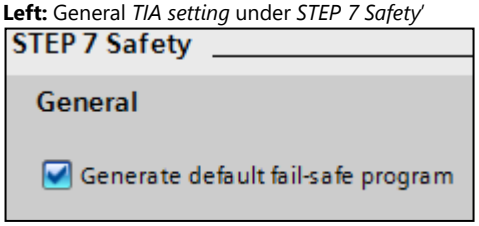


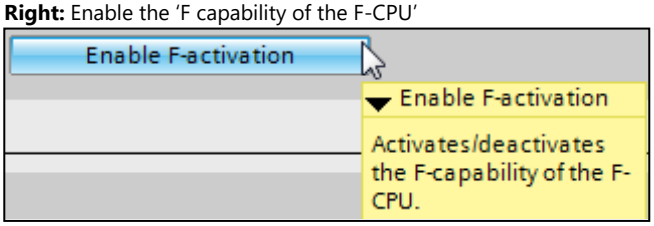
Figure 9: TIA – Add new device (Part 3, Finalization)

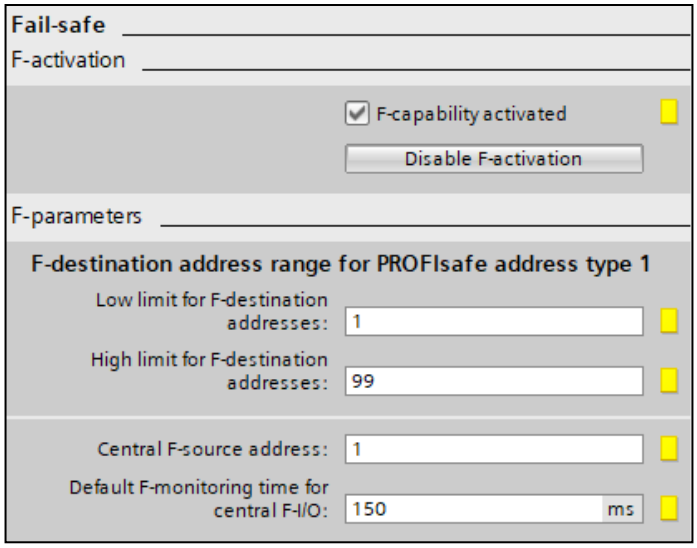
- Switch to "Fail-Safe" in the "General" tab.
- Enable the *»F-capability of the F-CPU«* including selection of the "Access level for the PLC":

Left: General *TIA setting* under *STEP 7 Safety'*



Right: Enable the 'F capability of the F-CPU'





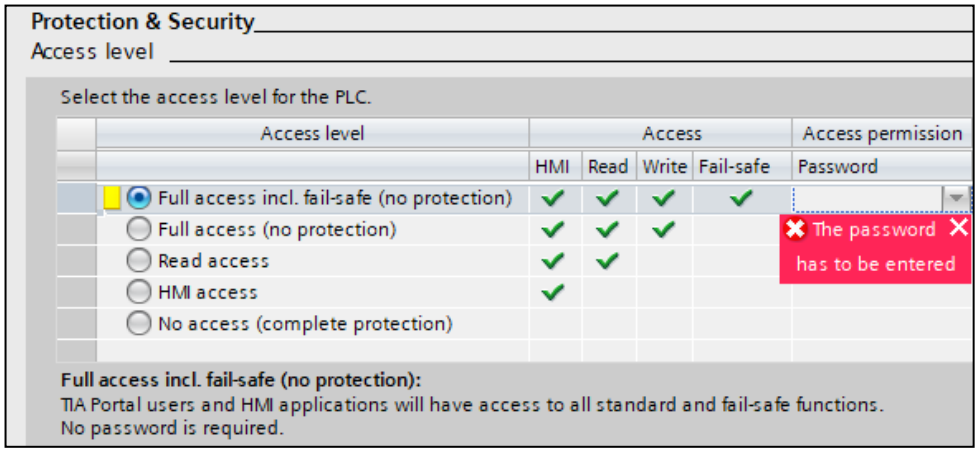


Figure 10: TIA – PLC » Enabling F-capability and select access level

7.3 Setting up the Ethernet adapter

Figure 11 schematically illustrates the wiring of the Ethernet connections:

- Top » *S7 X1 P1R & X1 P2R*: **192.168.0.1** / 255.255.255.0 (MAC ADD1)
  - SIMATIC S7-PLC with PROFINET interface *(X1)* with 2 ports (F-CPU 1518F-4 PN/DP)
  - Connection to programming device with PG/PC interface (*TIA Portal*)
  - Connection to remote I/O device PDP67 with PROFINET interface *ETH0 (X21)*
- Bottom / Left » *PC-ETH-Adapter*: **192.168.0.13** / 255.255.0.0
  - Programming device with PG/PC interface (*TIA Portal / PASconfig*)
  - Connection to SIMATIC S7-PLC with PROFINET interface *(X1 P2R)*
- Bottom / Right » *PDP67 X21*: **192.168.0.2** / 255.255.255.0
  - Remote I/O devcie PDP67 with PROFINET interface *ETH0 (X21)*
  - Connection to SIMATIC S7-PLC with PROFINET interface *(X1 P1R)*

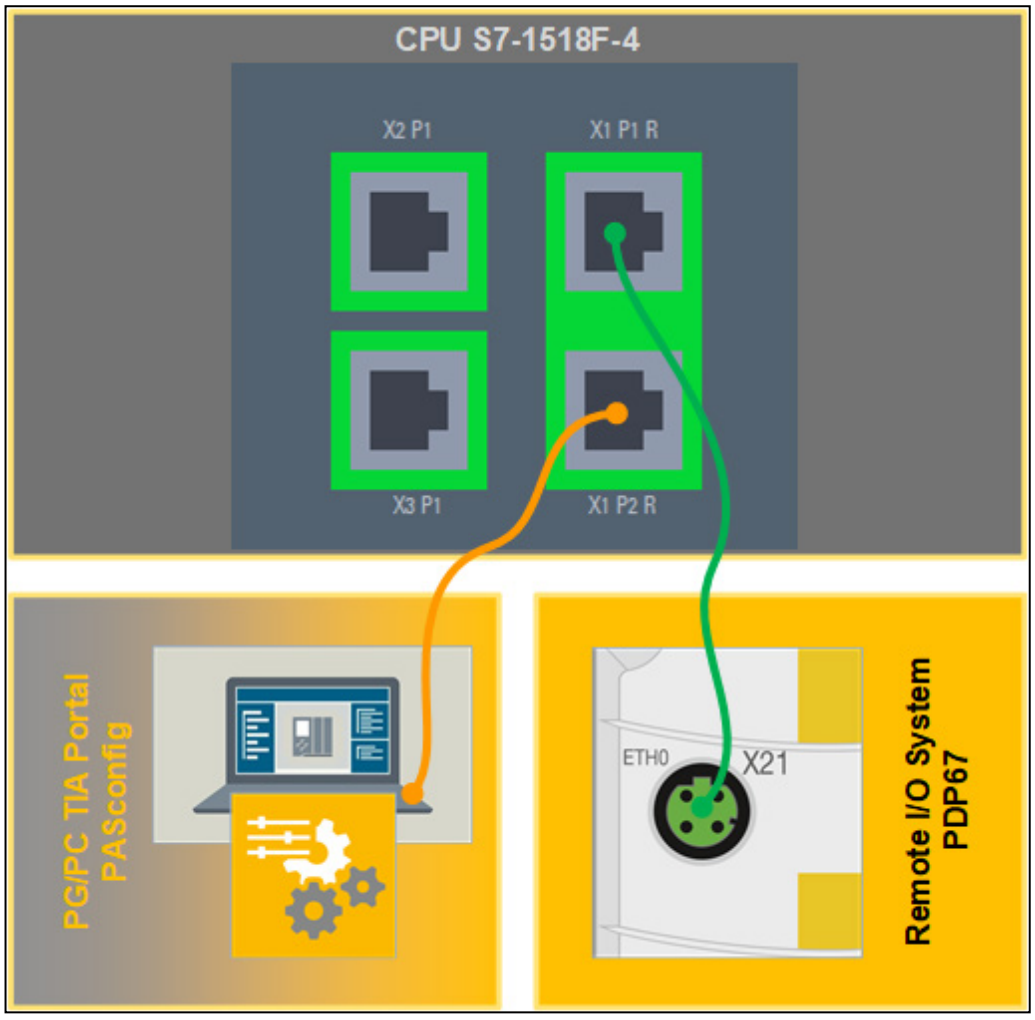


Figure 11: Application – Wiring of Ethernet connections (schematic)

Notes:

- Observe the (partly different) technical properties of the individual PROFINET interfaces for the SIMATIC CPUs (see SIMATIC CPU manual).
- In *TIA*, you can first search and display the "Accessible devices …" in the network in order to change the configuration for the used F-CPU.
  In this example, the default network address is used for the F-CPU.
- The default IP address of the PDP67 fieldbus devices when delivered: **0.0.0.0** (:18080 / 0.0.0.0). (applies only to the PROFINET version)

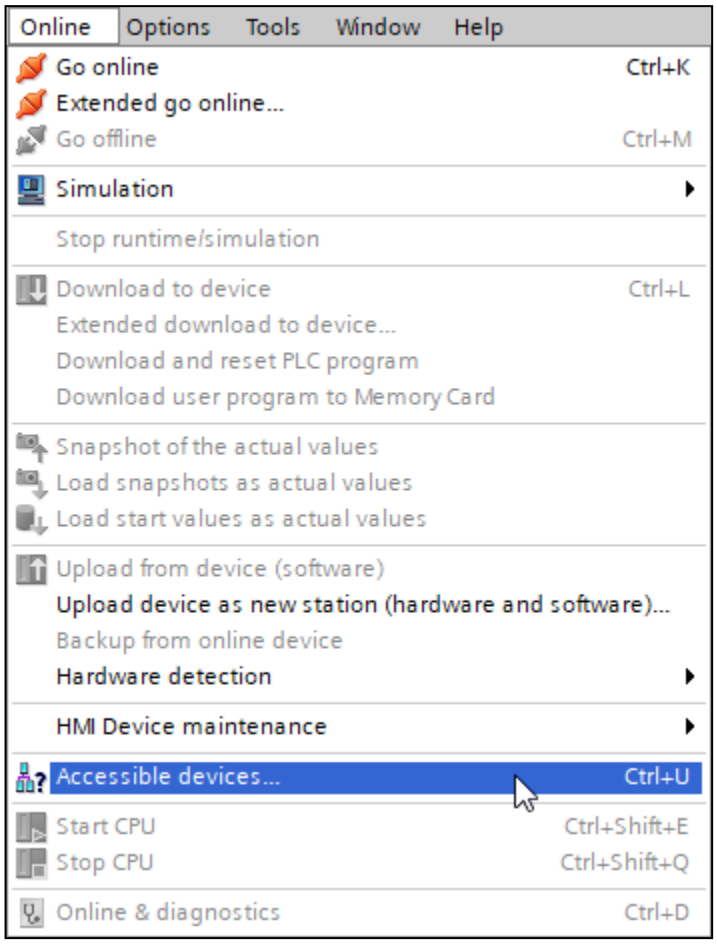


Figure 12: TIA – Search for "Accessible devices ..." (Part 1, Start)

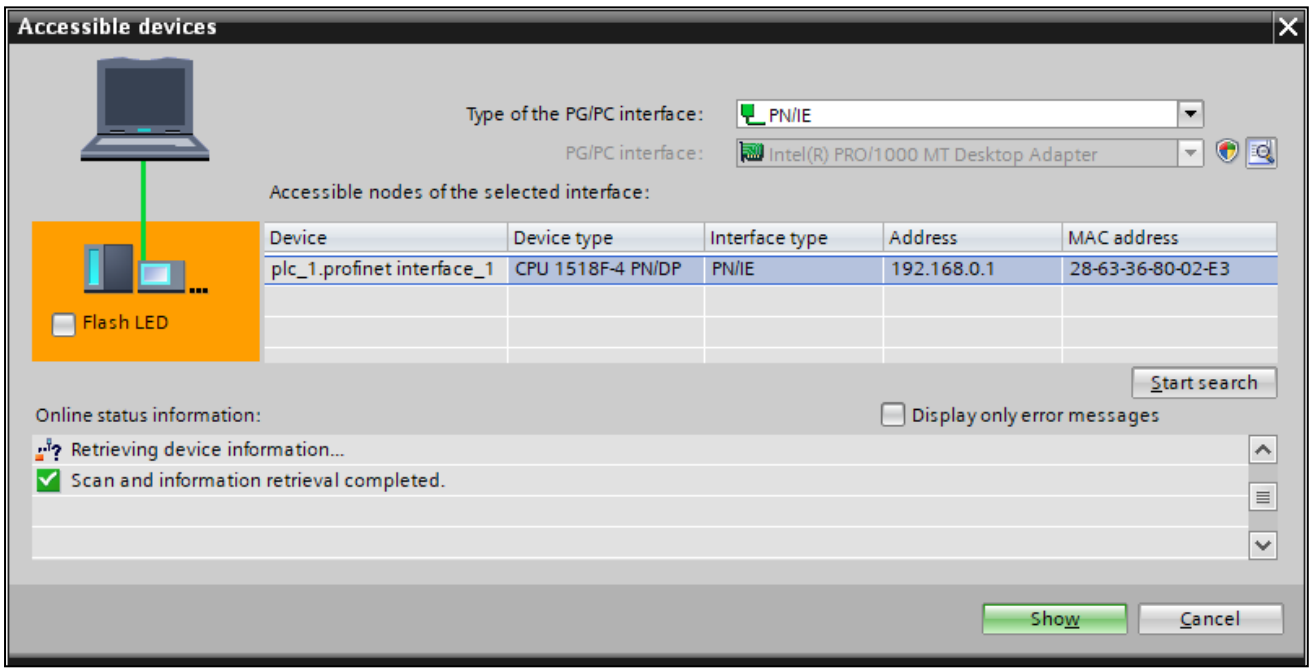


Figure 13: TIA – List of "Accessible devices ..." (Part 2, Overview)

- Switch to "Device view" (if not previously selected) and select the device ***PLC_1***:
- Open "Properties" window.
- Switch to the section 'PROFINET Interface [X1]' in the "General" tab and check its settings:

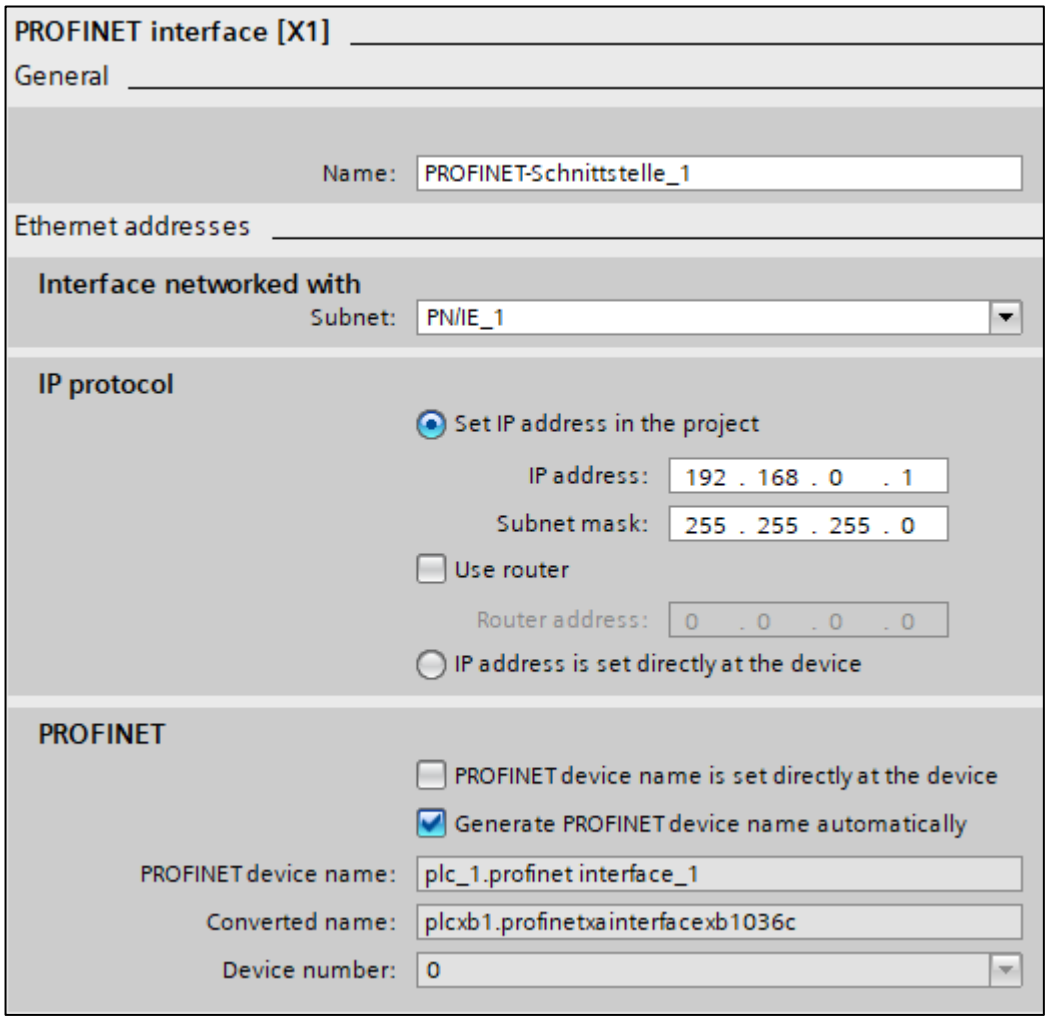


Figure 14: TIA – Properties of PLC-PROFINET interface [X1] » General

INFORMATION

The PDP67 device 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 F-CPU *1518F-4 PN/DP* has several separate Ethernet controllers.
Hence the Note:

- 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.

Function: Activate IRT function 'Sync master' (see also "Sync slave", Figure 31 [📖 27])

- Only use the IRT function when it is really needed; the default setting is 'Unsynchronized'.
- To activate the IRT function, select the synchronization role "Sync master" in the same section "PROFINET Interface[X1]" under "Real time Settings":

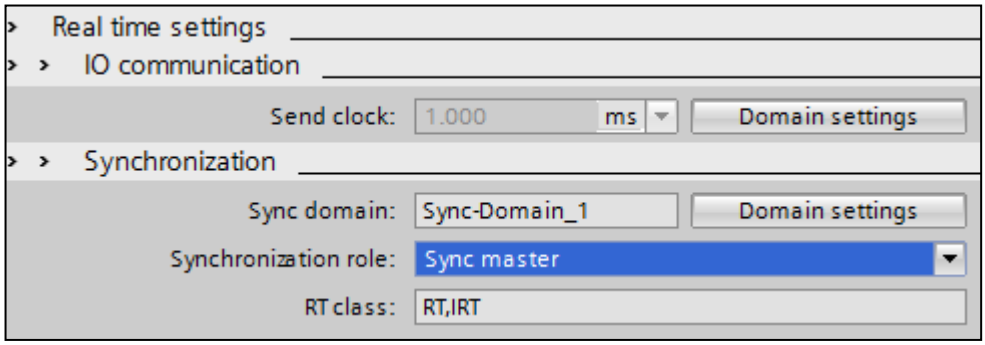


Figure 15: TIA – Properties of PLC-PROFINET interface [X1] » Real time (IRT)

8 Configuration of the PDP67 failsafe device

8.1 Device description file GSDML of the PDP67 fieldbus device

8.1.1 Download of the GSDML file and the PASconfig tool

For the integration of the Pilz PROFINET input/output modules in the *TIA* tool, the installation of a device description file (GSDML file) and the *PASconfig* tool for the configuration of PDP67 device are necessary.

- Download the latest GSDML file (in XML format) 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 PDP67 device for the search: ***4R000001***.

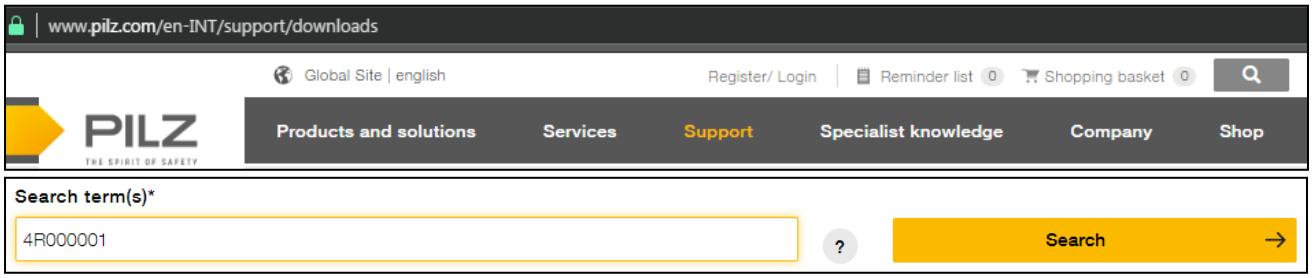


Figure 16: Pilz Homepage (www.pilz.com) – Search for "GSDML" and "PASconfig"

- The GSDML 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 GSDML file, but for the download the *PASconfig* software, for whose version V5.1.x no license is required yet.

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

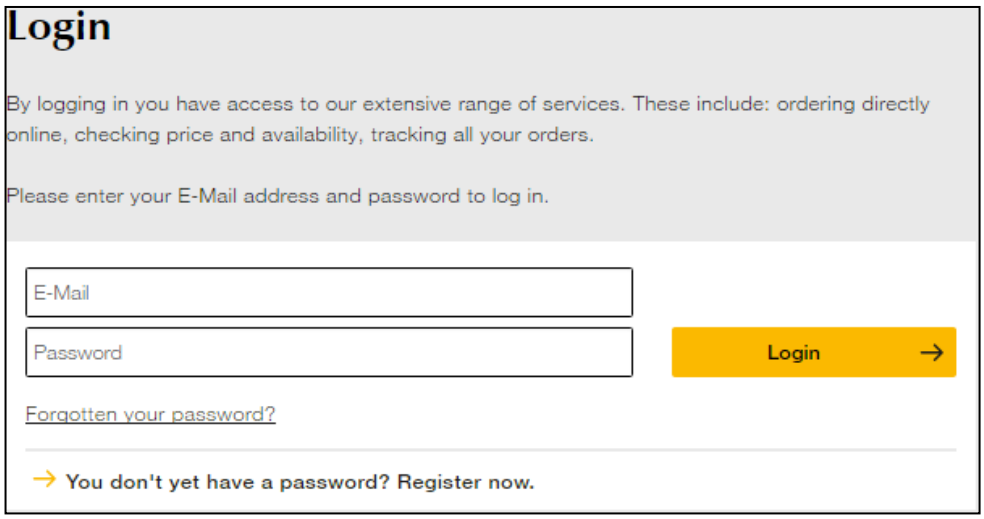


Figure 17: Pilz Homepage (www.pilz.com) – E-Shop Login

- The three ZIP files are downloaded to the computer and have to be unpacked.
- The software *PASconfig* must be installed according to the Siemens software *TIA Portal*.

8.1.2 Manage general station description files GSDML in TIA

- Open the function "Manage general station description files (GSD) " in the menu "Options"':

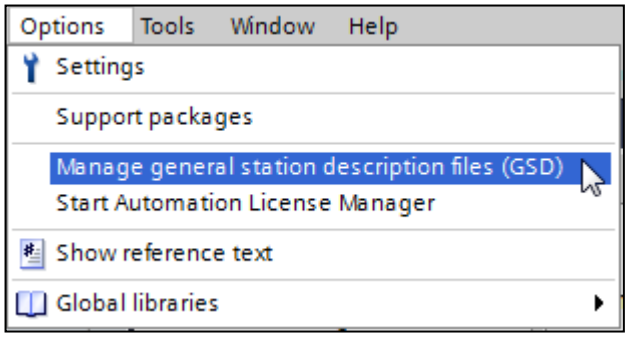


Figure 18: TIA – Manage general station description files GSDML (Part 1, Start)

- Install the downloaded GSDML file:

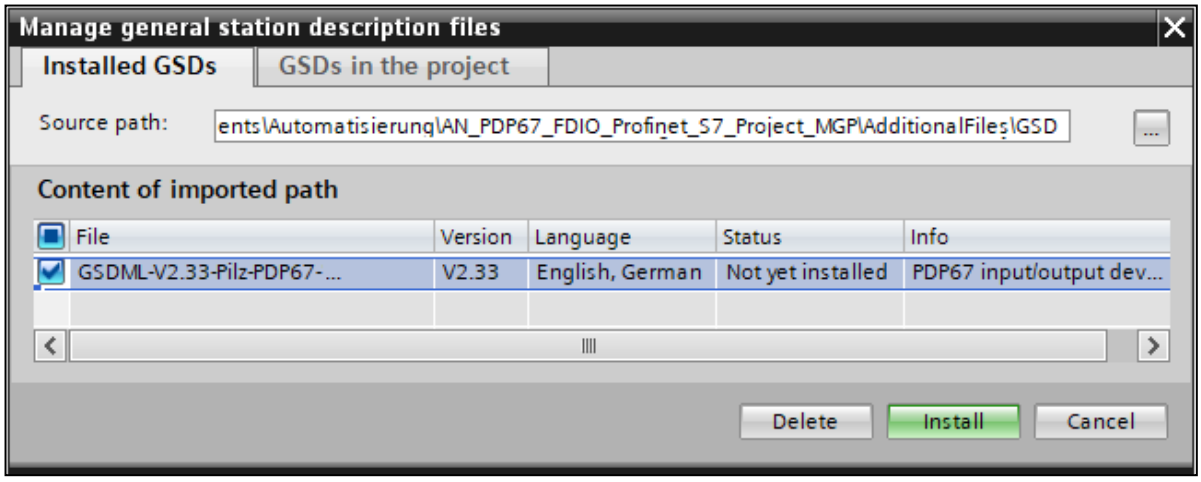


Figure 19: TIA – Manage general station description files GSDML (Part 2, Installation)

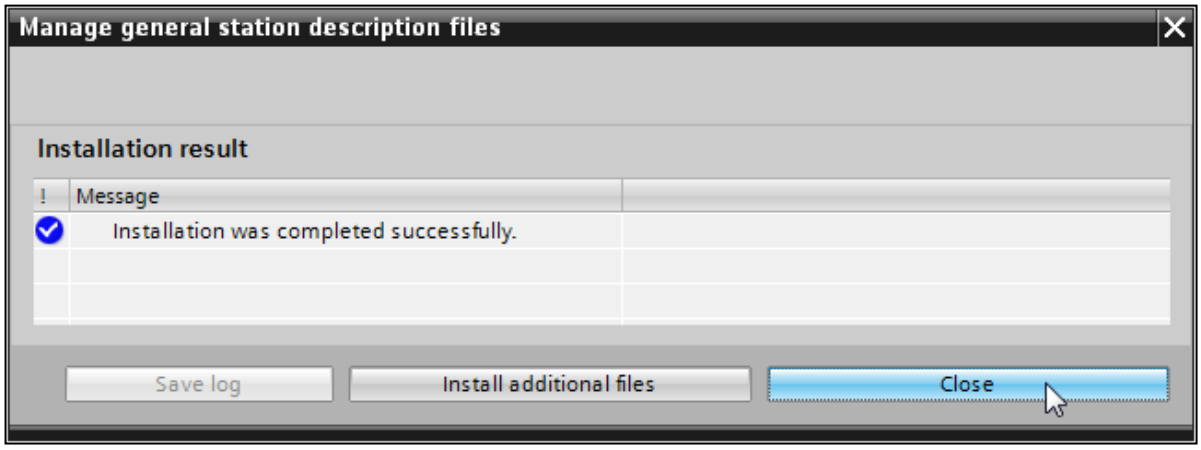


Figure 20: TIA – Manage general station description files GSDML (Part 3, Finalization)

8.2 TIA – Device configuration of PDP67 device

8.2.1 Create and configure the PDP67 fieldbus device

- Open the function “Devices & networks” in “Project tree“:

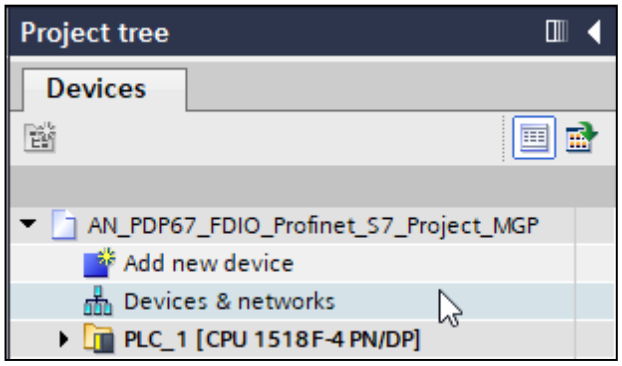


Figure 21: TIA – Open the function “Devices & networks” (Part 1, Start)

- Switch to the “Topology view”.
- Inserting the PDP67 fieldbus device:
  Path: Catalog » Other field devices » PROFINET IO » I/O » Pilz GmbH u. Co. KG » PDP67
  » PDP67 PN 6FDI 6FDIO 2FDOTP

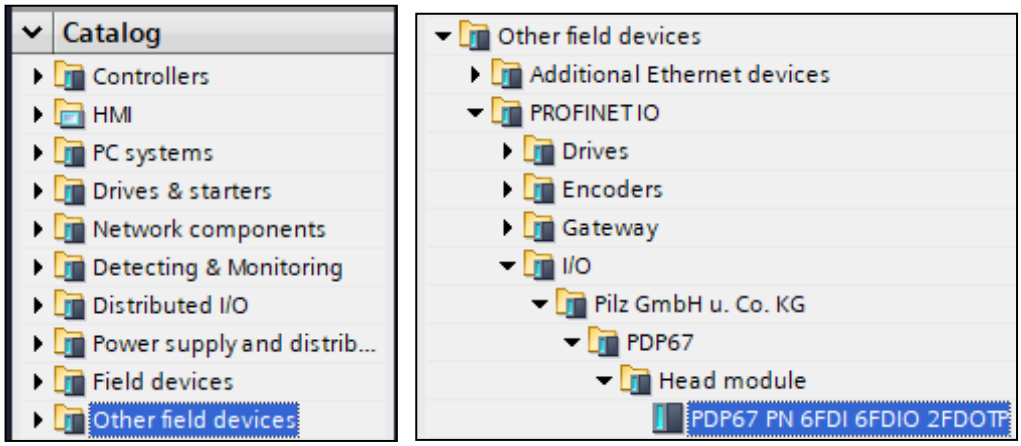


Figure 22: TIA – Inserting the PDP67 fieldbus device (Part 2a, Selection)

Note:

- If several GSDs are installed, please select the desired one in the “Information” window.
  It is recommended to select the latest version!

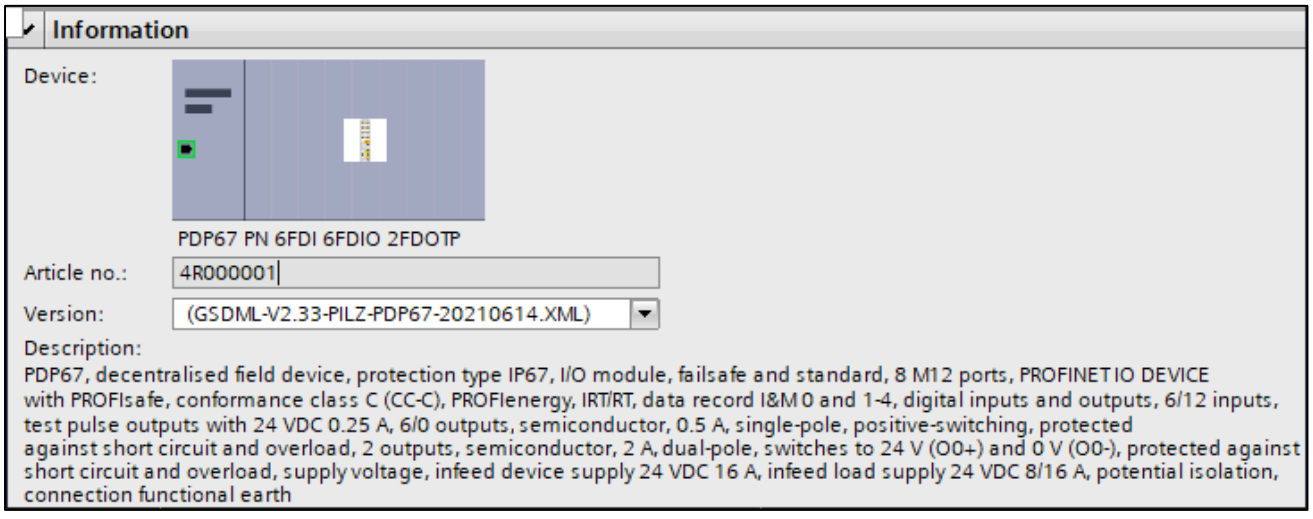


Figure 23: TIA – Inserting the PDP67 fieldbus device (Part 2b, Information)

Figure 24: TIA – Inserting the PDP67 fieldbus device (Part 2c, Finalization)

- The preset device name ***pdp67pn*** is still used, but it can also be changed in the properties of the devcie, e. g. in the Equipment identifying symbol (EIS):

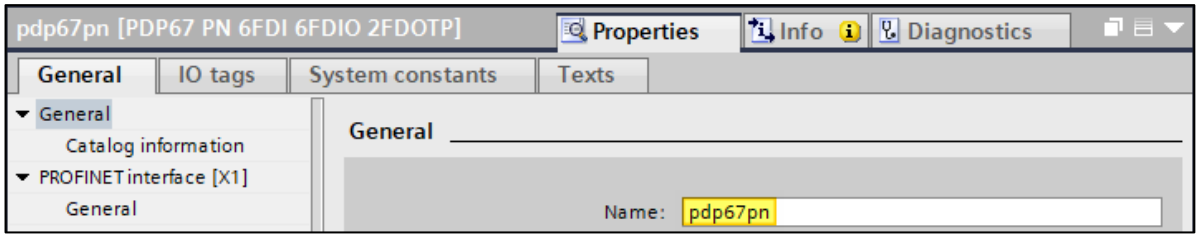


Figure 25: TIA – Assigning the device name 'pdp67pn' of the PDP67 fieldbus device

- Connect the S7-CPU and the I/O device in accordance with Figure 11: Application – Wiring of Ethernet connections (schematic) [🕮 18]:

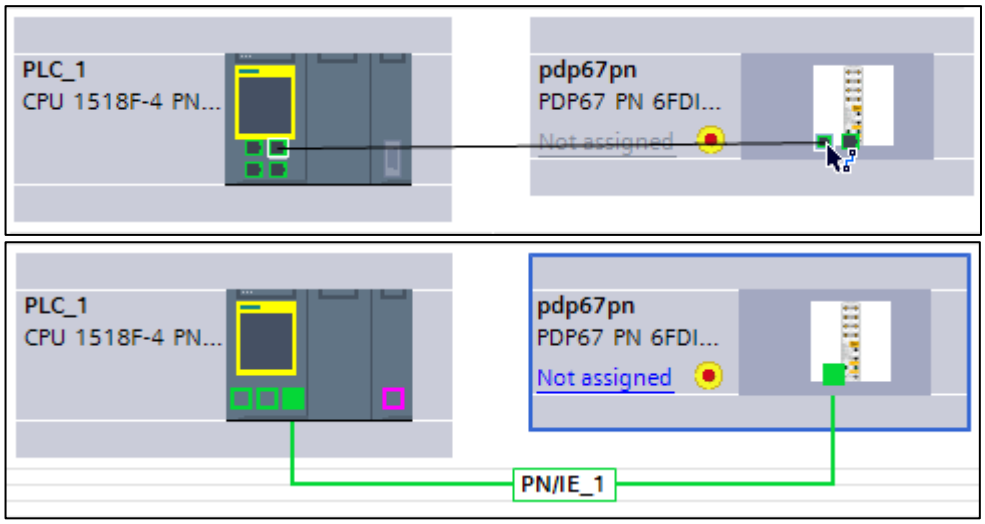


Figure 26: TIA – Connect the S7-CPU and the I/O device

- Switch to the "Network view":
  The two devices are networked in the subnet "PN/IE_1".

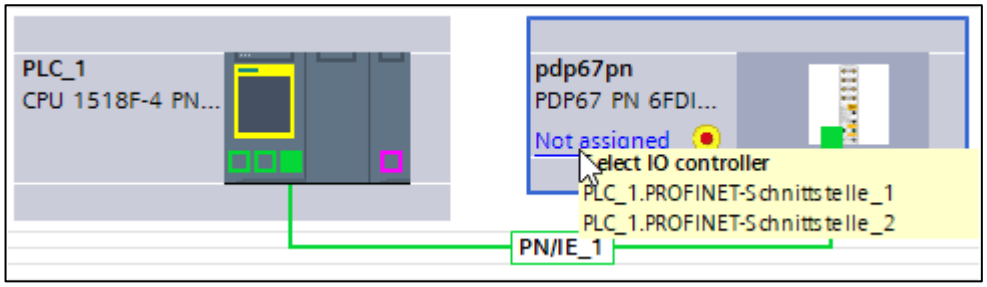


Figure 27: TIA – Assigning the I/O device to the S7 CPU (Part 1, Start)

- Assign the I/O device with the preset device name ***pdp67pn*** to the ***PLC_1***:

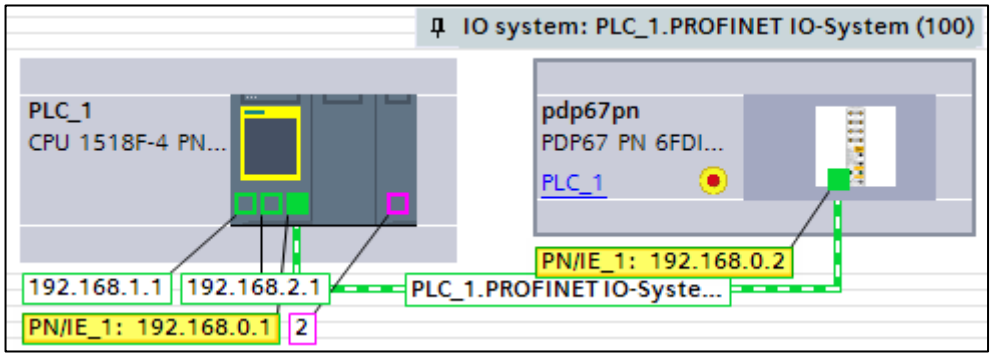
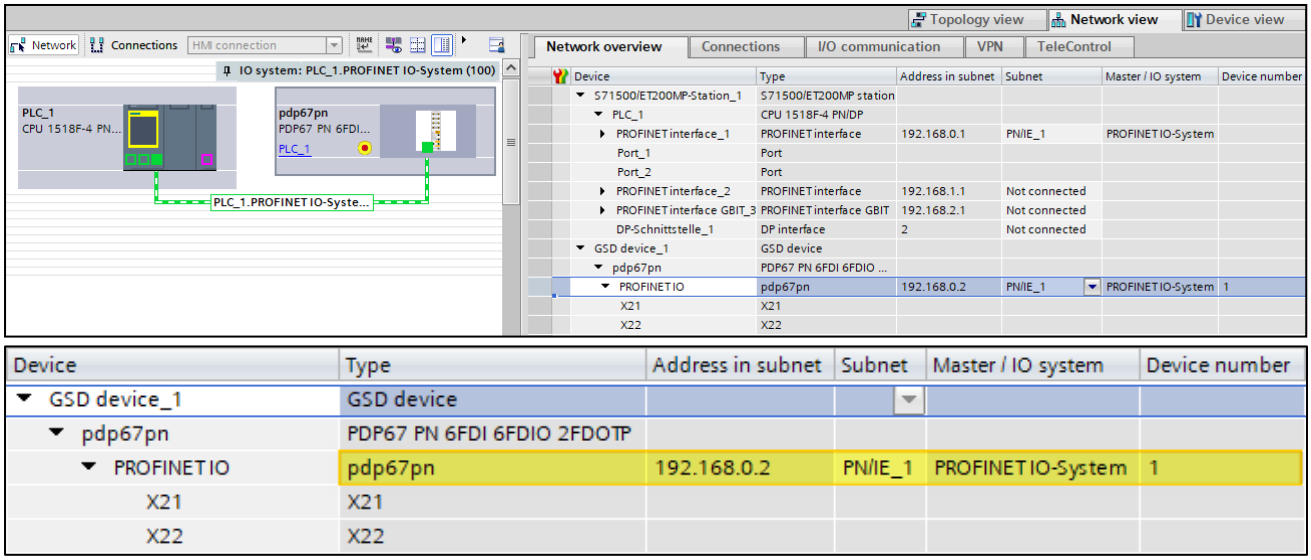


Figure 28: TIA – Assigning the I/O device to the S7 CPU (Part 3, Link-up)



Device	Type	Address in subnet	Subnet	Master / IO system	Device number
GSD device_1	GSD device				
pdp67pn	PDP67 PN 6FDI 6FDIO 2FDOTP				
PROFINET IO	pdp67pn	192.168.0.2	PN/IE_1	PROFINET IO-System	1
X21	X21				
X22	X22				

Figure 29: TIA – Assigning the I/O device to the S7 CPU (Part 3, Finalization)

- Switch to "Device view" (if not previously selected) and select the device ***pdp67pn*** [...] (see Figure 32 [🕮 28]).
- Switch to the section in the tab "General":
  - "PROFINET Interface [X1]" (corresponds to ETH port *ETH0 / X21* on the PDP67 device):

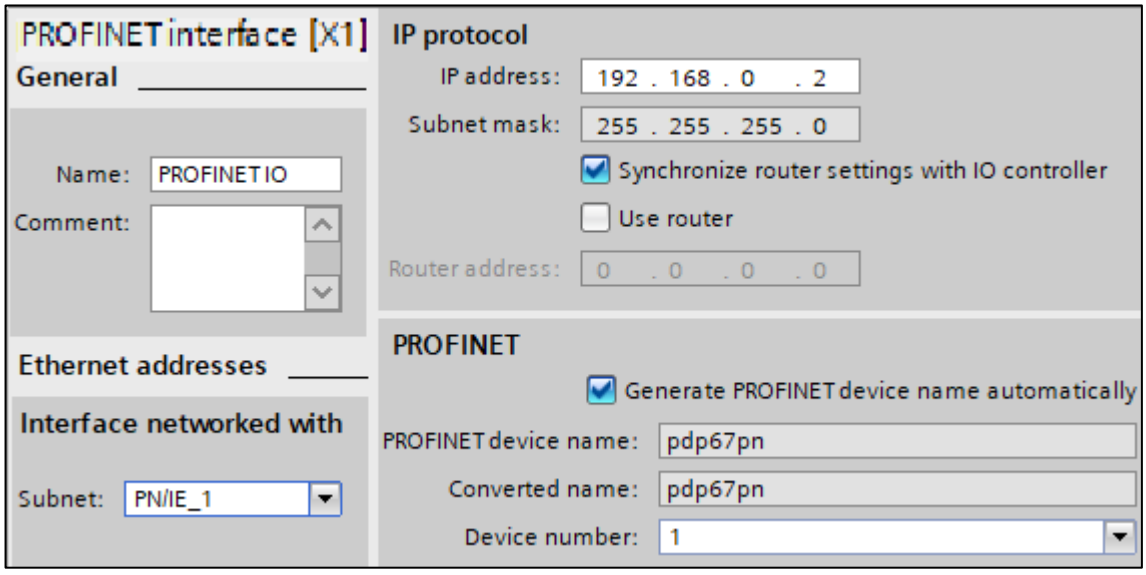


Figure 30: TIA – Properties of PDP67-PROFINET interface [X1] » General

Note:

- The default IP address of the PDP67 devices when delivered: **0.0.0.0** (:18080/0.0.0.0). (applies only to the PROFINET version)

Function: Activate IRT function 'Sync slave' (see also "Sync master", Figure 15 [📖 21])

- Only use the IRT function when it is really needed; the default setting is "RT"/'Unsynchronized'.
- To activate the IRT function, the RT class "IRT" is selected under "Real-time settings"; the new synchronization role "Sync slave" is then automatically defined:

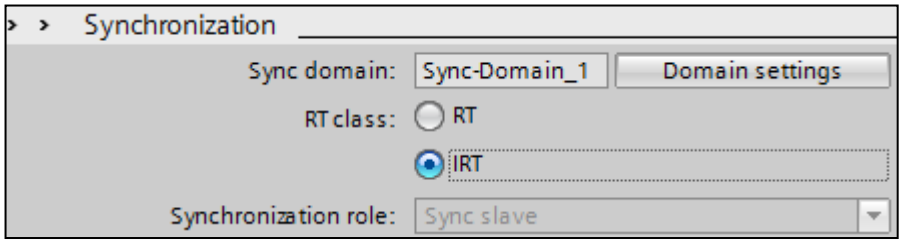


Figure 31: TIA – Properties of PDP67-PROFINET interface [X1] » Real time (IRT)

8.2.2 Adding the I/O containers of the PDP67 device

- Switch to "Device view" and select the device ***pdp67pn***:

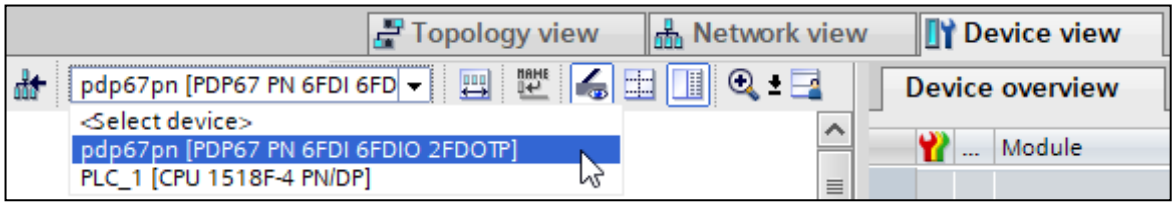


Figure 32: TIA – Adding the I/O containers to the PDP67 device (Part 1, Start)

- Open the section "Module" in the Catalog tree.

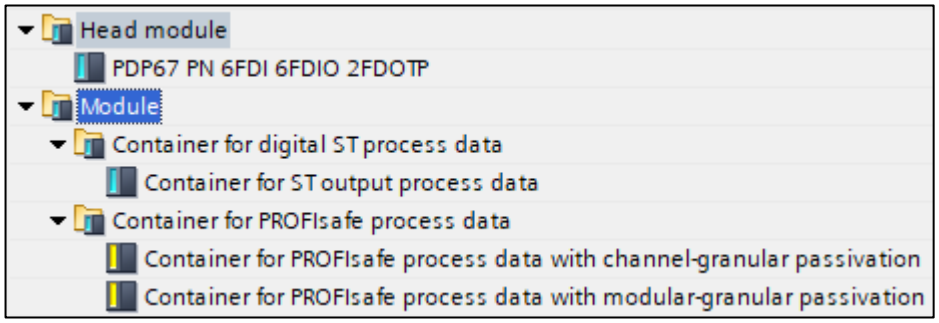


Figure 33: TIA – Adding the PROFIsafe Group to the PDP67 Device (Part 2)

As described in Chapter 6.2.2 PDP67 failsafe and standard I/O process image [📖 13], the default configuration can be changed.

One of the two containers for the PROFIsafe process data can be set on **slot 11**:
- Container for PROFIsafe process data with channel granular passivation (preset)
  » according to PROFIsafe specification version 2.6
- Container for PROFIsafe process data with modular granular passivation (optional)
  » according to PROFIsafe specification version 2.4

The container for digital ST process data can be added to **slot 10**:
- Container for ST output process data (preset)

The optional configuration of the GSDML file is used for the example:

...	Module	Rack	Slot	I address	Q address
	pdp67pn	0	0		
	PROFINET IO	0	0 X1		
	2FDI_1	0	1		
	2FDIO_1	0	2		
	2FDI_2	0	3		
	2FDIO_2	0	4		
	2FDI_3	0	5		
	2FDIO_3	0	6		
	FDOTP_1	0	7		
	FDOTP_2	0	8		
		0	9		
		0	10		
	Container für PROFIsafe-Prozessdaten mit modulgranularer Passivierung_1	0	11	4...13	4...9
		0	12		

Figure 34: TIA – Adding the I/O containers to the PDP67 device (Part 3, Finalization)

8.2.3 Setting up the PROFIsafe address of the PDP67 fieldbus device

Basic information of PROFIsafe addresses

- Each F-address may only be used once on a PROFINET device with PROFIsafe.
  The values of the F-addresses of the single devices do not have to be consecutive.
  – The permissible range of software F-addresses is: ***1 ... 65 534***.
    These values are positive integers.
- The F-destination address of the Pilz device is a software address and to define it, the same value must be entered in the following two configuration dialogue boxes, otherwise fault-free operation is not possible:
  1. in the *TIA* tool under the properties of the *PROFIsafe group* of the PDP67 device (see Figure 35)

  and

  2. in the *PASconfig* software
     see Chapter 8.3.3 Setting up the PROFIsafe address of the PDP67 device [📖 34 ff.]
     - see online help for software
     - Prerequisite:
       » There is an online connection to the PDP67 device.
       (see Chapter 8.3.1 Configure of PDP67 device [📖 32])
- The preset F-address of the PDP67 fieldbus devices on delivery is: 1
  (applies only to the PROFINET version)
- Should changed value of the F-address is to be accepted; a reset must always be executed.
  This is done automatically in the *PASconfig* tool when the software address is changed or by pressing the reset button (Restart by Warm Reset).
  – see Chapter 9.6.1 Carrying out of a restart (warm reset) by means of the Reset button [📖 53]

The PROFIsafe address 'F_Dest_Add' for the fieldbus device in the *TIA* tool must be set always.

- The following PROFIsafe address is specified for this application:
  – ADDRESS: **5** (default F-address is 1)
- To do this, select the properties of the PROFIsafe group in the "Device view" of ***pdp67pn*** (see Figure 34 [📖 28]) and
- set the value for *F-destination address* under the section "PROFIsafe":

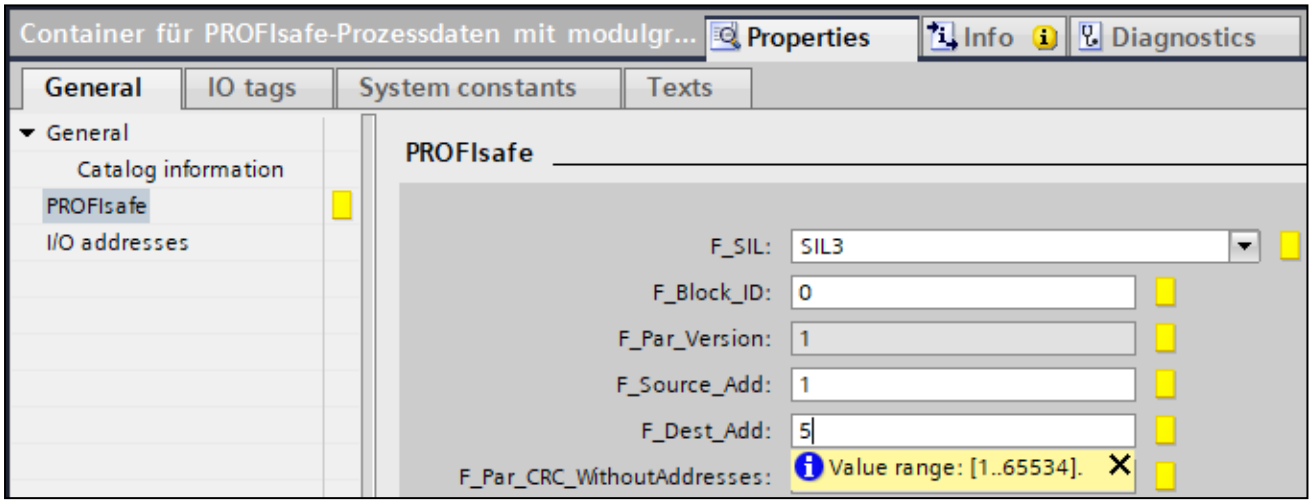


Figure 35: TIA – PROFIsafe-Group » Setting up of PROFIsafe address 'F_Dest_Add'

Note:

- The F-address is also required for establishing the Ethernet connection between the PASconfig PC and the PSS u2 I/O device.

8.2.4 Assign the device name to the PDP67 device

For the used PROFINET system, a device name must be assigned to the PDP67 Remote I/O device (IO device) so that the IO controller of the F-CPU can communicate with it.

- For further details, see the *TIA online help*, chapter "Addressing PROFINET devices".

Now you can begin assigning the device name.

- Select the device ***pdp67pn*** under "Devices and networks" (see Figure 29 [📖 26]).
- Right click on the device icon and select the function »*Assign device name*«:

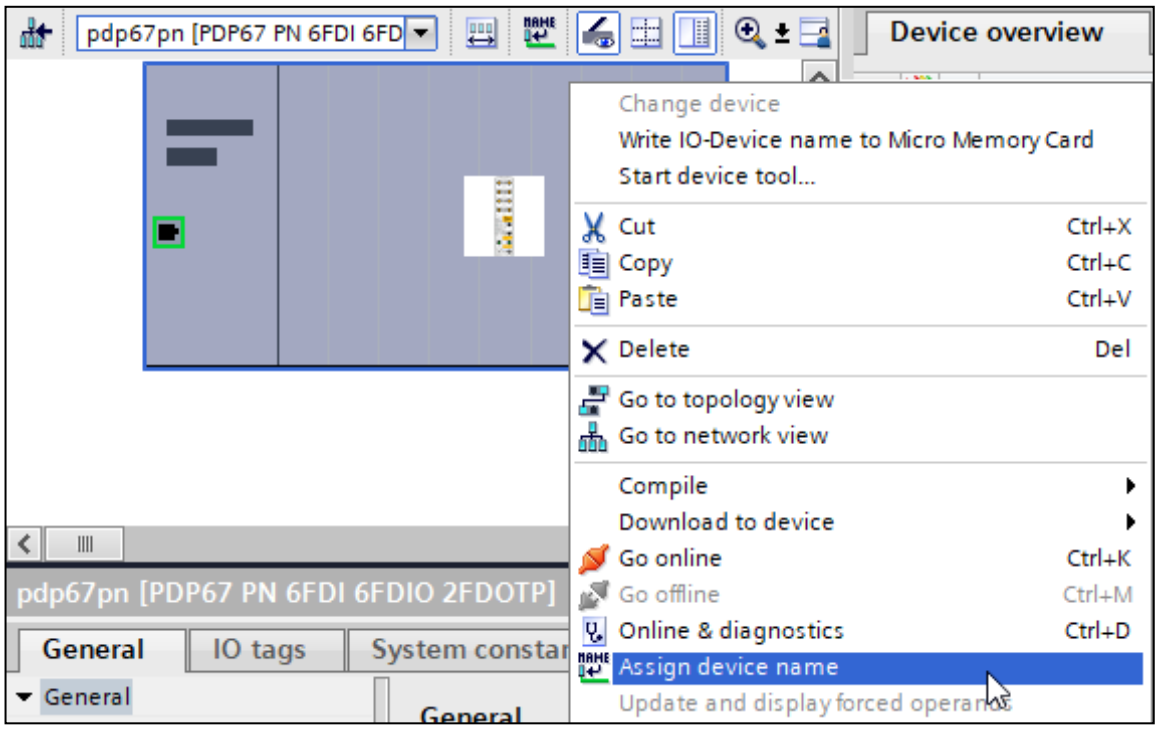


Figure 36: TIA – Assign device name » Select function (Part 1, Start)

- The PDP67 device, that is to be named, can be uniquely identified by MAC address and IP address. The "Devices MAC address" is lasered on the front of the fieldbus device to the left of the reset push-button (see left picture in Figure 37).
- For the unique device identification, the displayed device can be selected and the »*Flash LED*« function can be activated.
  - Activated: LEDs *RUN* and *DIAG* flash green in the same mode
  - Deactivated: LEDs *RUN* and *DIAG* displayed the current system status

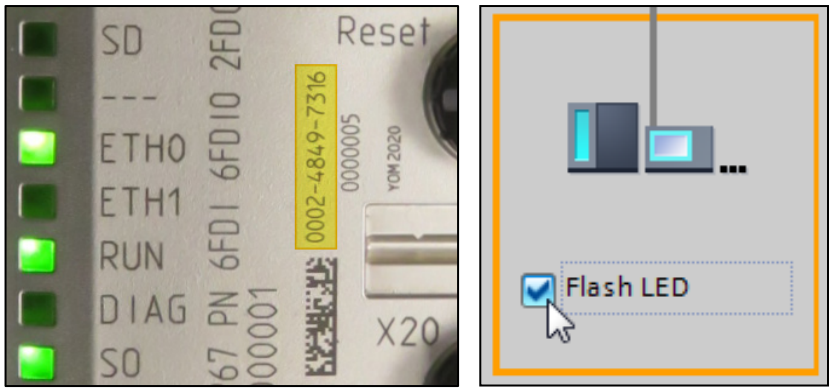


Figure 37: TIA – Assign device name » MAC / Function »Flash LED« (Part 2, Identification)

- The selected PDP67 device must be marked in the table and you click on the button *»Assign name«*:

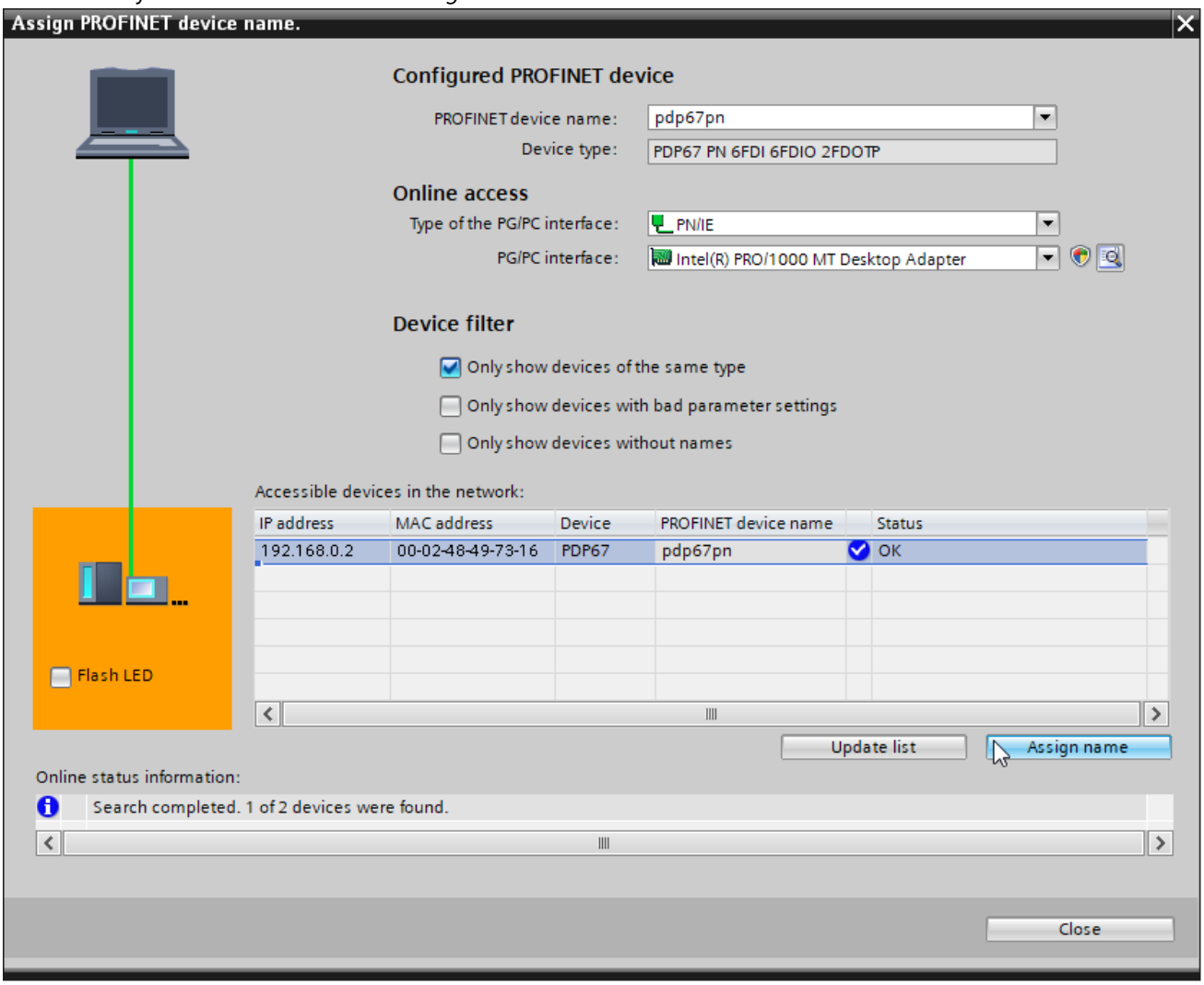


Figure 38: TIA – Assign device name » Select function (Part 3, Assignment)

- At the end, the "Online status information" is used to indicate whether the operation was successful:

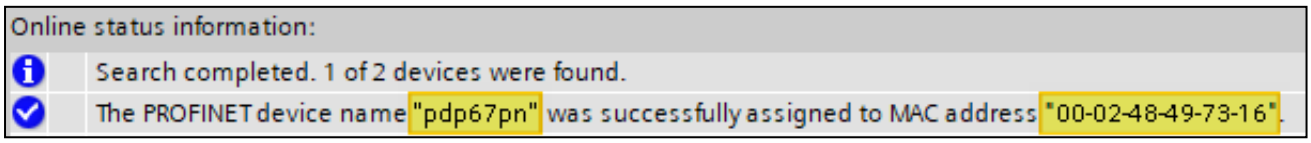


Figure 39: TIA – Assign device name » Select function (Part 4, Finalization)

- You can close the window now.

8.3 PASconfig – Device configuration of PDP67 device

8.3.1 Configure of PDP67 device

The basic configuration is already available; the data is generated automatically by means of the previously made settings in the *TIA*.

- see Chapter 8.2 TIA – Device configuration of PDP67 [📖 24 ff.]

A network connection is required for the online connection between the *PASconfig PC* and the PDP67 device (see Figure 11: Application – Wiring of Ethernet connections (schematic) [📖 18]). So you can run various online actions, e.g.:

- Firmware update,
- download of FS/ST configuration data,
- upload device data and
- display of error stack

8.3.2 Start of PASconfig via TIA device configuration

- Open the function “Devices & networks” in “Project tree”.
- Switch to “Device view” and select the device ***pdp67pn***.
- Right click on the device icon and select the function *»Start device tool …«* using the access point “Configuration”:

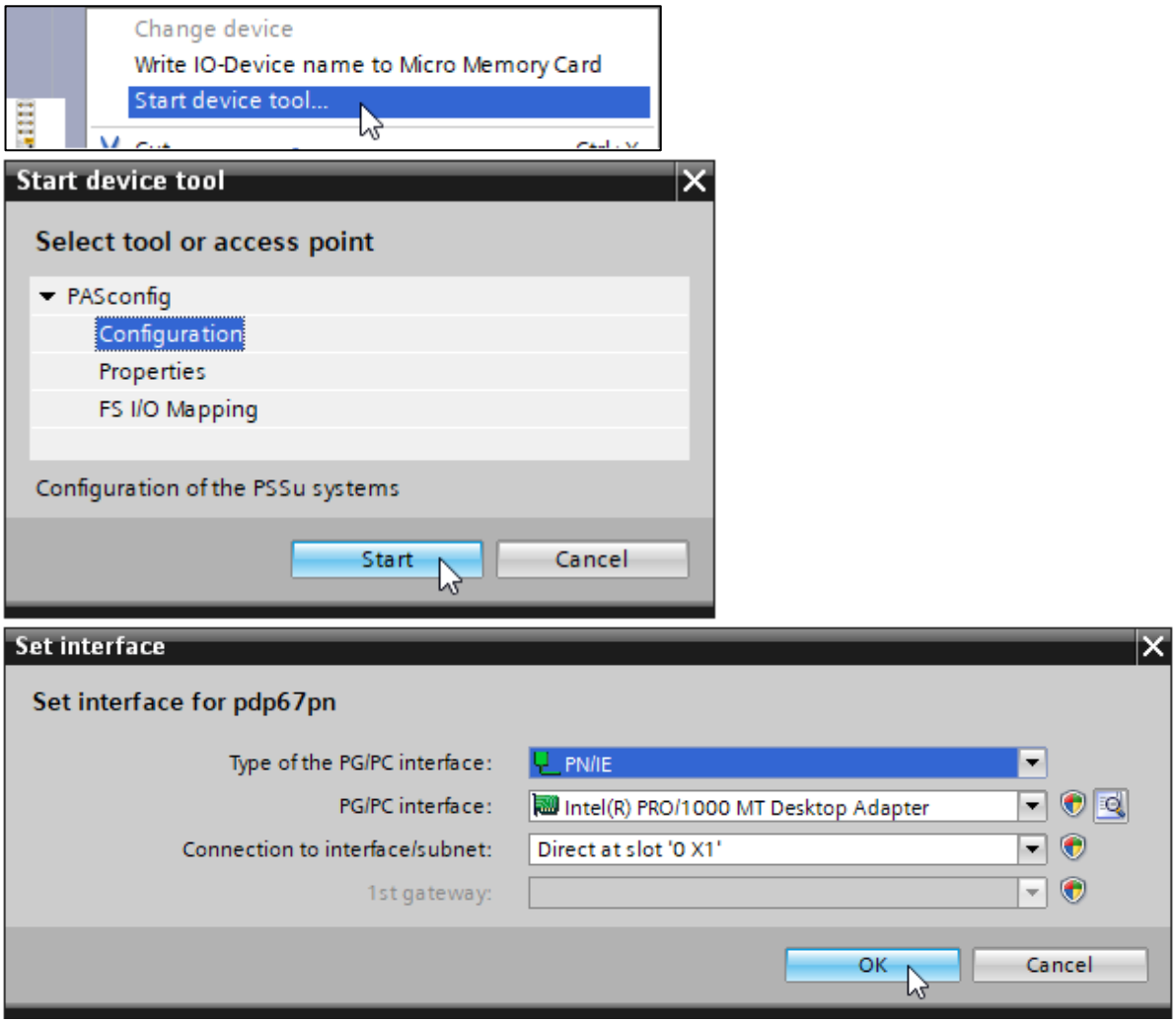


Figure 40: PASconfig – Start device tool from TIA » Access point “Configuration”

Note:

- The *PASconfig* tool opens with the ‘User interface language’ set in the *TIA*.
  In version 5.1.0, only the two languages *German* and *English* are supported.

- Now, for the first time, an attempt is made via the *PASconfig* tool to establish an online connection to the configured PDP67 device:

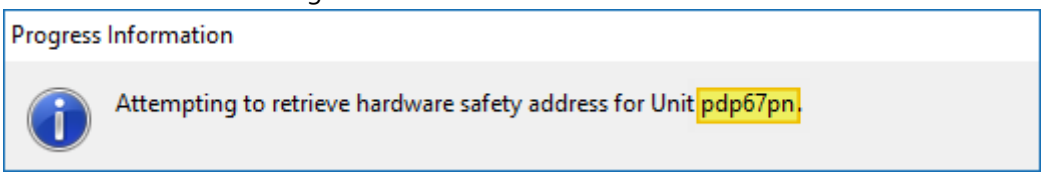


Figure 41: PASconfig – Status message 'Read F-address for Ethernet connection'

- Then, because of the IP address 0.0.0.0 still present on the device, the following reaction occurs, as no online connection can be established between the *PASconfig PC* and the PDP67 device:

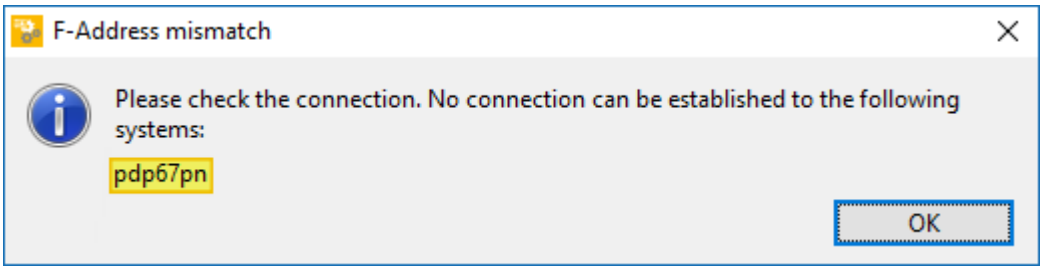


Figure 42: PASconfig – Error message 'No connection established'

Therefore, the PDP67 device must be assigned an IP address first, so that *PASconfig* can establish an online connection to this decentralised fieldbus device.

- One possibility is to save, compile and download the TIA project to the F-CPU.
  - see Chapter 8.4 TIA – Download the configuration to S7 F-CPU [🕮 39 f].
- After it restarts, the configured IP addresses are set in the PROFINET network:
  - see Figure 30: TIA – Properties of PDP67-PROFINET interface [X1] » General [🕮 26].

Notes:

- Make sure that the IP address of the *PASconfig-PC* is in the same subnetwork as the IP address of the PDP67 device.
  - For PROFINET networks, the free Siemens tool *PRONETA Basic* can be used to perform many analysis and configuration tasks, please see Chapter 9.1.1 Determining the IP address and port number [🕮 41].
- In the ***Connection manager***, the ***F-address***, which has been configured in the *TIA* tool for the PROFIsafe group, must be set in addition to the IP address.
  - Important: Please observe the notes in the Chapter 9.1.2 Determination and temporary assignment of the F-address [🕮 41 f].

8.3.3 Setting up the PROFIsafe address of the PDP67 device

After assigning the IP address to the PDP67 device, when the TCI function "Configuration" (Figure 40 [📖 32]) is called up again, the F-address of the PROFIsafe group saved in the device is checked first; in the factory setting, the default F-address is "***[1]***".
If this is different from the F-address "***[5]***"configured and transferred by the *TIA project* (Figure 35 [📖 29]), an automatic procedure is executed at the *PASconfig* tool.

- Start with Function "Download Project F-address":

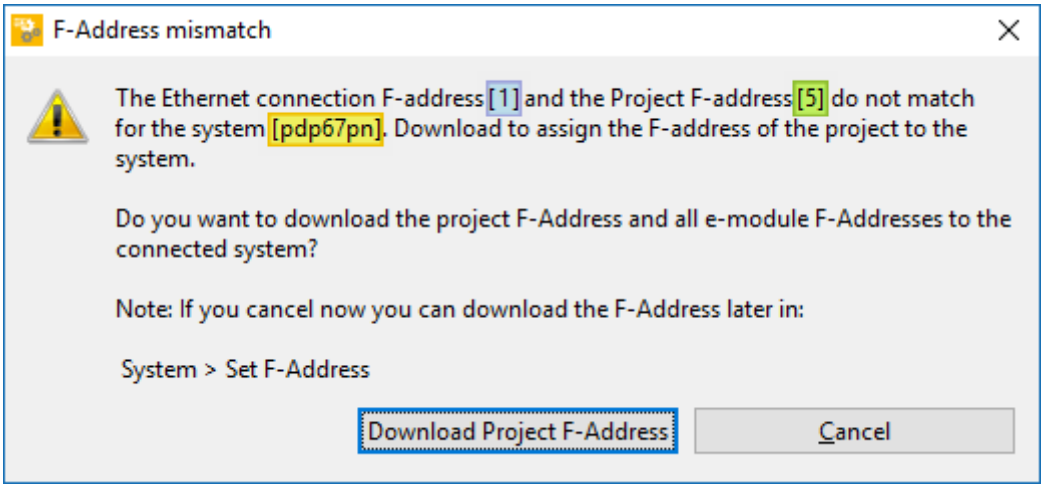


Figure 43: PASconfig – Function "Download Project F-address" (Part 1, Start)

- After this, the PDP67 device must be restarted to accept the values:

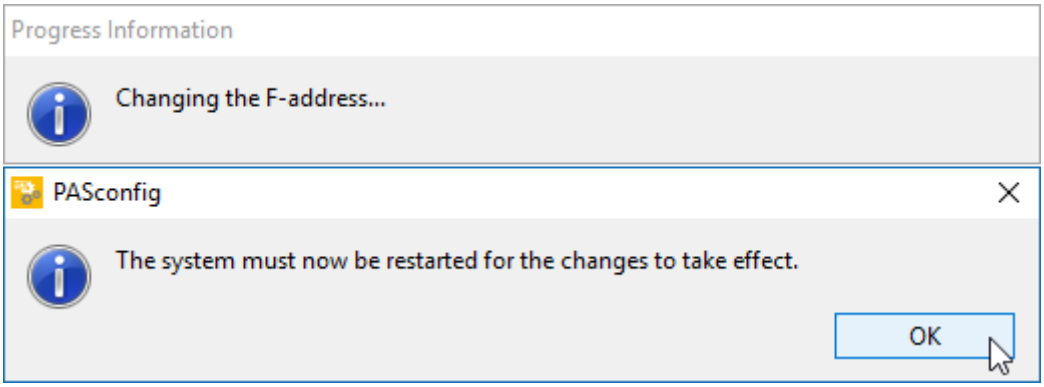


Figure 44: PASconfig – Function "Set F-addresses" (Part 2, Restart)

- The successful restart of the device is displayed:

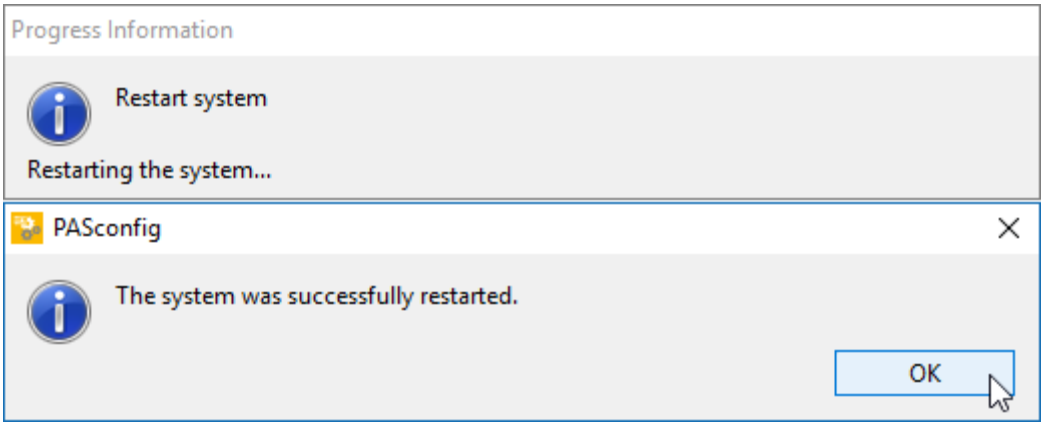


Figure 45: PASconfig – Function "Set F-addresses" (Part 3, Finalization)

- After the restart, the device "PLC_1:pdp67pn" transferred from the *TIA project* is displayed:

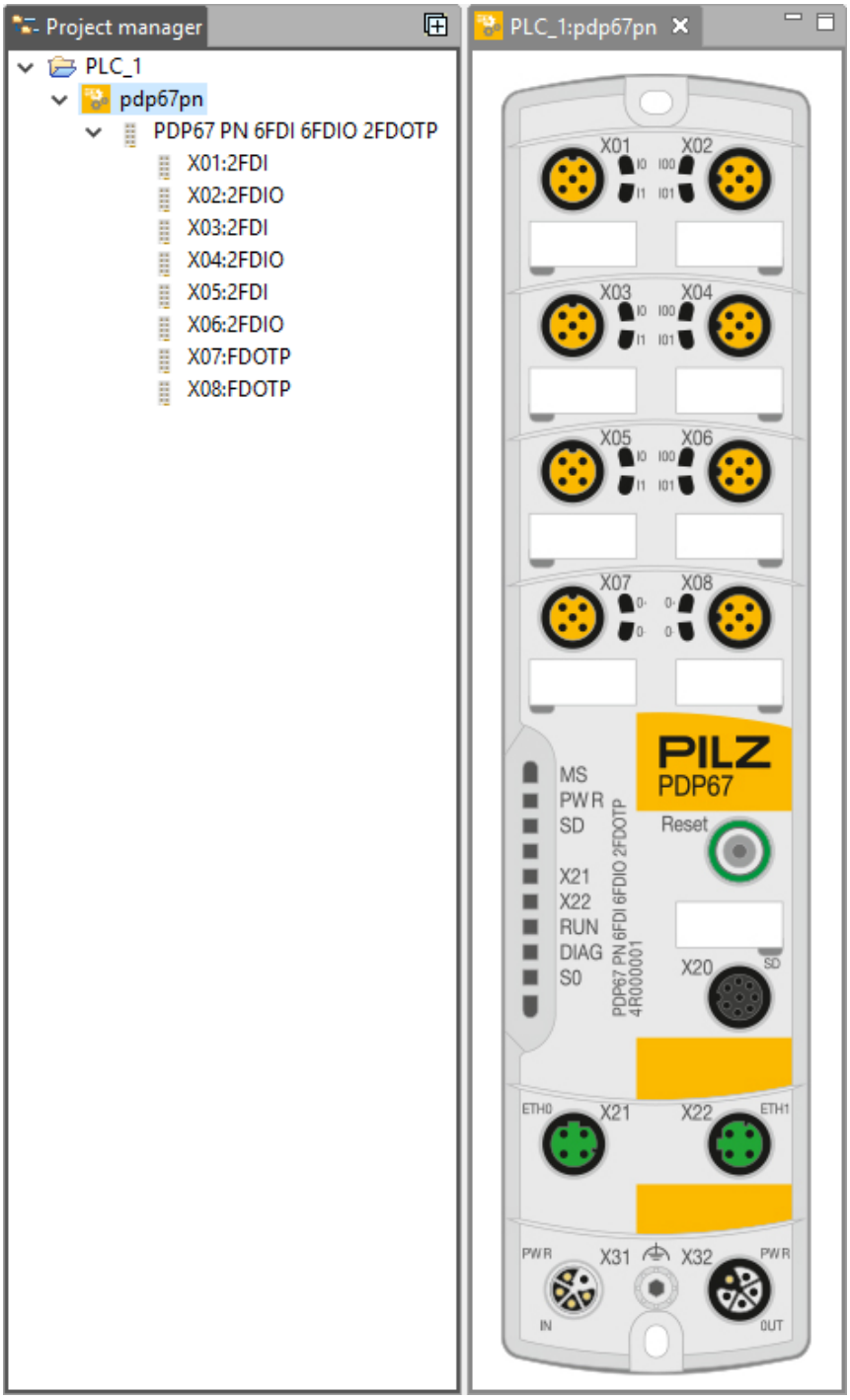


Figure 46: PASconfig – I/O device "PLC_1:pdp67pn"

- The "Change device" function in the *PASconfig* tool can be used to check the settings transferred from the *TIA*:

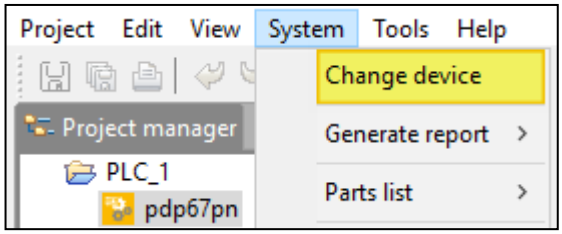


Figure 47: PASconfig – PDP67 device » Function "Change device" (Part 1, Start)

- The first window displays general data of the PDP67 fieldbus device.

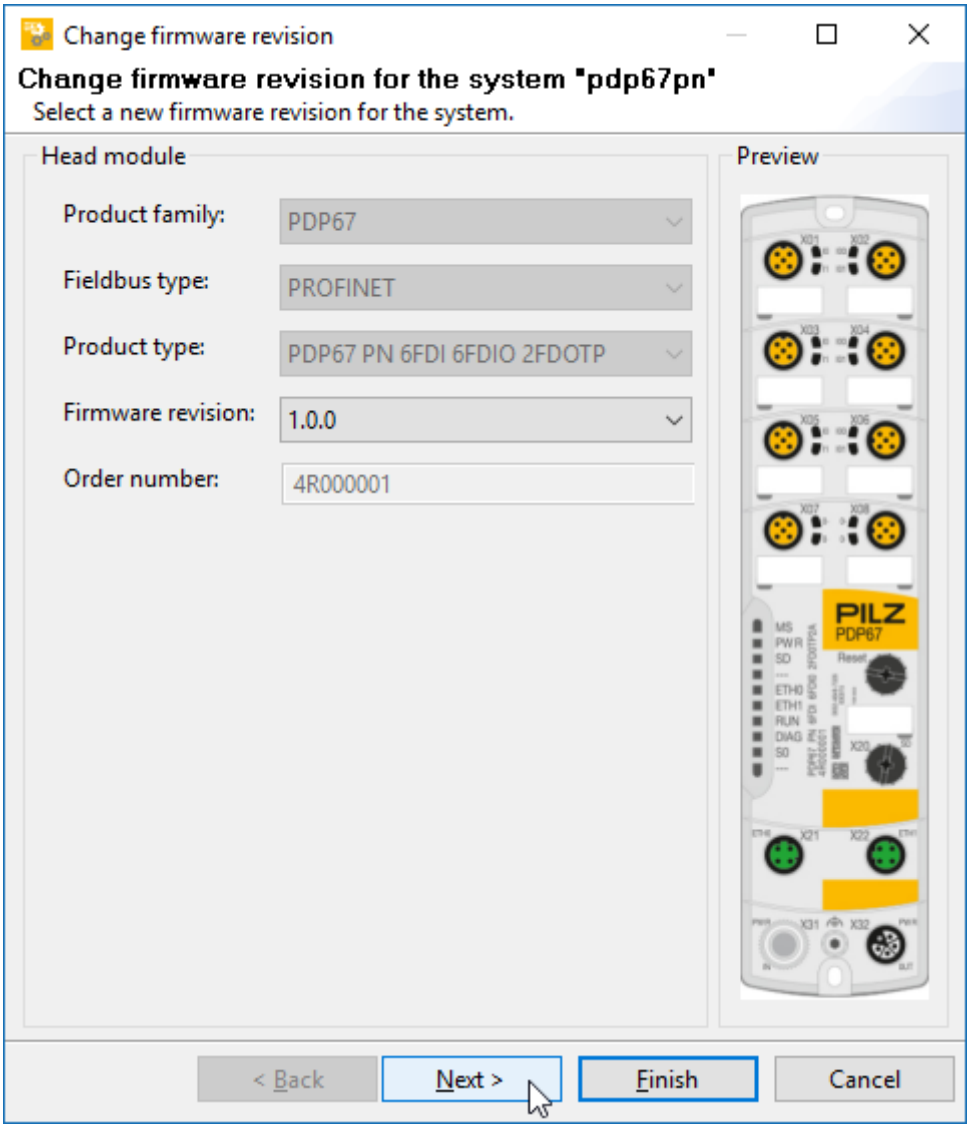


Figure 48: PASconfig – PDP67 device » Function „Change device“ (Part 2, Version)

- Press »*Next*« to enter the second window, where the data for the “Connection” is displayed:

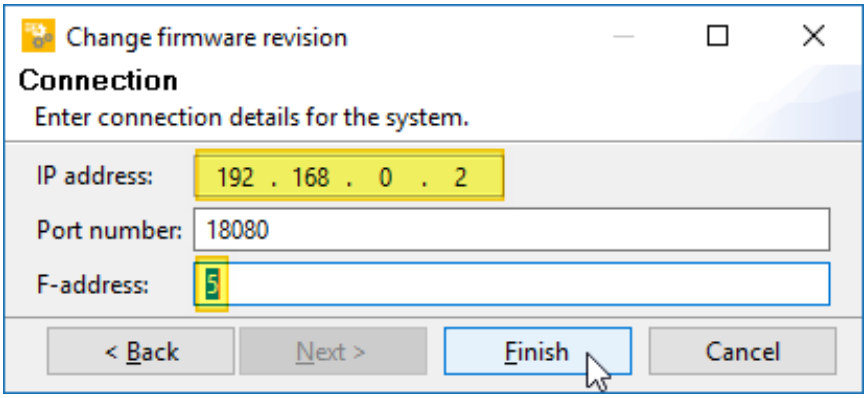


Figure 49: PASconfig – PDP67 device » Function “Change device“ (Part 3, F-address)

- The changed configuration can still be transferred to the PDP67 device.
  Normally, this is done at the end of the device configuration:
  – Chapter 8.3.4 Download the configuration to PDP67 device [🕮 37 f.]

8.3.4 Download the configuration to PDP67 device

- The configuration you just created must be saved.

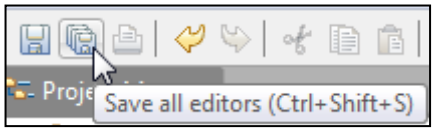
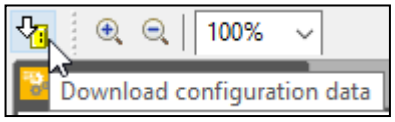


Figure 50: PASconfig – Save configuration » Save all editors

- Now start with the function *»Download configuration data«*:



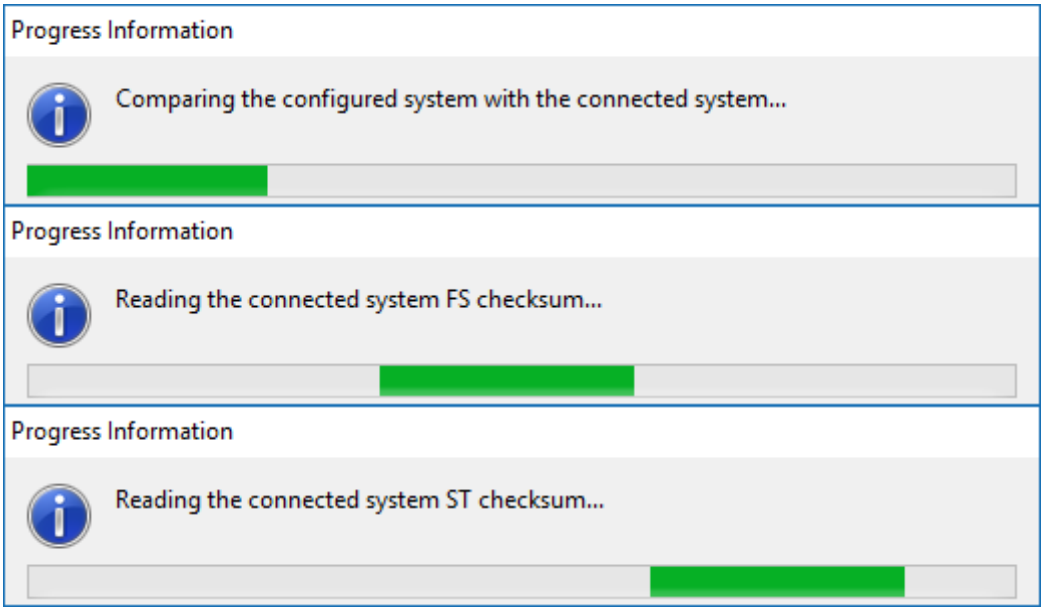


Figure 51: PASconfig – Download configuration » Reading the connected PDP67 device (Part 1)

A password is required to transfer the FS configuration.
The default password is "**pssu**".

- It can be changed via the menu item 'System' » 'Change FS password ...'.

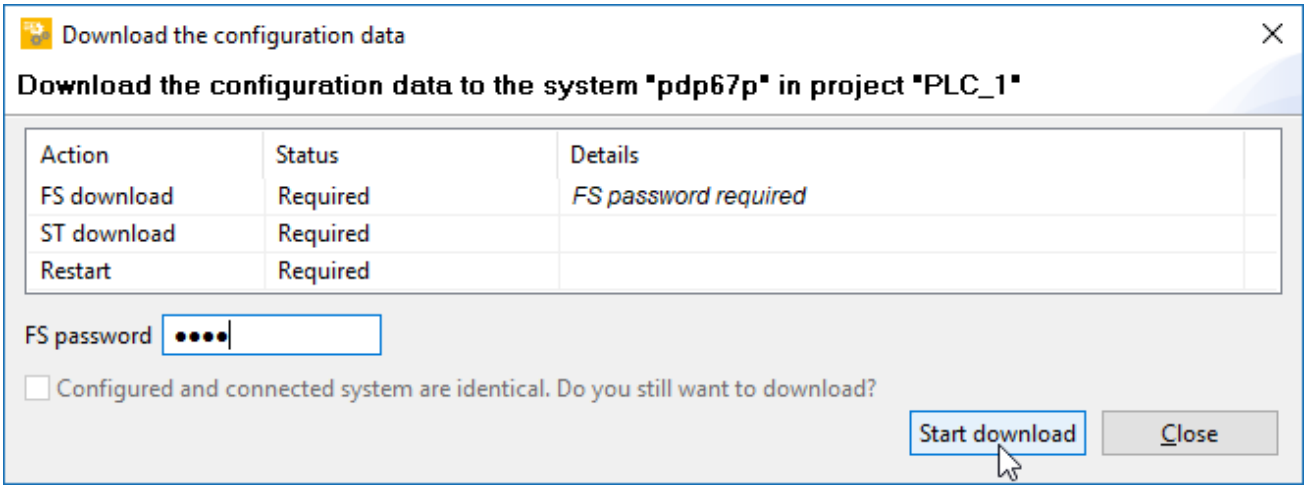


Figure 52: PASconfig – Download configuration » Entering the password (Part 2)

- Now the download of the configuration data and the automatic restart is executed:

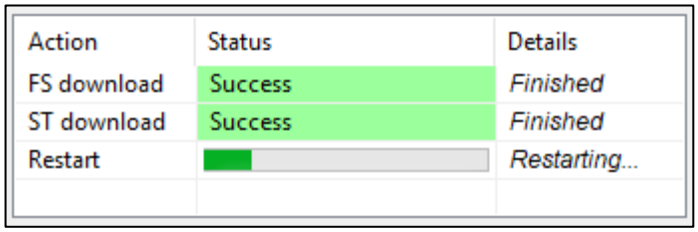


Figure 53: PASconfig – Download configuration » Download FS data and restart device (Part 3)

- The download window can now be closed:

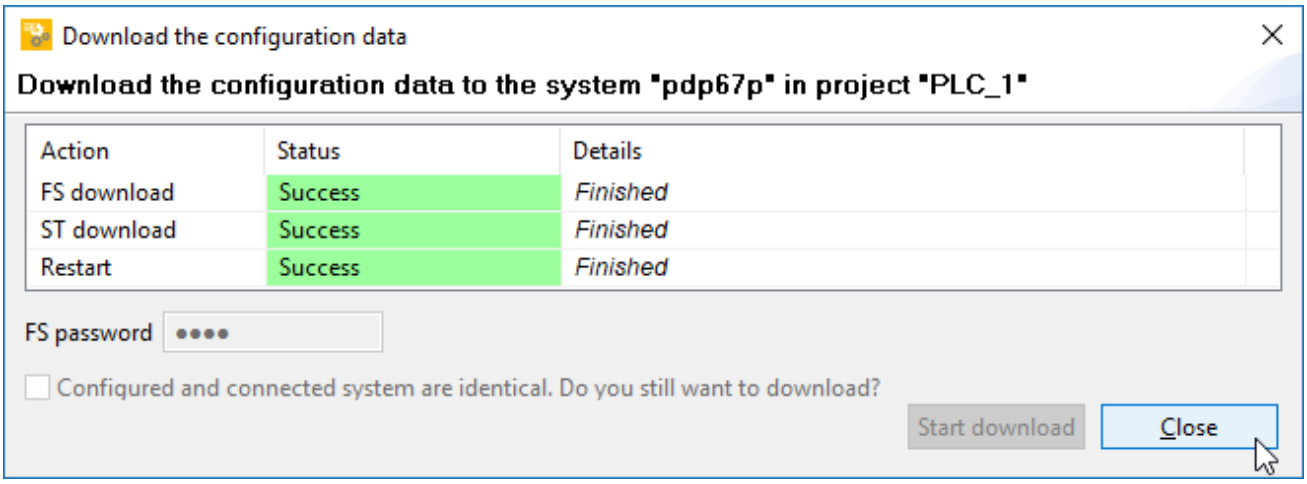


Figure 54: PASconfig – Download configuration » Close download window (Part 4)

- The *PASconfig* tool can now be closed:

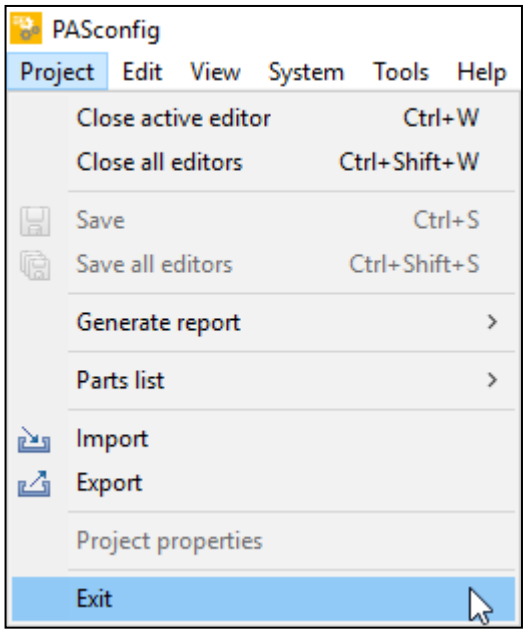


Figure 55: PASconfig – Close tool

8.4 TIA – Download the configuration to S7 F-CPU

- After closing the *PASconfig* tool, the *TIA project* is saved first:

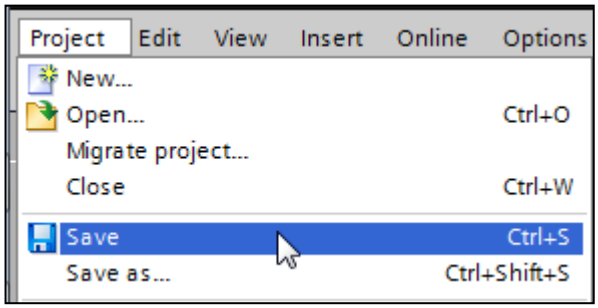


Figure 56: TIA – Download configuration » Save project (Part 1, Start)

- Now the F-CPU is selected in the project tree and the *TIA project* is compiled:

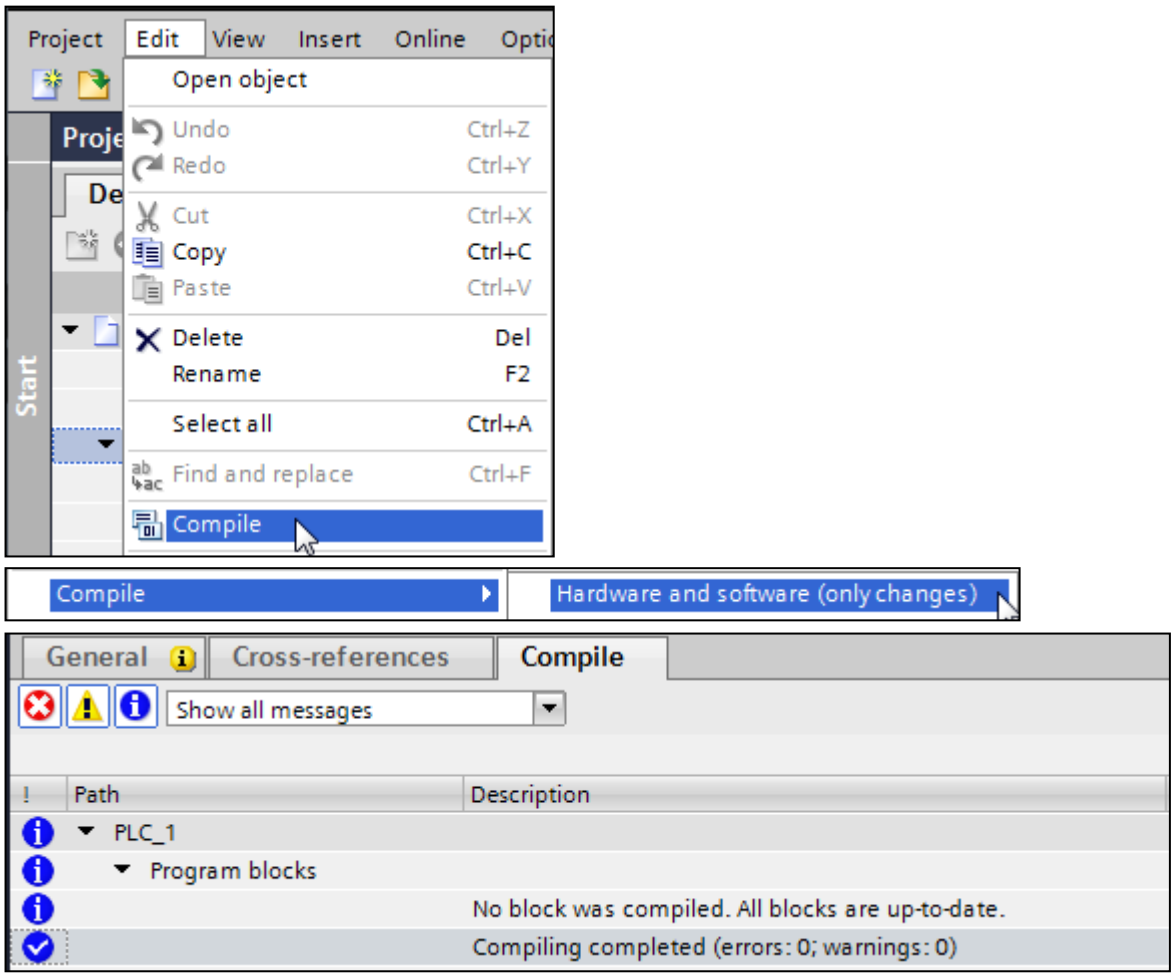


Figure 57: TIA – Download configuration » Compile project (Part 2)

- The *TIA project* is then loaded into the F-CPU:

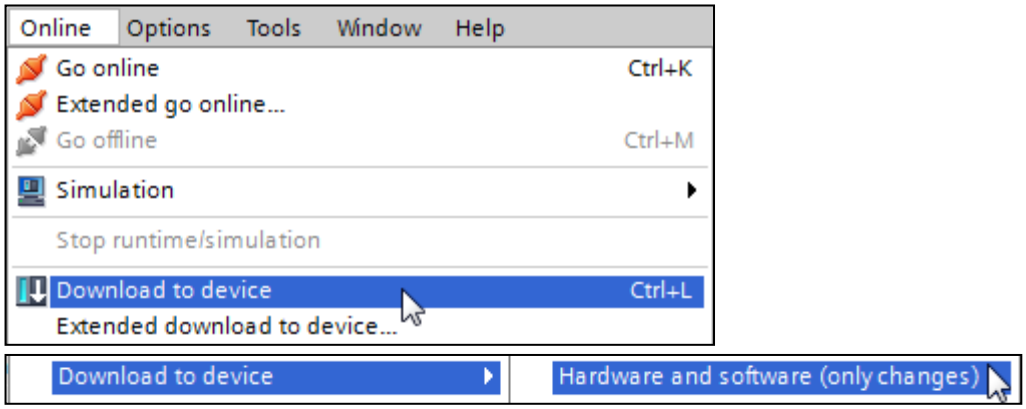


Figure 58: TIA – Download configuration » Download project to device (Part 3)

- The F-CPU can now be set to the operating mode *RUN*.
  Now there should be no error messages in the PDP67 device diagnostics:

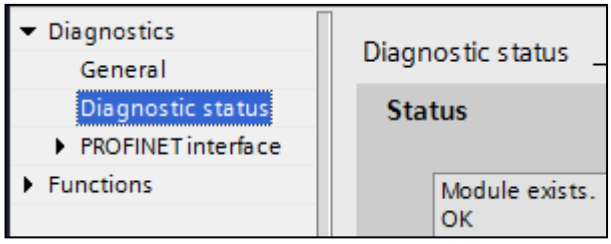


Figure 59: TIA – Download configuration » Check Diagnostic status (Part 4, Finalization)

- The error-free status of the two devices can be also recognized by their LEDs:
  - The 'SO' LED on the Pilz device only lights up green when the container for the PROFIsafe process data is configured and the PROFIsafe communication connection to the F-CPU is active.
  - The current failsafe process image only becomes visible in the online view of the PLC variables in the TIA tool when there is a read/write access to these failsafe signals in the program code of an F-Function block that is assigned to an active F-Runtime group of the F-CPU.
    Otherwise, for example, there is neither a read access to a failsafe input nor to its associated valid bit and thus no real status information; both signals then always have the value 'Zero' in the online view.

Figure 60: PDP67 / F-CPU – Diagnostic status with error-free configuration

9 Helpful functions for commissioning and maintenance

9.1 Notes on establishing the online connection to the PDP67

An online connection between the *PASconfig* PC and the PDP67 device is required to perform various online actions, e. g. to execute a firmware update, download the FS/ST configuration data or display the error stack.
The *PASconfig PC* must have an IP address from the same subnetwork as the IP address of the PDP67 device, the port number is necessary for the connection to the configuration PC.

- For this communication connection to the device, three parameters are required, as shown in the Figure 49: PASconfig – PDP67 device » Function "Change device" (Part 3, F-address) [📖 36]:
  1. the IP address (default setting: 0.0.0.0 »» 192.168.0.2),
  2. the port number (default setting: 18080 »» 18080) and
  3. the F-address (default setting: 1 »» 5).

9.1.1 Determining the IP address and port number

The following tools can be used to determine existing PROFINET devices in a network:

- First of all, you should use the online functions of the PLC programming tool used, here especially for ***TIA*** in the Online menu the function Accessible devices ... .
  - see Chapter 7.3 Setting up the Ethernet adapter [📖 18], Figure 12 & Figure 13
- For PROFINET networks, the free Siemens tool ***PRONETA Basic*** can be used to perform many analysis and configuration tasks for these devices, such as displaying and setting the IP address and the PROFINET device name.

9.1.2 Determination and temporary assignment of the F-address

The FS container used in slot 11 has an F-address:

- see Info under Chapter 6.2.2 PDP67 failsafe and standard I/O process image [📖 13]

- This has two functions:
  1. software F-address of the device for PROFIsafe communication in the PROFINET network and
  2. necessary (third) parameter for establishing the connection to the configuration PC.

Without the F-address, no connection to the PDP67 device can be established.
If you no longer know the F-address of a fieldbus device that has already been configured or used, you can read it out from the device using the *PASconfig* tool and use it temporarily for communication between the configuration PC and the Pilz device.

- Prerequisites:
  - The configuration PC is connected to the PDP67 device and
  - you know the IP address and the port number of the device (see Chapter 9.1.1)
- Procedure:
  - The configuration of a PDP67 device with an unknown F address is imported either via an existing PLC project or it must be newly created in *PASconfig*.
  - Then start the »***Connection manager***« in the Tools menu, activate the line with the correct connection in its table and should first »*Test*« whether this is "error-free".

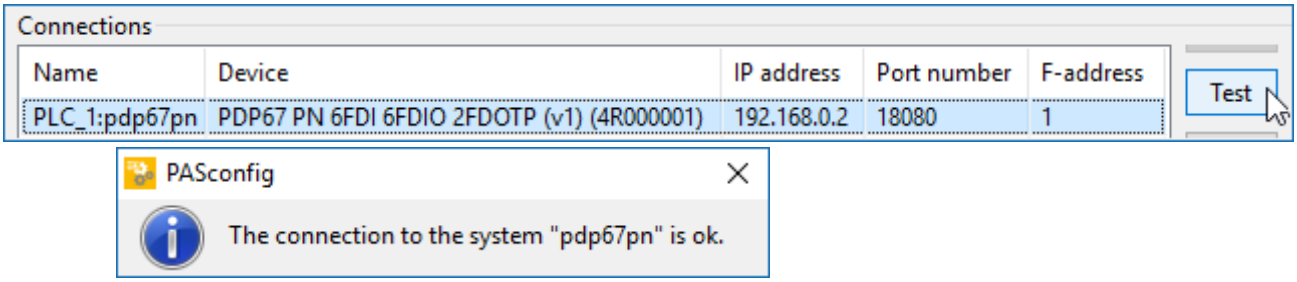


Figure 61: PASconfig – Connection manager » Manage connections to systems

– Now click on the button »*Edit*«, a window like in Figure 62 opens:
  - There you click on the button »*Retrieve F-address for the Ethernet connection.*« (1).
  - Now you are asked to enter the FS password (default: "*pssu*") (2)(3), to execute the function:
    » The F-address for the Ethernet connection is now read out of the device.
    » This F-address is then displayed (4) and
    » temporarily assigned for the selected PDP67 device with »*Finish*« (5).

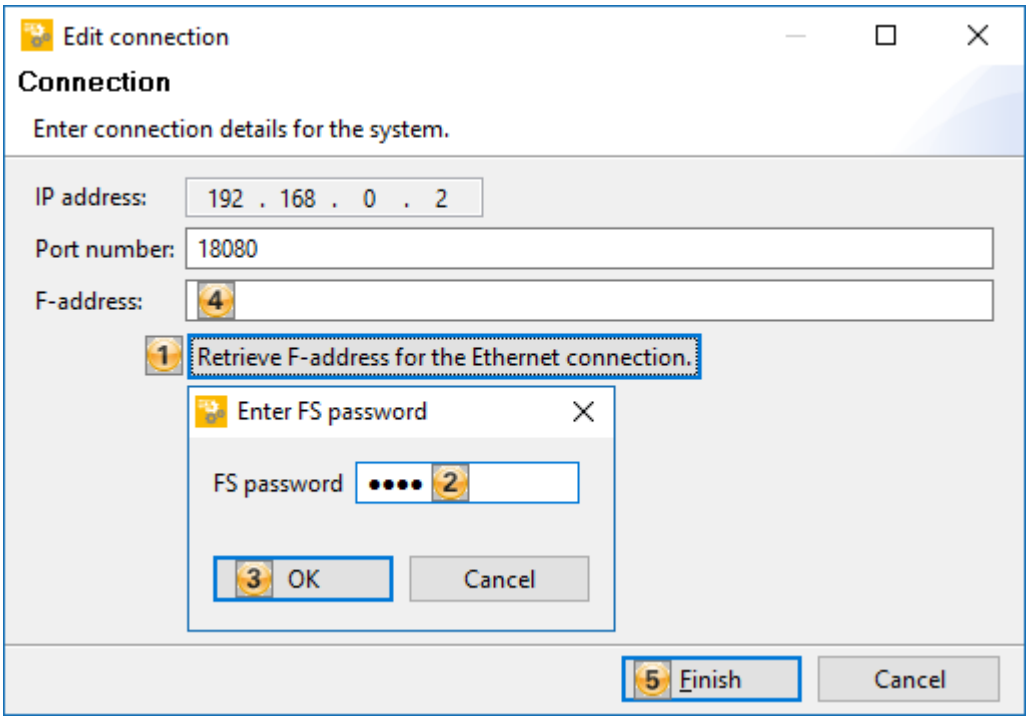


Figure 62: PASconfig – Connection » Read out the F-address for the Ethernet connection

- Now you can perform two functions independently of each other and in any order:
  1. download the actual I/O configuration on the device
     - see Chapter 8.3.4 Download the configuration to PDP67 device [🕮 37 ff]

  and

  2. download the current F-address to the device.
     To do this, start the option »*Set F-address*« in the System menu.
     The »*Download*« (1) also replaces the (previously existing and temporarily assigned) *Device F-address* in the right column with the current *Project F-address* (2)(3),
     Error-free communication with the PROFIsafe master should then be possible.
     - see Figure 60: PDP67 / F-CPU – Diagnostic status with error-free configuration [🕮 40]

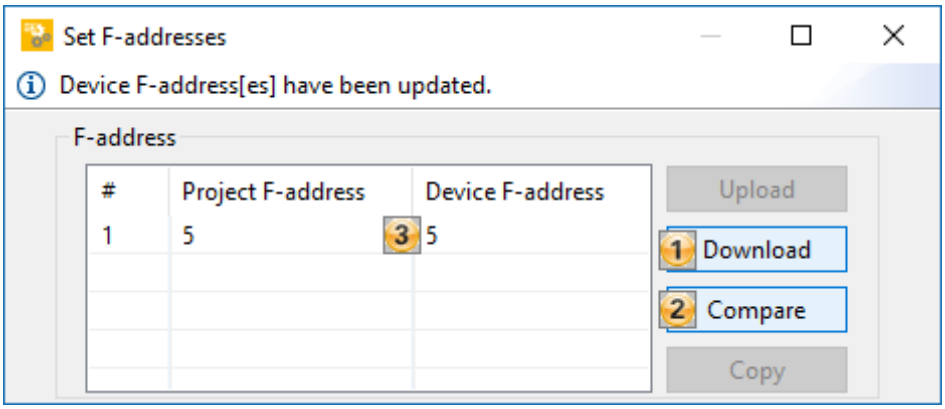


Figure 63: PASconfig – Enter F-adress » Download and Compare

9.2 Comparison of checksums of the failsafe configuration data

The FS checksum for the PDP67 device 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 fieldbus device.

- The CRC can be checked in two places:
  1. still directly in the tool *PASconfig* in the menu 'system':

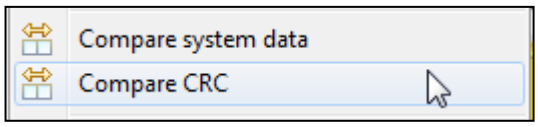


Figure 64: PASconfig – Function "Compare CRC"

or

  2. in *TIA* via *»Start Device Tool...«*, here now via the access point "Properties":

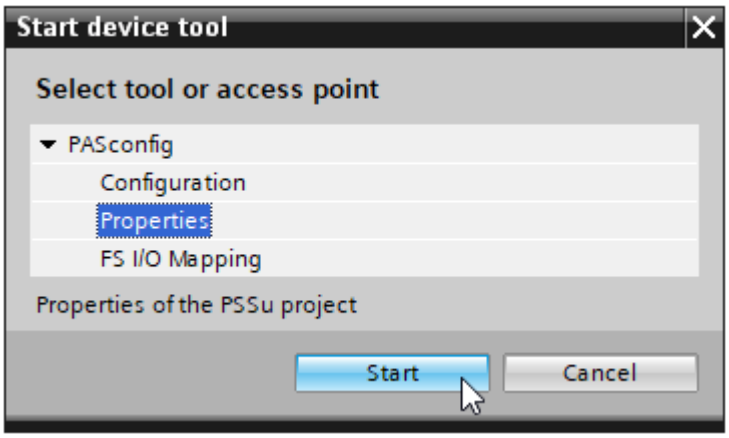


Figure 65: PASconfig – Function "Properties"

- Then the window with the offline configured *system properties* of the PDP67 device is displayed, here you can then start the comparison with the device data that are stored online:

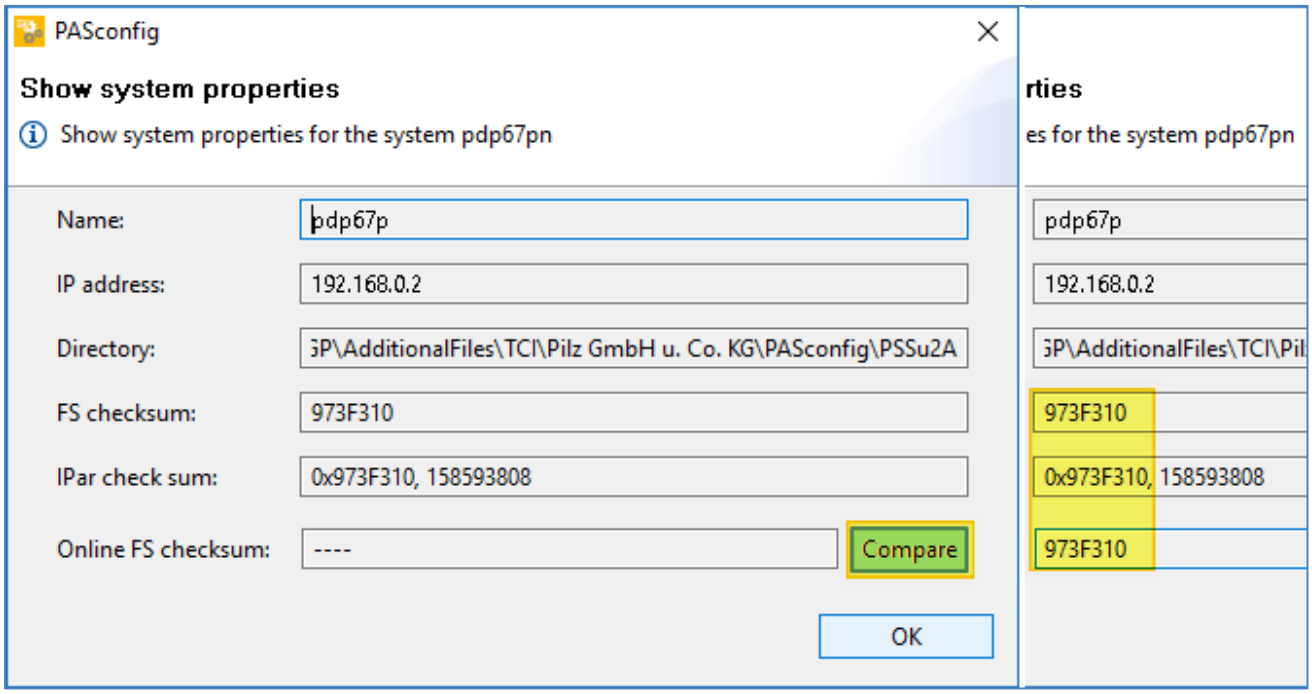


Figure 66: PDP67 – Display of the system properties with offline/online comparison (Example)

Note:

- The values of the checksums in the figures in this chapter are only examples.

9.3 Display of the actual mapping of the I/O addresses to the I/O ports

General information on I/O addresses and their port assignment for the PDP67 device can be found:
- in Chapter 6.2.2 PDP67 failsafe and standard I/O process image [📖 13] and
- in Figure 80: PDP67 – Wiring » Graphical overview of electrical port assignment [📖 54].

To directly read the ***currently configured*** mapping of the I/O addresses to the I/O ports for the PDP67 device, you can use the function "View process image".

- This can be done in two places:
  1. still directly in the tool *PASconfig* in the menu 'system':

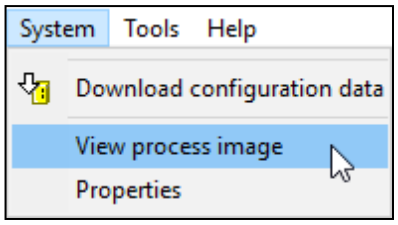


Figure 67: PASconfig – Function "View process image"

or

  2. in *TIA* via *»Start Device Tool...«*, here now via the access point "FS I/O Mapping":

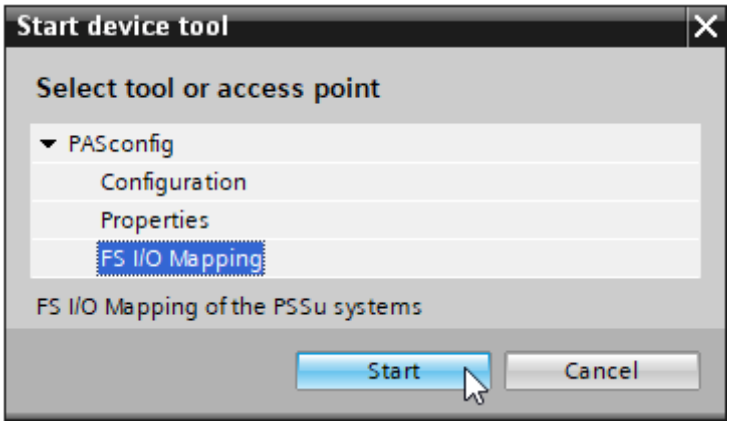


Figure 68: TIA – Function "FS I/O Mapping"

In the preset basic configuration, a total of 12 FS inputs (FDI) are assigned to ports *X01...X06* and one two-pole FS output (FDOTP) each to ports *X07, X08*.
- see Chapter 6.2.1 Variable I/O address assignment [📖 13] (Configuration example 1)

- Now change the configuration of port *X02* to two single-pole FS outputs (FDO):

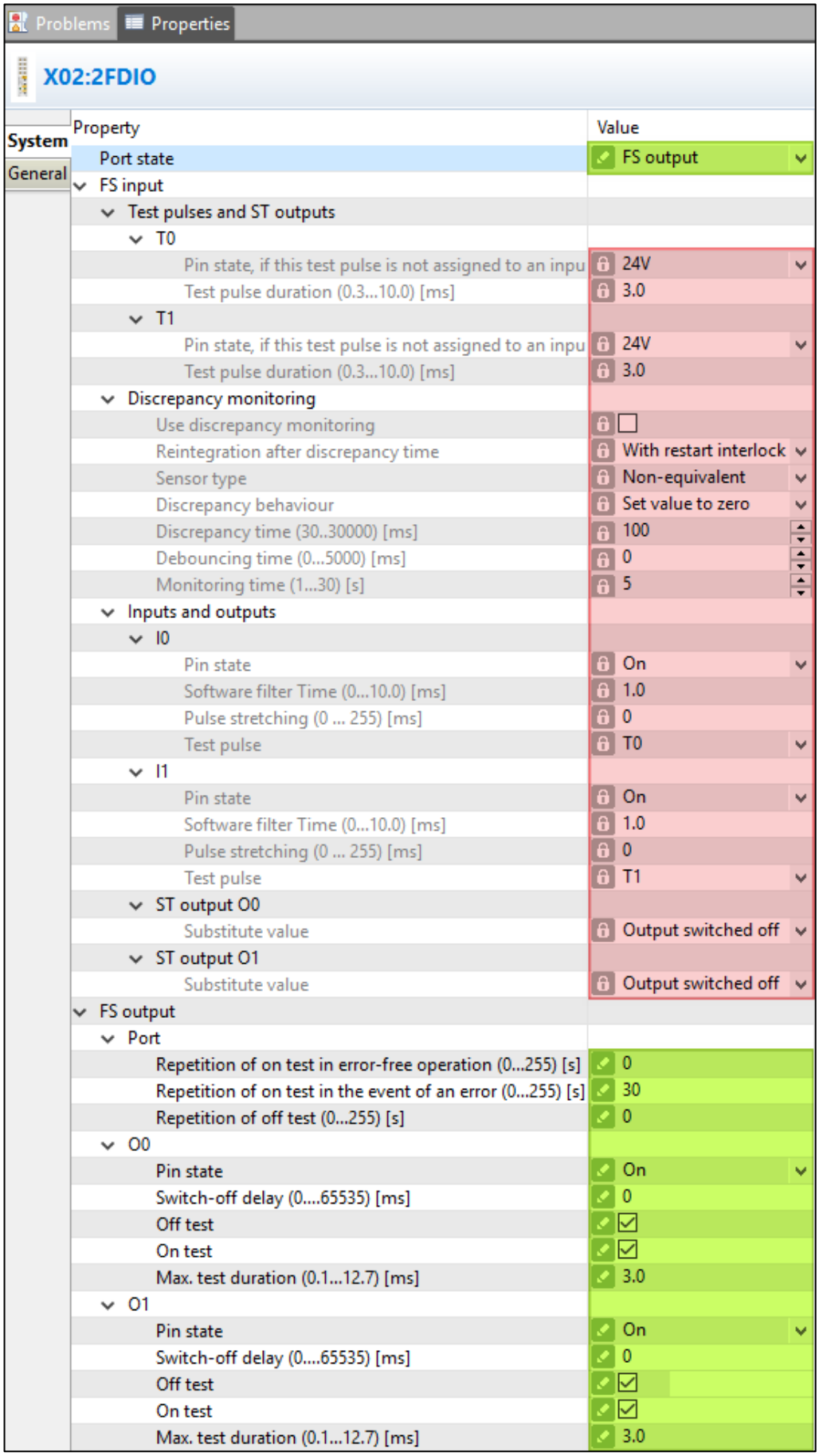


Figure 69: PASconfig – Configuration of X02:2FDIO » Port state "FS output"

- This also changes the actual view of the process image:
  – The two FS inputs and their assigned valid bits are no longer activated (highlighted red) and
  – the two FS outputs and their assigned valid bits are now available (highlighted green).

View process image

Process image information for device PDP67 PN 6FDI 6FDIO 2FDOTP

FS process image

Process image of inputs for PDP67 PN 6FDI 6FDIO 2FDOTP

Port	Variable name	Terminal	Address [byte]	Address [bit]	Data type	ID
Port 1	P1.I0	X01:4	0	0	BOOLEAN1	0
Port 1	P1.I1	X01:2	0	1	BOOLEAN1	1
Port 3	P3.I0	X03:4	0	2	BOOLEAN1	2
Port 3	P3.I1	X03:2	0	3	BOOLEAN1	3
Port 5	P5.I0	X05:4	0	4	BOOLEAN1	4
Port 5	P5.I1	X05:2	0	5	BOOLEAN1	5
-	-		0	6	-	6
-	-		0	7	-	7
-	-		1	0	-	8
-	-		1	1	-	9
Port 4	P4.I0	X04:4	1	2	BOOLEAN1	10
Port 4	P4.I1	X04:2	1	3	BOOLEAN1	11
Port 6	P6.I0	X06:4	1	4	BOOLEAN1	12
Port 6	P6.I1	X06:2	1	5	BOOLEAN1	13
-	-		1	6	-	14
-	-		1	7	-	15
Port 1	Valid(P1.I0)		2	0	BOOLEAN1	16
Port 1	Valid(P1.I1)		2	1	BOOLEAN1	17
Port 3	Valid(P3.I0)		2	2	BOOLEAN1	18
Port 3	Valid(P3.I1)		2	3	BOOLEAN1	19
Port 5	Valid(P5.I0)		2	4	BOOLEAN1	20
Port 5	Valid(P5.I1)		2	5	BOOLEAN1	21
-	-		2	6	-	22
-	-		2	7	-	23
-	-		3	0	-	24
-	-		3	1	-	25
Port 4	Valid(P4.I0)		3	2	BOOLEAN1	26
Port 4	Valid(P4.I1)		3	3	BOOLEAN1	27
Port 6	Valid(P6.I0)		3	4	BOOLEAN1	28
Port 6	Valid(P6.I1)		3	5	BOOLEAN1	29
-	-		3	6	-	30
-	-		3	7	-	31
Port 7	Valid(P7.O0)		4	0	BOOLEAN1	32
Port 8	Valid(P8.O0)		4	1	BOOLEAN1	33
Port 7	OpenCircuit(P7.O0)	X07:4, X07:3	4	2	BOOLEAN1	34
Port 8	OpenCircuit(P8.O0)	X08:4, X08:3	4	3	BOOLEAN1	35
-	-		4	4	-	36
-	-		4	5	-	37
-	-		4	6	-	38
-	-		4	7	-	39
Port 2	Valid(P2.O0)		5	0	BOOLEAN1	40
Port 2	Valid(P2.O1)		5	1	BOOLEAN1	41
-	-		5	2	-	42
-	-		5	3	-	43
-	-		5	4	-	44
-	-		5	5	-	45
-	-		5	6	-	46
-	-		5	7	-	47

Process image of outputs for PDP67 PN 6FDI 6FDIO 2FDOTP

Port	Variable name	Terminal	Address [byte]	Address [bit]	Data type	ID
Port 7	P7.O0	X07:4, X07:3	0	0	BOOLEAN1	0
Port 8	P8.O0	X08:4, X08:3	0	1	BOOLEAN1	1
-	-		0	2	-	2
-	-		0	3	-	3
-	-		0	4	-	4
-	-		0	5	-	5
-	-		0	6	-	6
-	-		0	7	-	7
Port 2	P2.O0	X02:4	1	0	BOOLEAN1	8
Port 2	P2.O1	X02:2	1	1	BOOLEAN1	9
-	-		1	2	-	10
-	-		1	3	-	11
-	-		1	4	-	12
-	-		1	5	-	13
-	-		1	6	-	14
-	-		1	7	-	15

OK

Figure 70: PASconfig – Function "FS I/O Mapping" » Process image table

9.4 Notes on the diagnostic display in TIA and PASconfig

- The following example show diagnostic displays from the *TIA* tool. These two online functions for diagnostics are accessible via the context menu of the F-CPU:
  - »Go online«:
    This will include the activation of the function in the project navigation, which shows the operating status or diagnostic status of the online-connected devices with icons.

  - »Online & diagnostics«:
    This opens a system related window with information on the diagnostics and other online functions. In the “Diagnostics” folder, you can select the group “Diagnostic buffer”, in which the “Events” are tabulated as a log file for the F-CPU and the modules assigned to it.

The following figure shows the online display of the *TIA project* with the diagnostic symbols and the “Diagnostic buffer” of the F-CPU:

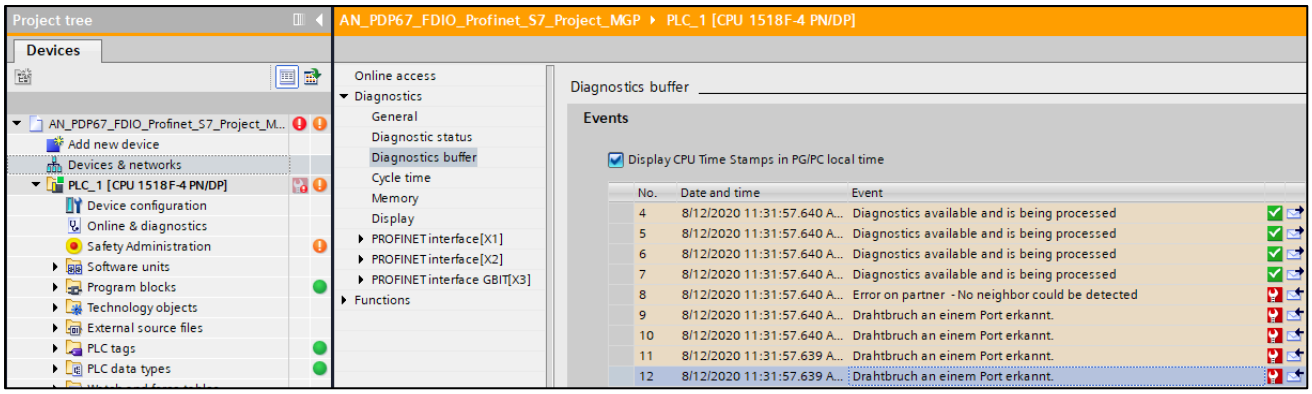


Figure 71: TIA – F-program » Online diagnostic display and “Diagnostic buffer” of the F-CPU

- The more detailed error stack of the PDP67 device can be accessed in the *PASconfig* tool:

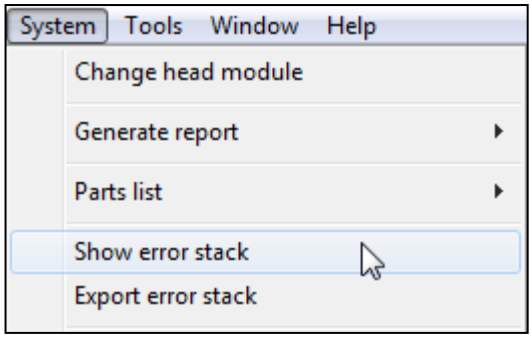


Figure 72: PASconfig – PDP67 » Display of Error stack

9.5 Notes on possible start-up errors of the PDP67 device

In the MDF file (Module Description File) belonging to the device the maximum safety is preset. This means, for example, that in the configuration the test pulses are activated for the FS inputs and the switch-on and switch-off tests are activated for the FS outputs.
If you load this standard configuration into the PDP67 device without adapting it to the actual electrical wiring (or even with unconnected I/O ports!), start-up problems may occur after restarting the device. This is explained using the following examples.

9.5.1 Example for start-up errors of the two-pole FS outputs

- Cause of error:
  - The two-pole outputs on ports *X07* and *X08* are activated although they are not used.
- Then the following system reaction occurs during start-up:
  - PDP67:
    - The LED *DIAG* lights up red.
    - The LED *SO* flashes green.
    - The LEDs *O+* and *O-* on the respective port of the two-pin FS output flash green.
  - F-CPU:
    - The LED *Err* flashes red.
- The error message of the F-CPU contains:

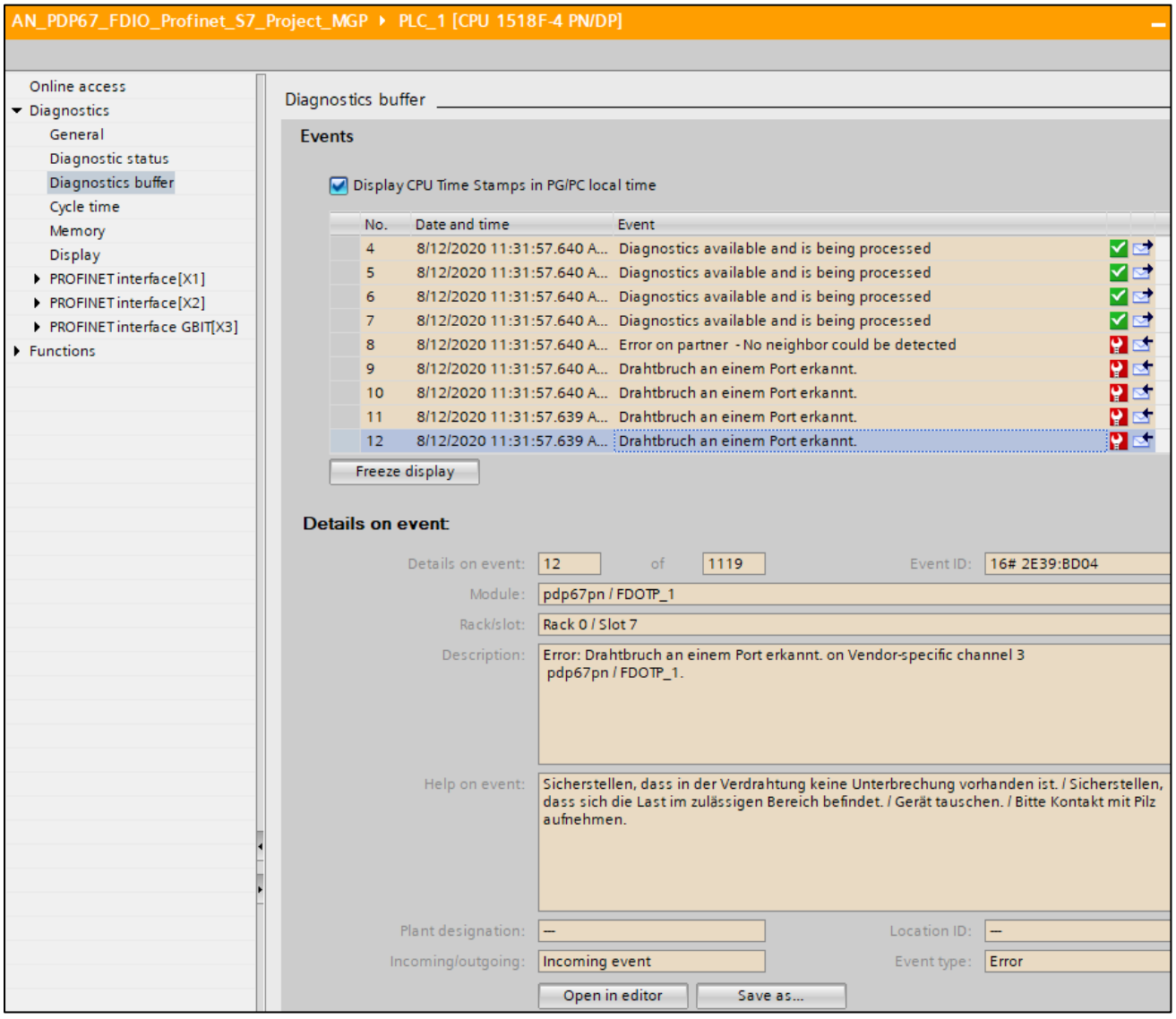


Figure 73: TIA – F-CPU » Display of the error stack for two-pole FS outputs

- and in the diagnostic message of the PDP67 device:

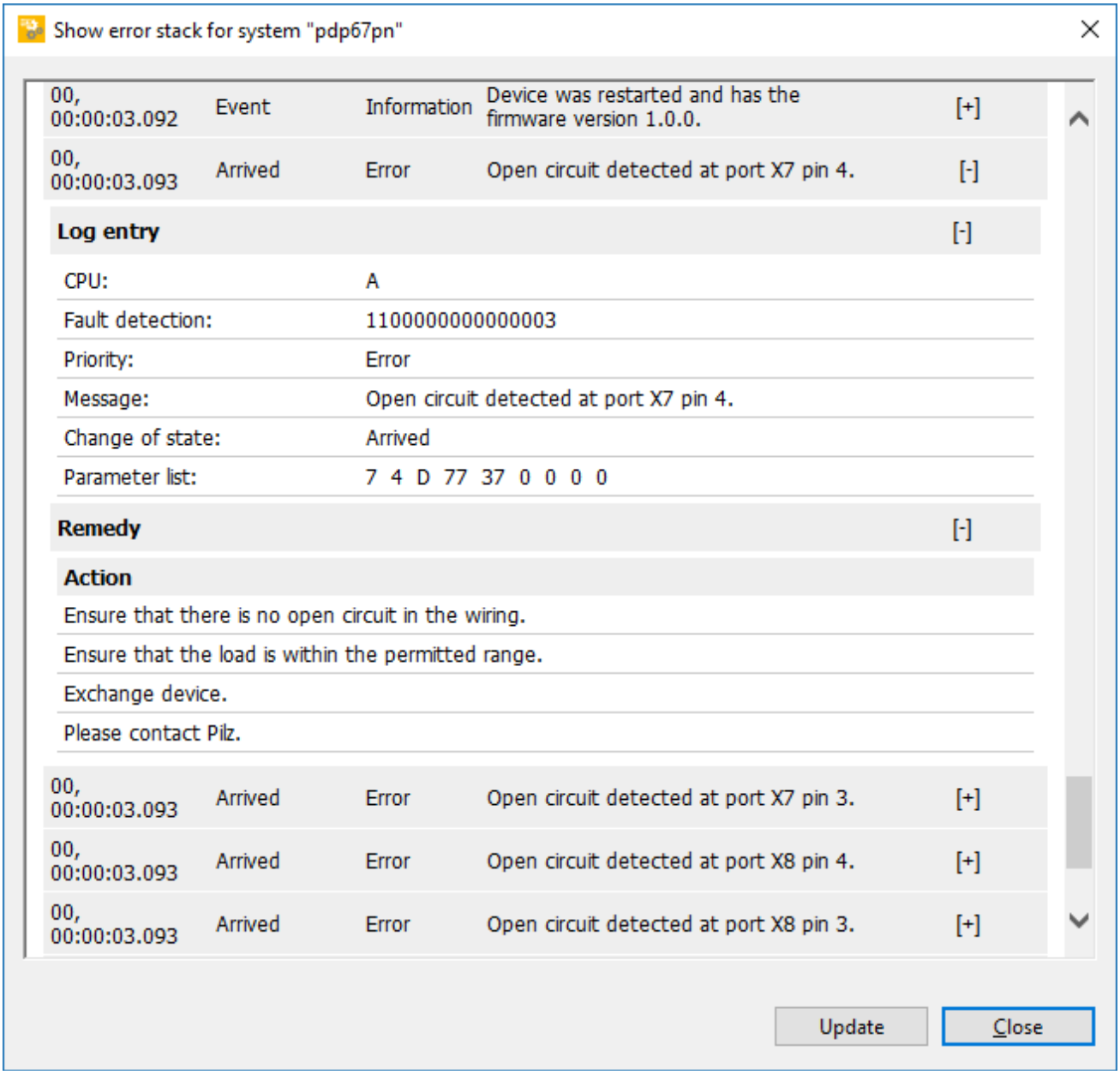


Figure 74: PASconfig – PDP67 » Display of the error stack for two-pole FS outputs

- Remedy: This can be remedied by deactivating the unused FS outputs:

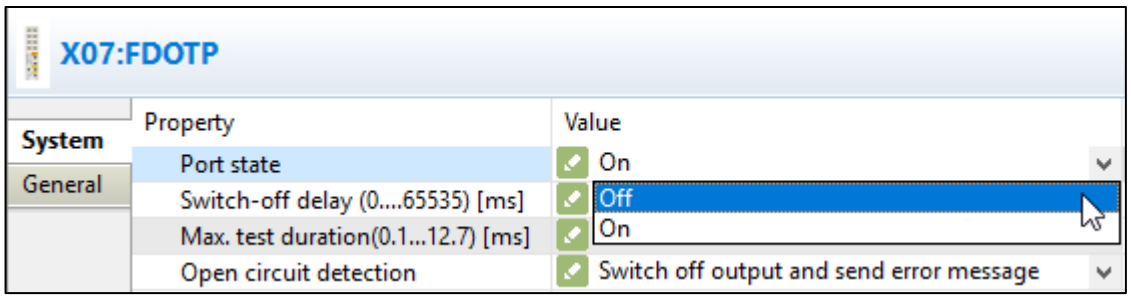


Figure 75: PASconfig – PDP67 » Deactivation of unused two-pole FS outputs

9.5.2 Example for start-up errors of the of FS inputs

- Cause of error:
  - The FDI port *X03* is used for the 24V supply and evaluation of the OSSD outputs of receiver Rx of the *PSEN opII4F* light curtain is used.

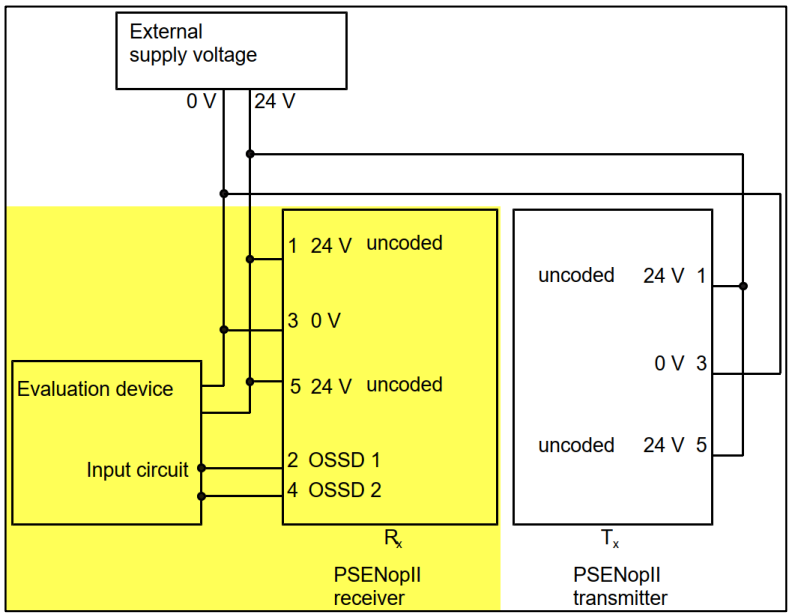


Figure 76: PSEN opII4F – Two-channel connection on the input circuit of the evaluation device

- Then the following system reaction occurs during start-up:
  - PDP67:
    - The LED *DIAG* lights up red.
    - The LED *SO* flashes green.
    - The LEDs *I0* and *I1* at port *X03* of the FS inputs flash green.
  - F-CPU:
    - The LED *Err* flashes red.
- The error message of the F-CPU contains:

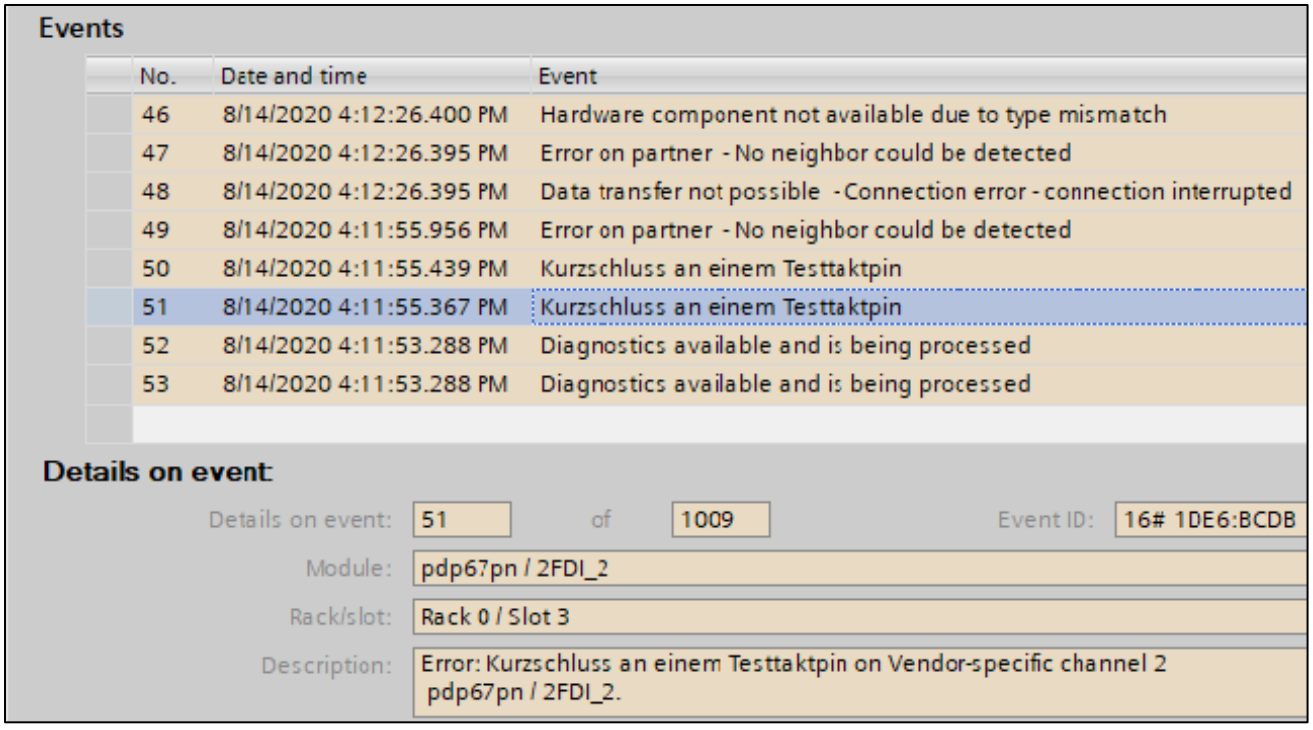


Figure 77: TIA – F-CPU » Display of the error stack for FS inputs

- and in the diagnostic message of the PDP67 device:

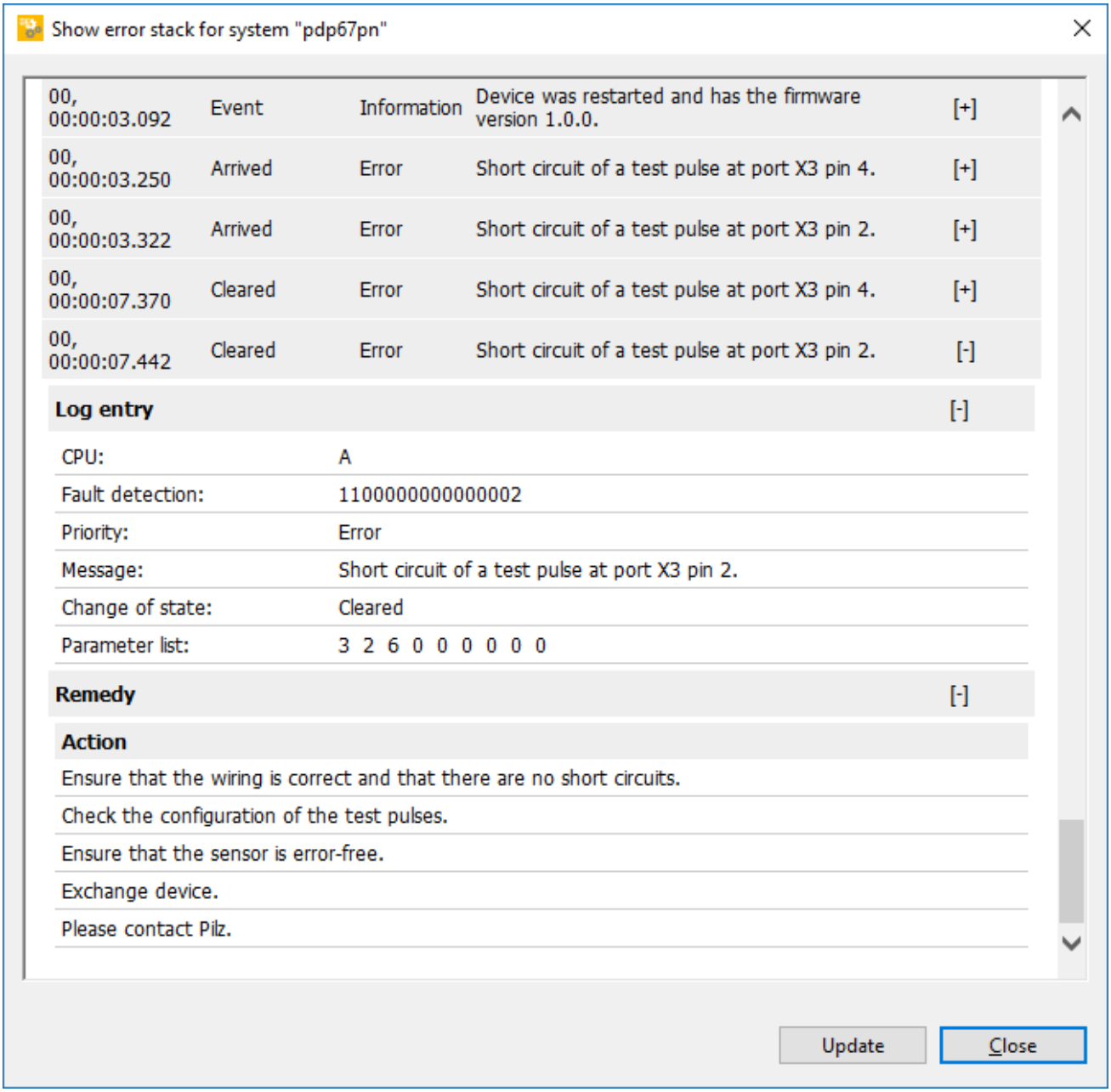


Figure 78: PASconfig – PDP67 » Display of the error stack for FS inputs

- Remedy:
  The supply to the OSSD outputs of the *PSEN opII4F* light grid requires 100 mA per output.
  The test pulse outputs of the FS inputs each supply 500 mA, so configure them:
  – *T0/T1* » Pin status: "24V"
  – *I0/I1* » Test cycle: "No test pulse"

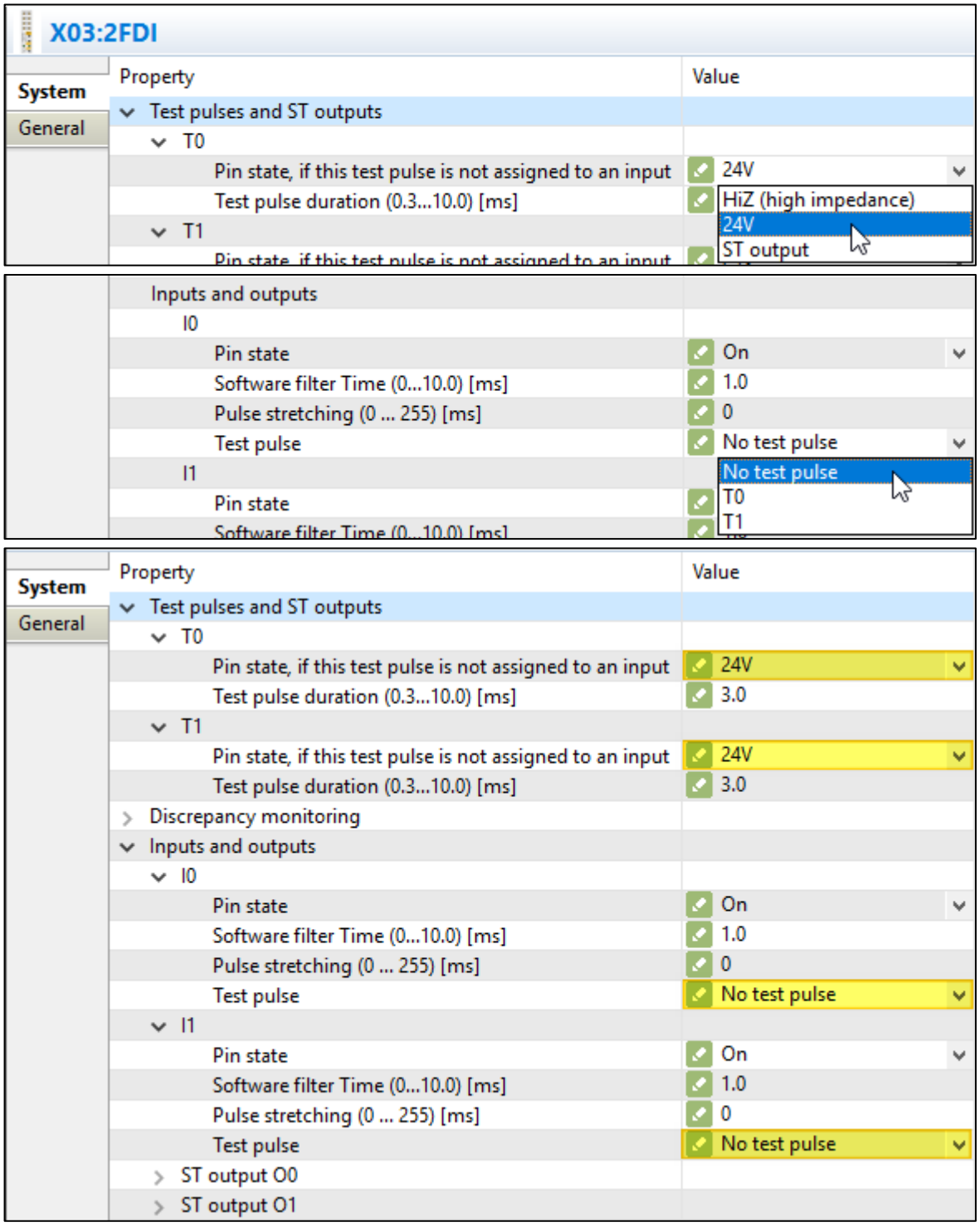


Figure 79: PASconfig – PDP67 » Adjusting the test pulse outputs of the FS inputs

9.6 Notes on using the MircoSD card and Reset button

9.6.1 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.

9.6.2 Device exchange using MicroSD card and Reset button

- A MircoSD card is available as an optional accessory for the PDP67 device.
  - 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 PDP67 device, 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 device on the microSD card; this must match the FS checksum of the configured device.
      » see Chapter 9.2 Comparison of checksums of the failsafe configuration data [📖 43]
      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 LED *SD* 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.
  - Profinet Factory Reset is executed
  - Error stack is not deleted
  - The fieldbus device is automatically restarted.

10 Appendix

10.1 Electrical port assignment of PDP67 device

- Graphical overview of electrical port assignment without those for Reset button and Removable media:

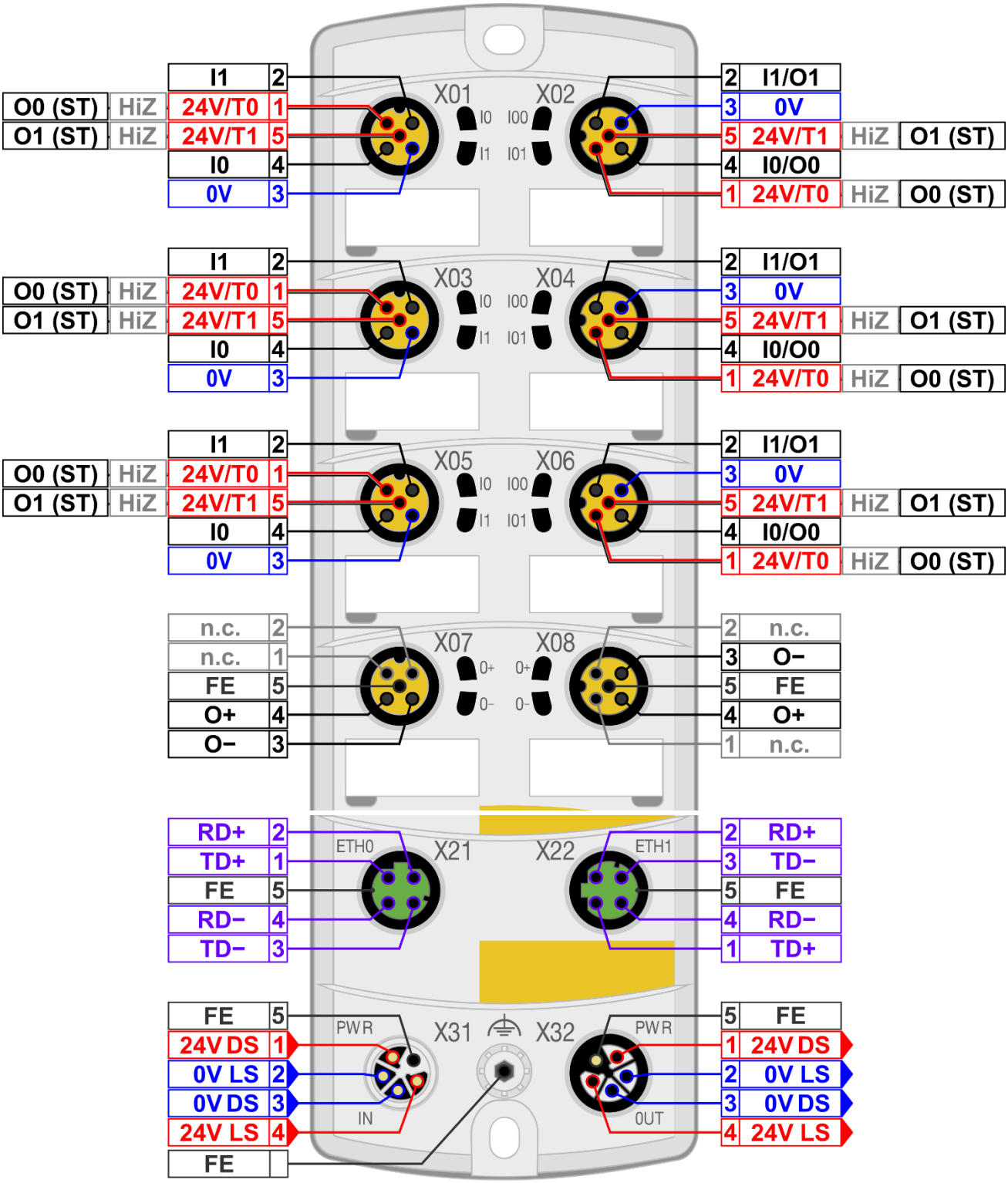
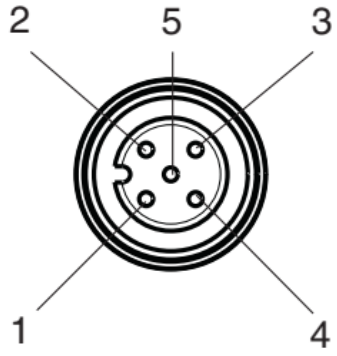


Figure 80: PDP67 – Wiring » Graphical overview of electrical port assignment

Now the electrical pin assignment for each port type is shown in detail:

- Pin assignment of the Input and output ports *X01…X08* (**Failsafe** and **Standard**)

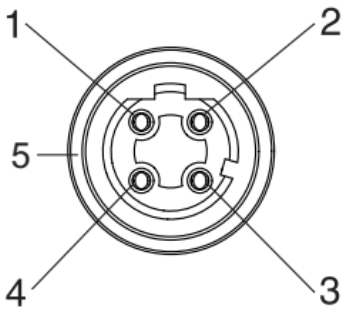


Pin	Assignment		
	2FDI *X01, X03, X05*	2FDIO *X02, X04, X06*	FDOTP *X07, X08*
1	24V/T0 /HiZ/ O0 (ST)	24V/T0 /HiZ/ O0 (ST)	n.c.
2	I1	I1 O1	n.c.
3	0V	0V 0V	O–
4	I0	I0 O0	O+
5	24V/T1 /HiZ/ O1 (ST)	24V/T1 /HiZ/ O1 (ST)	FE

Notes to the port function "FS input" at *X01…X06*:
On a 2FDI(O) port without activated test clock outputs (option: "ST output"), 2 FS inputs [Pin 2&4] and 2 controllable single-pole ST outputs [1&5] can be used simultaneously; you can even mix the listed options channel by channel!
However, the failsafe function is then limited (no test pulses available).
With the "24V" option, you have a permanent power supply in each case [1&5].

Figure 81: PDP67 – Wiring » Pin assignment X01…X08 (M12, female, A coded)

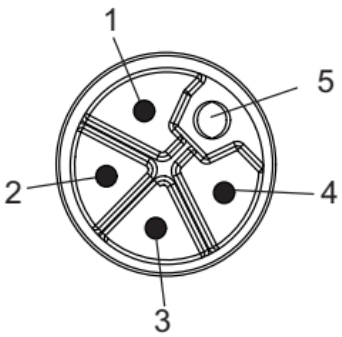
- Pin assignment of the Ethernet ports *X21, X22*

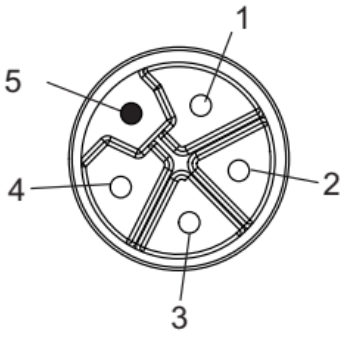


Pin	Assignment
1	TD+
2	RD+
3	TD–
4	RD–
5	FE

Figure 82: PDP67 – Wiring » Pin assignment X21, X22 (M12, female, D coded)

- Pin assignment of the Power supply ports *X31, X32*
  - Note here the direction of the wiring:
    - *X31*: Interface **from** the 24 V power supply or **from previous** decentralised device
    - *X32*: Interface **to the next** decentralised device





Pin	Assignment
1	+24 VDC Device Supply
2	0 VDC Load Supply
3	0 VDC Device Supply
4	+24 VDC Load Supply
5	FE

Figure 83: PDP67 – Wiring » Pin assignment X31, X32 (M12, male & female, L coded)

CAUTION!

In order to guarantee protection type IP67, unused plug-in connectors should be sealed using the protective caps supplied.

11 Table of figures

Support

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