Build a SafetyNET p connection between two PNOZmulti 2 systems

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Product

Type:	Small controllers
Name:	PNOZ m B1, PNOZ m ES SafetyNET
Manufacturer:	Pilz GmbH & Co. KG, Safe Automation

Document

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Application Note – 1006688_EN_01

Document Revision History

Release	Date	Changes	Chapter
01	2023-08-17	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.

August 2023

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
PNOZmulti 2	**PNOZmulti** Generation **2**	www.pilz.com > PNOZmulti 2
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**rganization **U**nit	
NC	**N**ormally **C**losed	
NO	**N**ormally **O**pen	
Equipment ID	**Equipment Id**entifier	

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
2	Operation Manual PNOZ m B1	www.pilz.de > Download 1003790
3	Operation Manual PNOZ m ES SafetyNET	www.pilz.de > Download 1004535
4	Operation Manual PNOZ m EF 4DI4DOR	www.pilz.de > Download 1002702
5	Data sheet SafetyNET p Cable	www.pilz.de > Download 1003730

1.2 Documentation from other sources of information

No.	Description	Item No. / Download
1		
2		
3		
4		

2 Used hardware and software

2.1 Pilz products

No.	Descriptions	Order number	Version	Number
1	Hardware PNOZ m B1	772101	01.09.00	2
2	Hardware PNOZ m EF SafetyNET	772122	01.01.00	2
3	Hardware PNOZ m EF 4DI4DOR	772143	1.1	2
4	Hardware SN CAB RJ45s RJ45s, 0,5m	380001	--	1
5	Hardware Set4 Spring Terminals	751016	--	2
6	Hardware Set 5 Spring Terminals	751017	--	2
7	Hardware Spring terminals PNOZ mml2p	783540	--	2
8	Software PNOZmulti Configurator	--	11.2.0	--
9	Online help PNOZmulti Configurator	--	11.2.0	--

2.2 Third-party products

No.	Descriptions	Order number	Version	Number
1				
2				
3				
4				

2.3 Structure of the application (schematic)

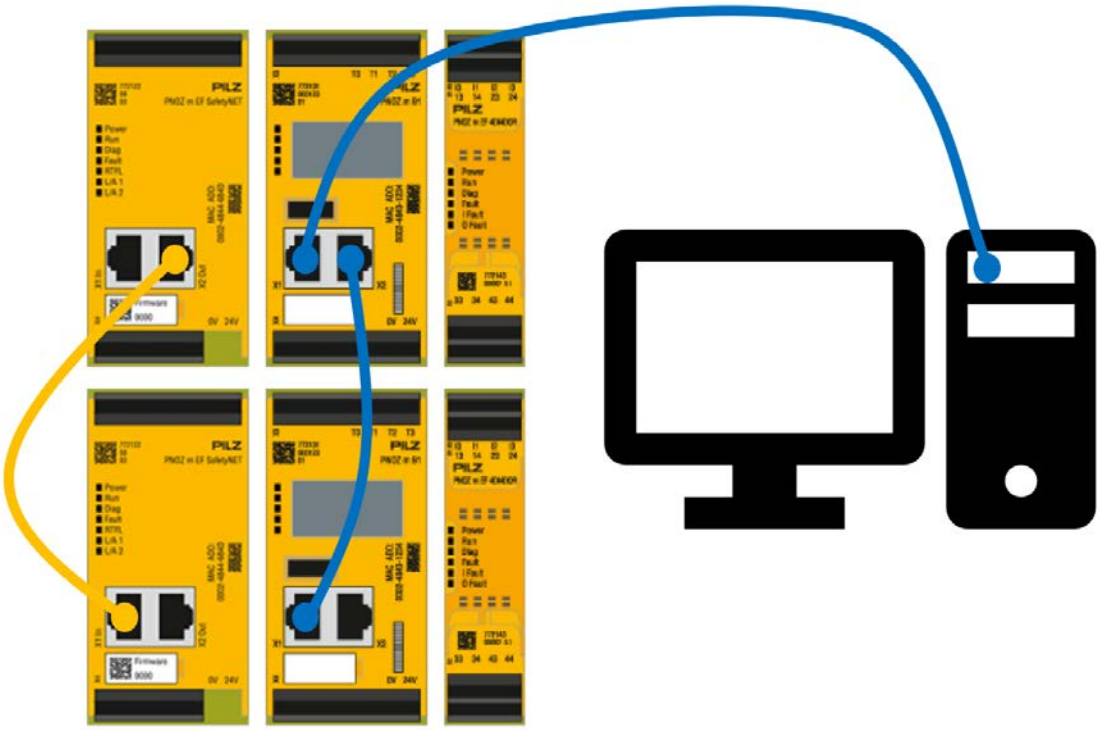


Figure 1: Application – Structure of the hardware (schematic)

- Yellow shows the SafetyNET p-Cable and the blue cable is a normal RJ45-Cable for the connection between the programming computer and the system.

3 Application description

This Application Note uses the PNOZmulti Configurator to describe how to connect two PNOZmulti 2 systems via SafetyNET p.
Two programs are written using the PNOZmulti Configurator and linked together via the PNOZmulti Editor (implemented in the configurator). Then these are transferred to the systems and the entire system is then tested for function.
The basic procedure for successful basic configuration is shown here step-by-step, mostly in pictures.

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 PNOZmulti 2 systems with the order number 772101.

4 Configuration

4.1 Configuration in the PNOZmulti Configurator

- For connection of several PNOZmulti with SafetyNET p it is necessary to create a PNOZmulti program for each base unit. In case of this AN two programs must be created. The following explanation serves to create both programs.

4.1.1 Hardware configuration

- For creation of the program the PNOZmulti Configurator is necessary (see Chapter 2.1 Pilz products [📖 6]).
- If the configurator starts, a new project is opening automatically. The first thing that can be done here is the hardware configuration.
  - With a double click on the desired module in the module view or with drag & drop.

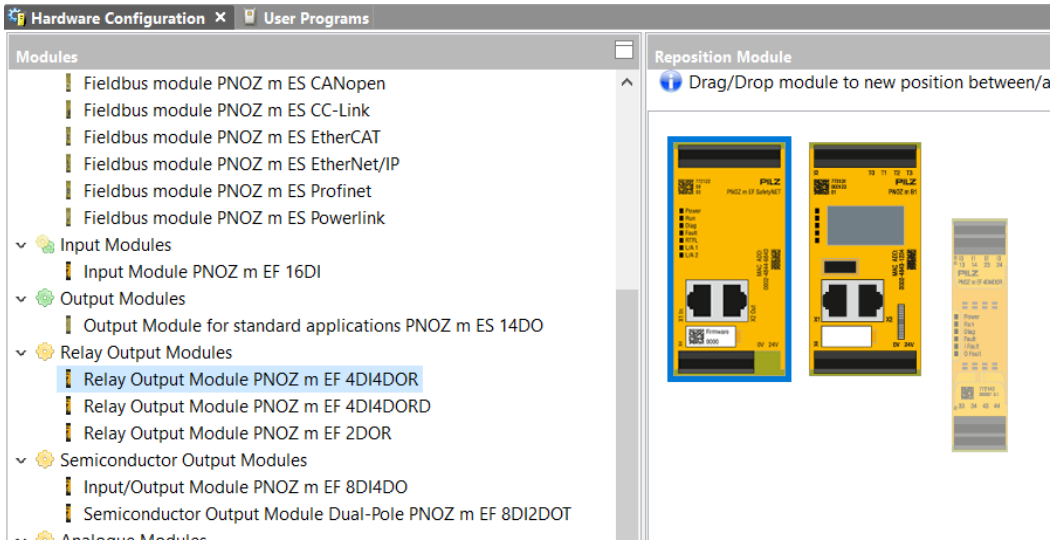
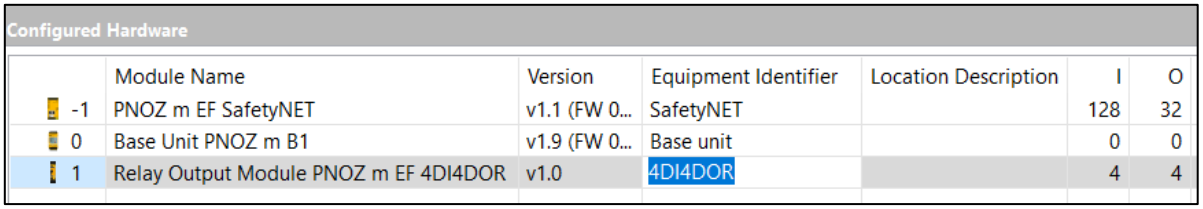


Figure 2: Drag & Drop from module view to HW-Configuration

- For the easy recognizability of the modules the equipment ID should be changed.



	Module Name	Version	Equipment Identifier	Location Description	I	O
-1	PNOZ m EF SafetyNET	v1.1 (FW 0...	SafetyNET		128	32
0	Base Unit PNOZ m B1	v1.9 (FW 0...	Base unit		0	0
1	Relay Output Module PNOZ m EF 4DI4DOR	v1.0	4DI4DOR		4	4

Figure 3: Change equipment ID

- Switch to “User Programs” tab

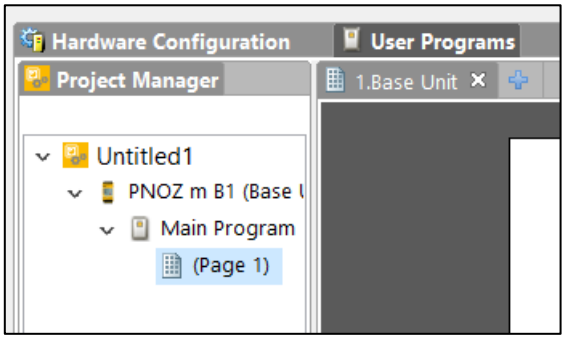


Figure 4: Tab "User Program"

4.1.2 Program creation

- With a double click on the input element a simple input can be added:

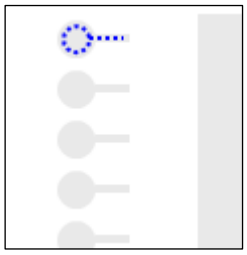


Figure 5: Double click input element

- Now the respective input with the correct equipment ID can be chosen.

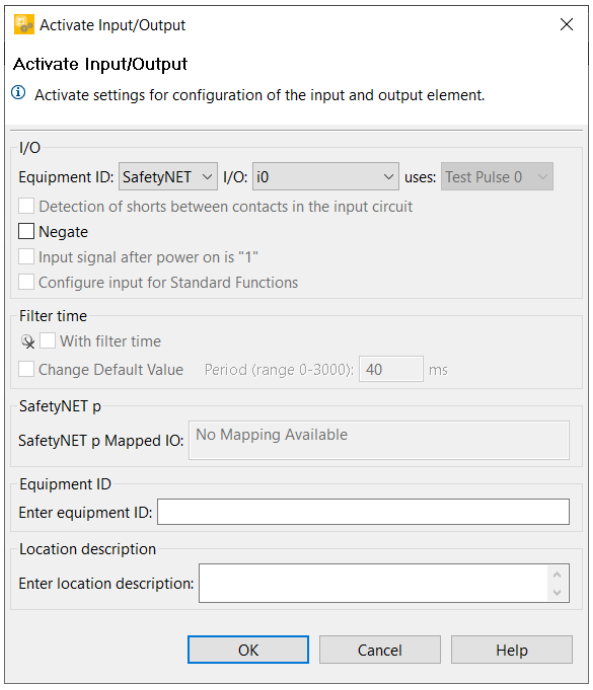


Figure 6: Choose equipment ID and input

- With a double click on one of the middle placeholders (rectangular) logic can be added.

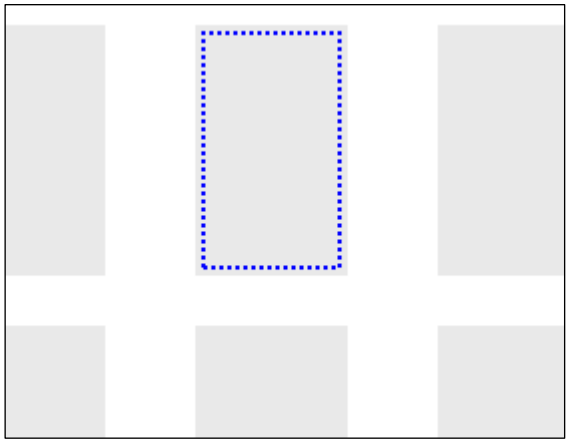
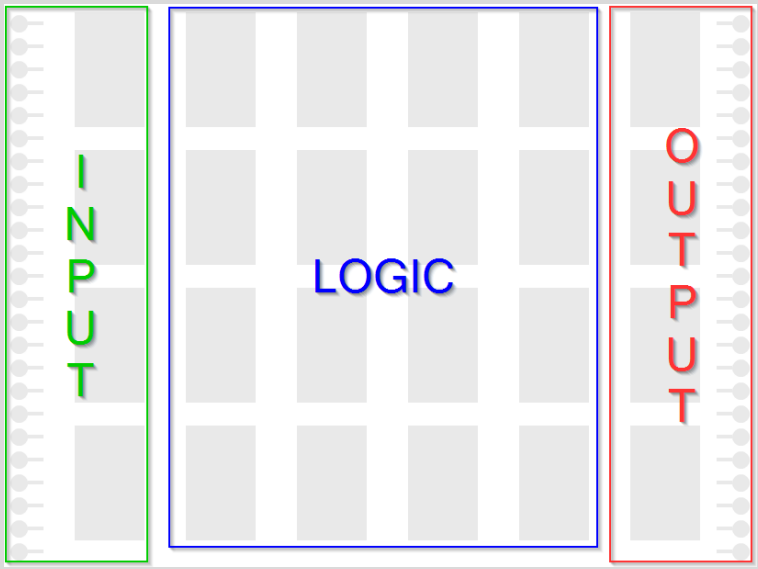


Figure 7: Double click on placeholder

INFORMATION

The placeholder in the left and right are reserved for input and output elements and cannot be used for logic blocks.



- Select element and make required settings (See Online Help).

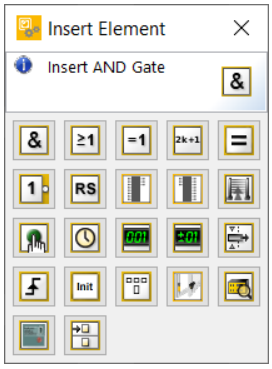


Figure 8: Select element

- Accept with "OK"

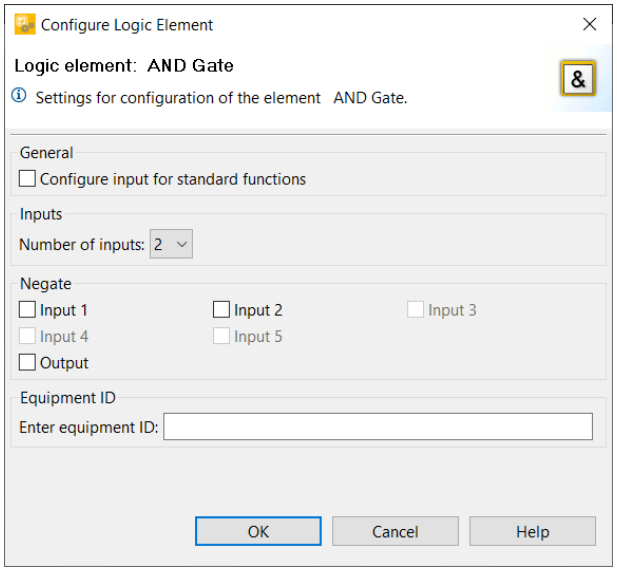


Figure 9: Settings of logic block "AND"

- -With double click on placeholder for outputs a output block can added:

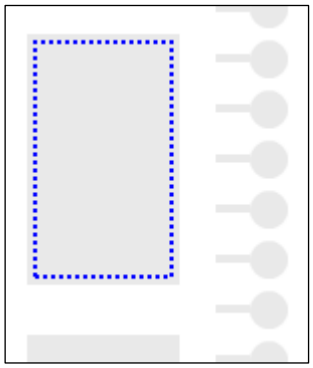


Figure 10: Output placeholder

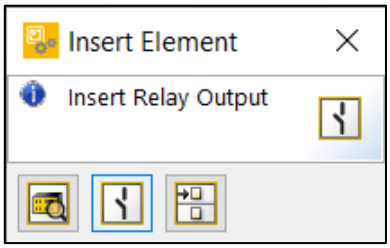


Figure 11: Select relay output

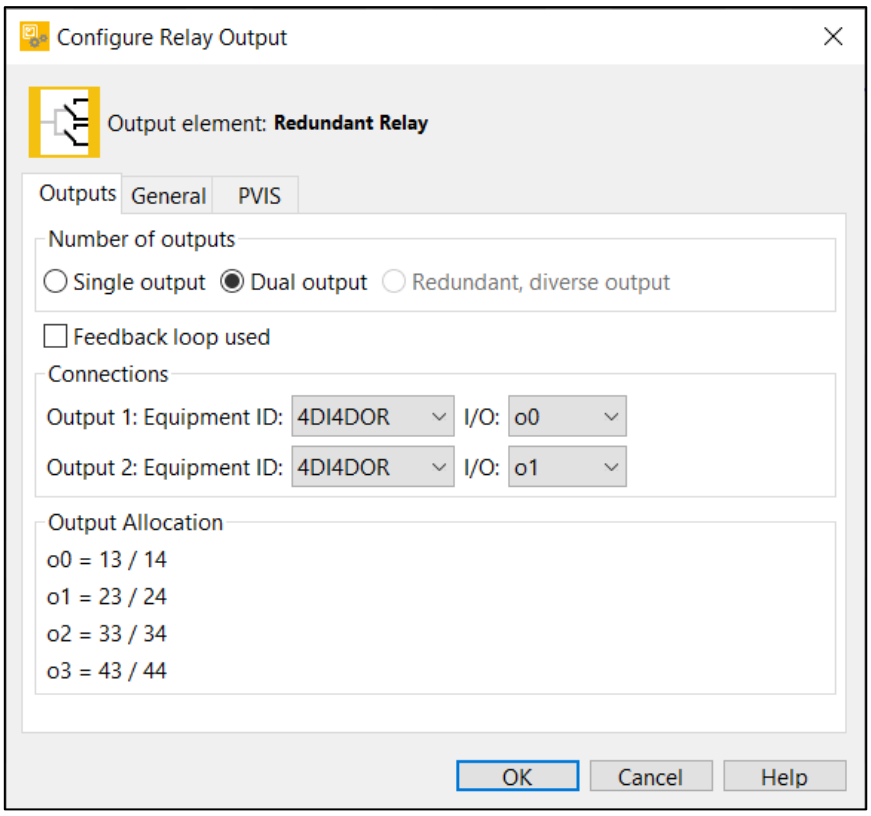


Figure 12: Set settings for relay output

- Now it is possible to drag and drop a red dot and then connect it to an orange dot.

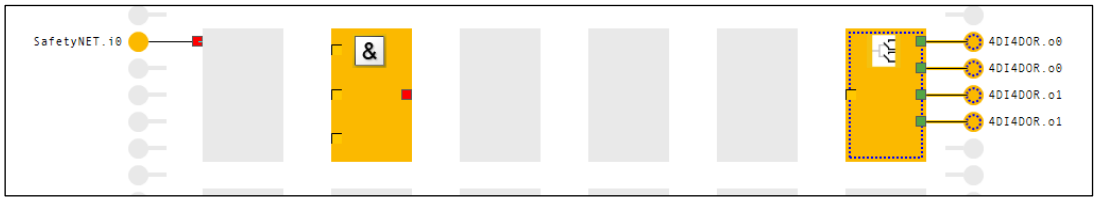


Figure 13: Colored dots at the blocks

INFORMATION

The color of the dots changes only after clicking on a red dot.

- Important for the SafetyNET p connection is the SafetyNET status element. It can be added as input element as soon as a SafetyNET Module is added in the hardware configuration.

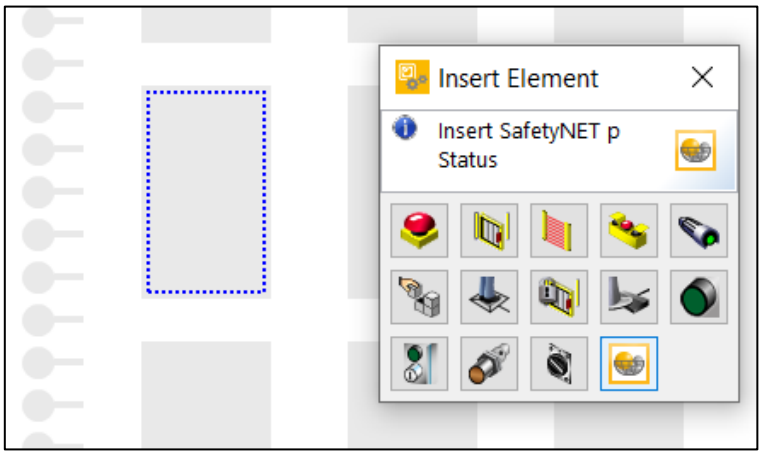


Figure 14: Add SafetyNET p status

- The standard configuration is sufficient here.

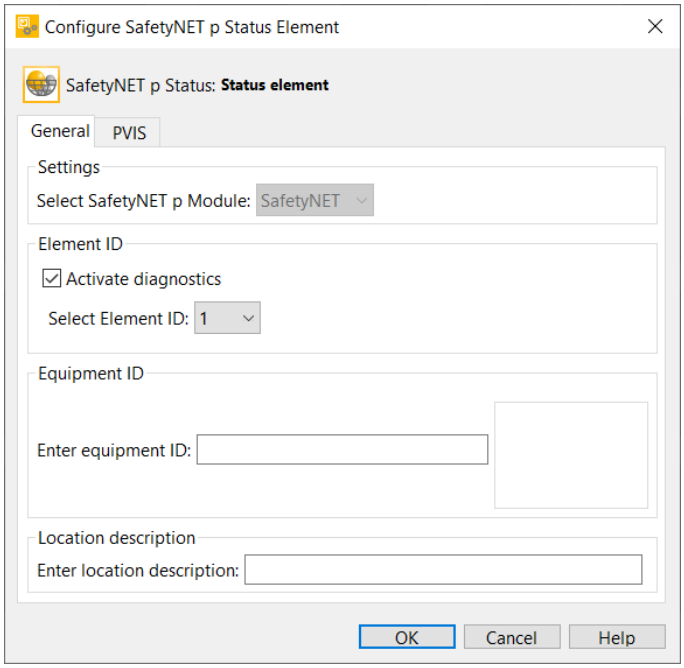


Figure 15: Configuration SafetyNET p status element

4.1.2.1 Program 1

- The complete program looks like this:

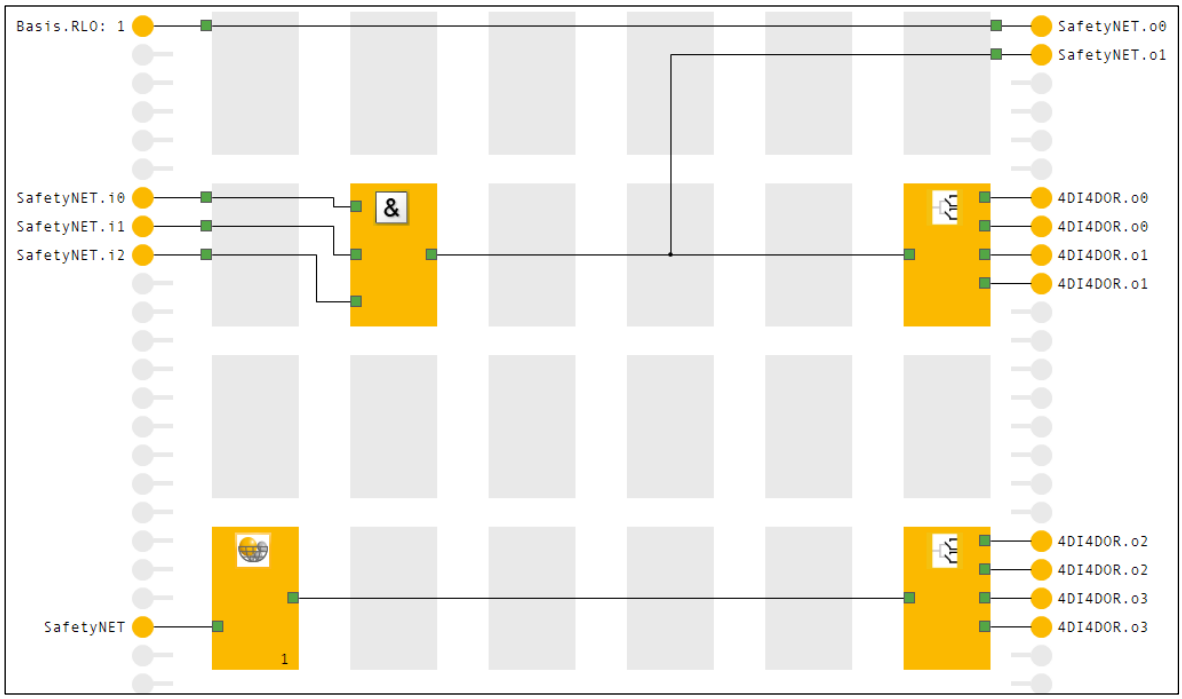


Figure 16: Program 1

- The configuration goes on in Chapter 4.1.3 hange IP-Address (recommended) [📖 15].
  Program 2 will be created later.

4.1.2.2 Program 2

- The complete program looks like this:

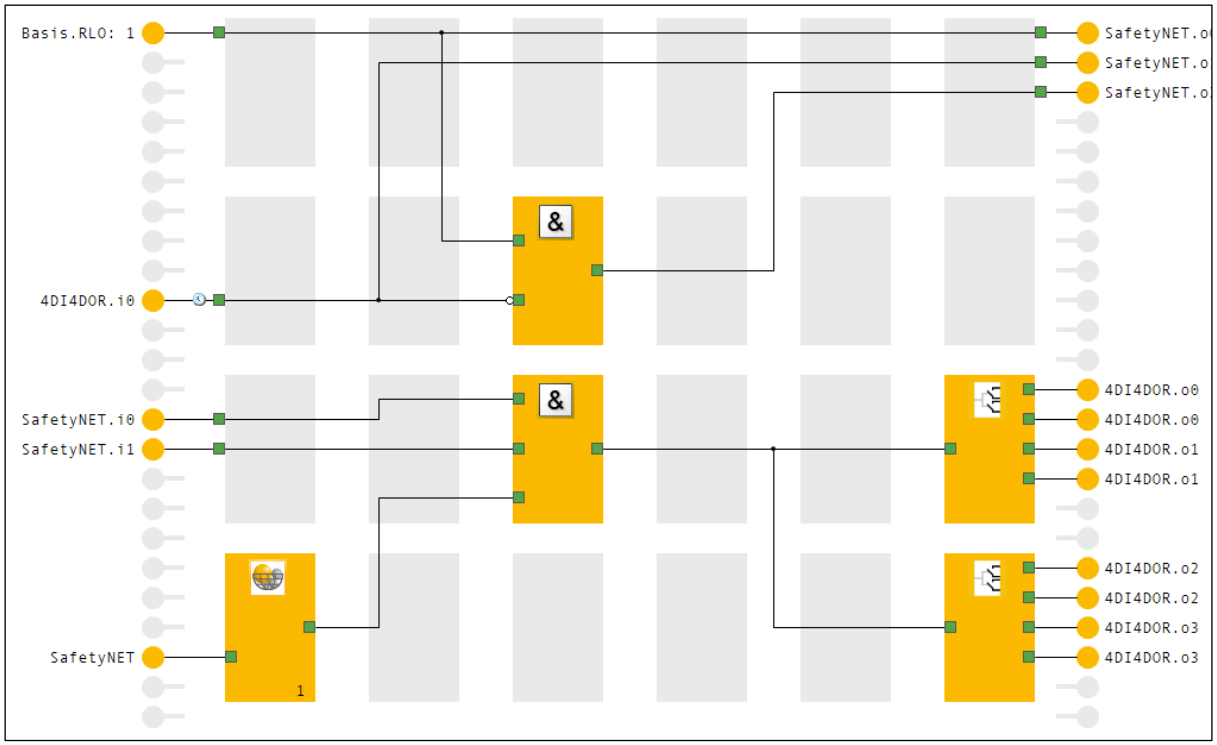


Figure 17: Program 2

4.1.3 Change IP-Address (recommended)

- The respective base unit must be connected DIRECTLY to the configuration PC via network cable (Not via the other base unit).
- Then the appropriate connection can be selected (Default IP: 169.254.60.1).

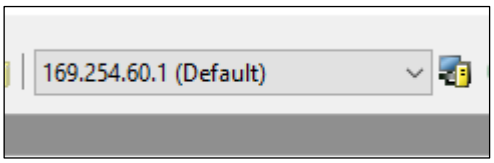


Figure 18: Select interface

- The "Online" button establishes a connection to the base unit.

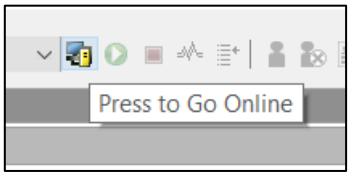


Figure 19: Button "Online"

- Once the connection is established, the "Configure Device Ethernet Connection..." button can be selected.

Figure 20: Button "Configure Device Ethernet Connection..."

- An IP address for the base unit must now be set here. (Important: Activate the checkbox "Use as project Ethernet connection").
  - For program 1 we use 192.168.0.50
  - For program 2 we use 192.168.0.51

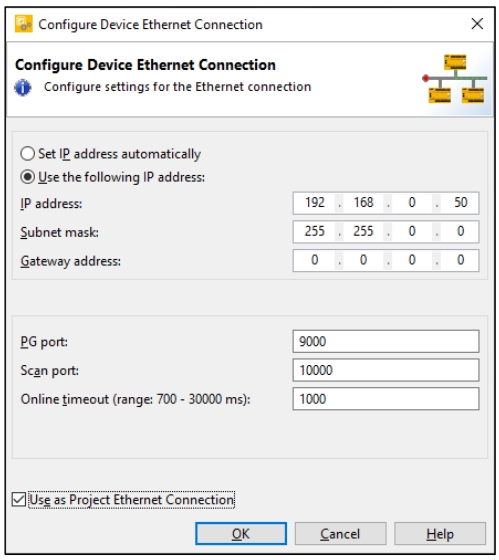


Figure 21: Set IP-Address and checkbox

- A window opens. Confirm with yes.

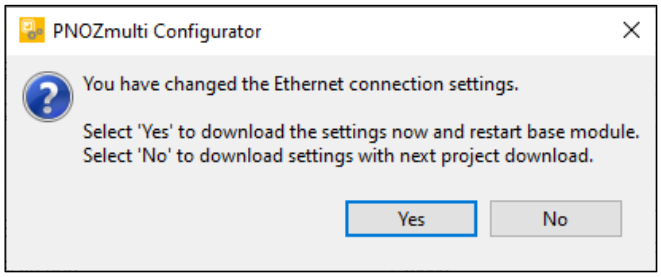


Figure 22: Apply settings and restart

- Now the device data of the base unit must be entered to verify that the IP address is changed on the correct device.

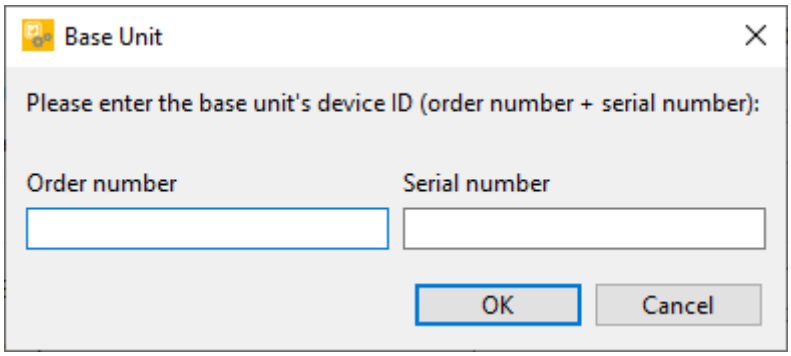


Figure 23: Enter device data

- The device is assigned the new IP address and the process is confirmed with the following window:

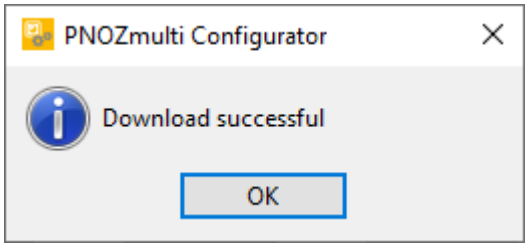


Figure 24: Confirmation of correct download

- If this has been done for both projects, both devices can now be connected to the configuration PC, as shown in Figure 1: Application – Structure of the hardware (schematic) [📖 7].

4.1.4 Save program

- Select the “Save” button to save the program.

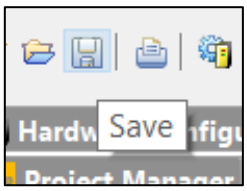


Figure 25: Button "Save"

- Since there is no SafetyNET p configuration yet, the following note can be confirmed with "OK".

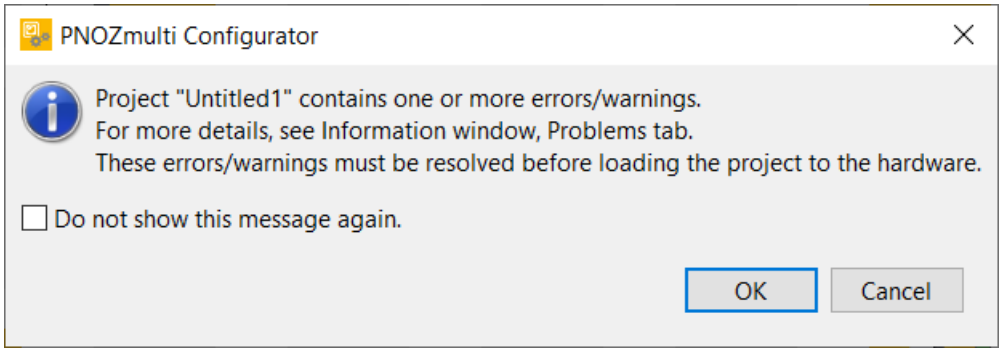


Figure 26: Hint with error/warning

- In the next window, passwords for the 3 user levels must be defined. However, only level 1 is used in this AN.

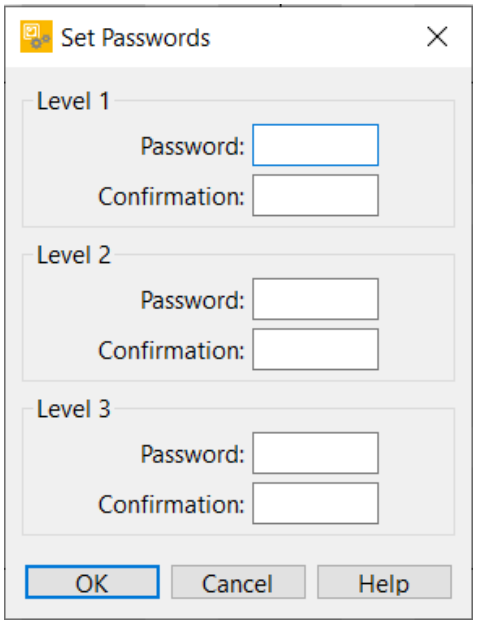


Figure 27: Set up passwords

- Now the save path must be selected. Then confirm with "OK".

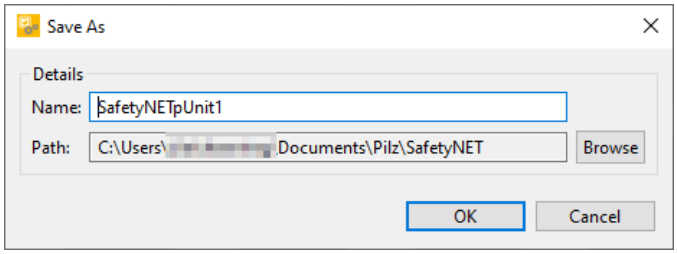


Figure 28: Choose save path

- The program is saved.
- You can now start creating the 2nd program. To do this, repeat the steps from Chapter 4.1 Configuration in the PNOZmulti Configurator [📖 9]
- Program 2 should be saved in the same directory as program 1.

4.2 Configuration in the PNOZmulti Network Editor

- Once the two programs have been created, the SafetyNET p connection can be configured.
- To do this, start the editor in the PNOZmulti Configurator (regardless of whether it is newly opened or still in the project) via Project → PNOZmulti Network Editor → Start PNOZmulti Network Editor....

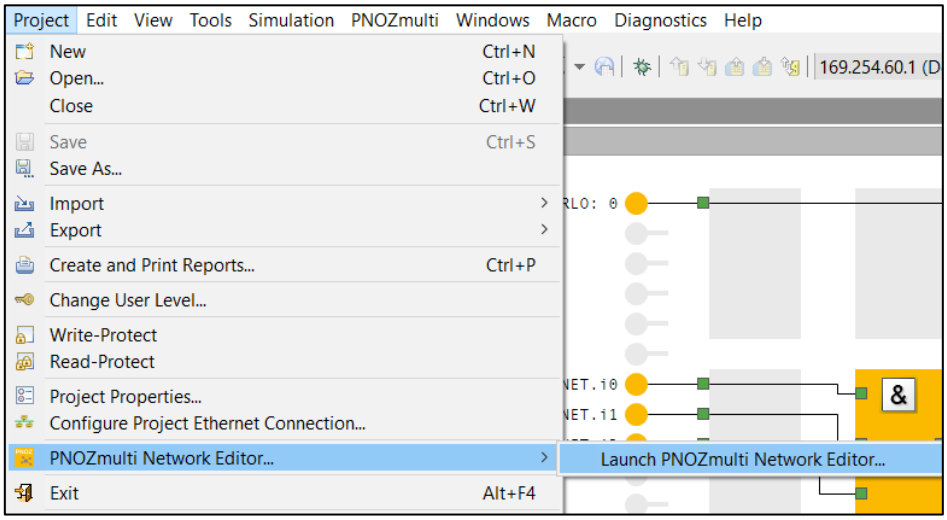


Figure 29: Start PNOZmulti Network Editor

- With the button "New" a new SafetyNET p project is created. This is necessary to correctly assign the virtual inputs and outputs between the projects.

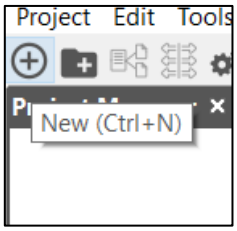


Figure 30: Button "New"

- A project name and the save location are assigned here.

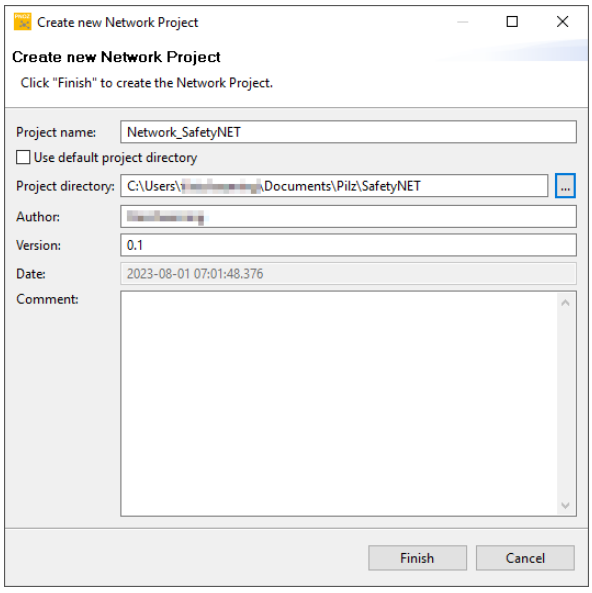


Figure 31: Set up project name and save path

- Now the option "Copy sub-project into Nework project" can be selected via the context menu on the newly created project in the project manager.

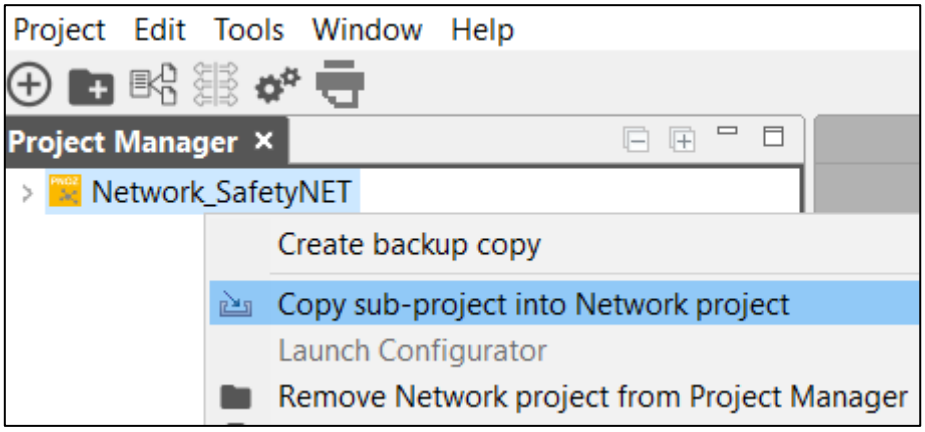


Figure 32: Copy sub-project

- In the new window, select the parent folder where the two projects are located:
  - Prerequisite: Both projects are located in the same folder.

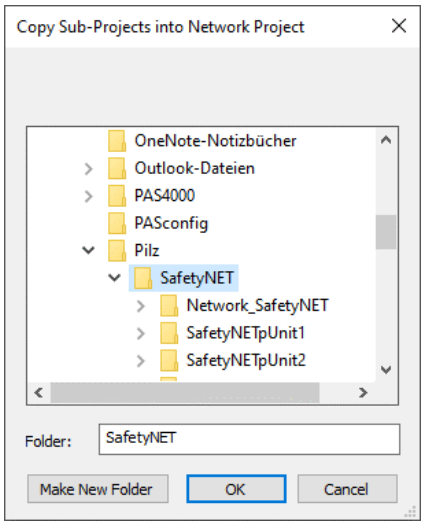


Figure 33: Choose folder

- All projects in the directory that can be integrated into the network are now displayed. All required projects must now be selected. Then confirm with "OK".

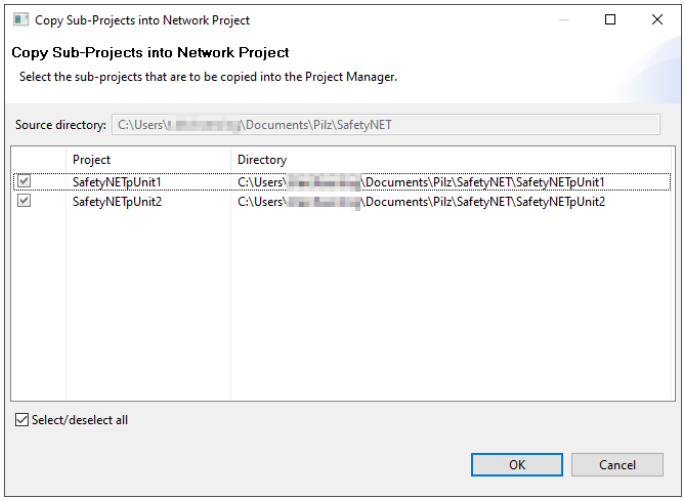


Figure 34: Project view

- The projects are now copied to the network project and are visible in the project manager. One of the projects is marked as [Master].

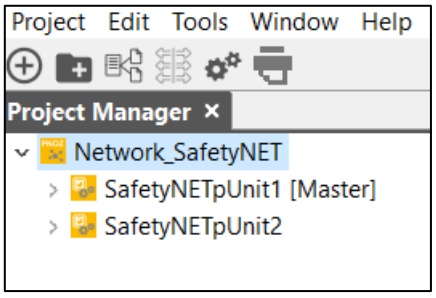


Figure 35: Project manager after adding the projects

- Now the mappings must be carried out. For this purpose, the I/O Mapping Editor must be opened.

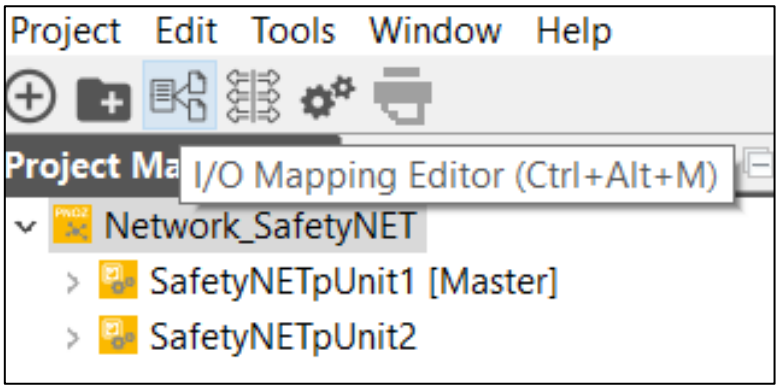


Figure 36: Open I/O Mapping Editor

- The first program is selected as the data source and the second as the data sink.

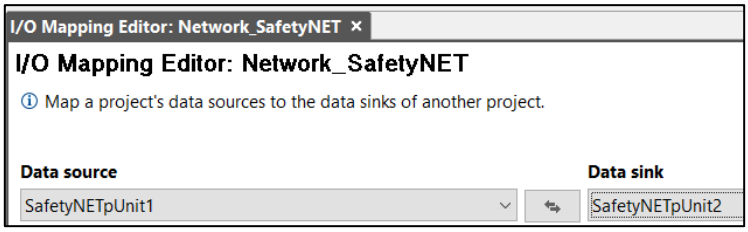


Figure 37: Data source and data sink

- Now an output is selected as source and the corresponding input in the 2nd program as sink. Subsequently, the selected inputs and outputs can be connected with each other via the button "Perform mapping".

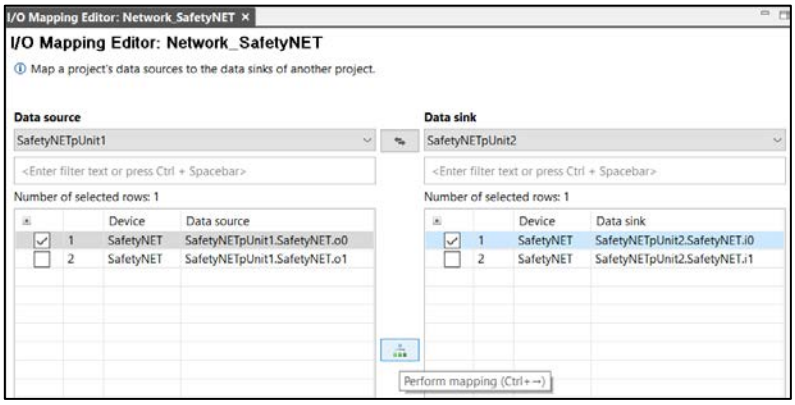


Figure 38: Perform mapping

- The performed mapping can be checked in the I/O mapping list.

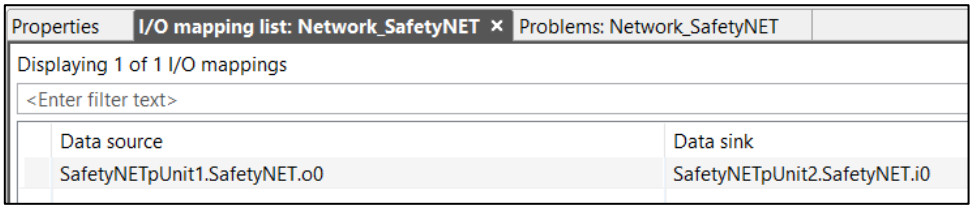


Figure 39: I/O mapping list

- This is done for all combinations. Then the data source and data sink can be swapped. Then the mappings can be made again.
- There are several ways to swap the data sink and source:
  - By the arrow key (for two projects):

Figure 40: Swap arrows

  – By selecting the source and sink (for two or more projects).

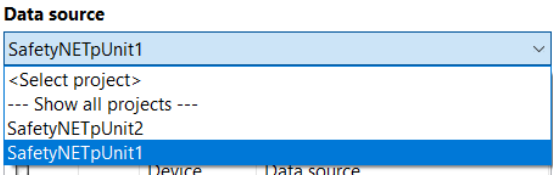


Figure 41: Swap data source

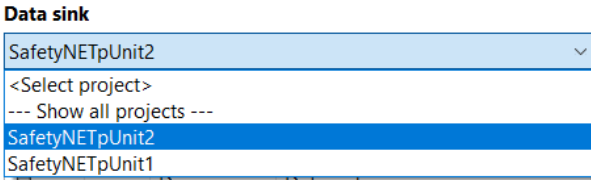


Figure 42: Swap data sink

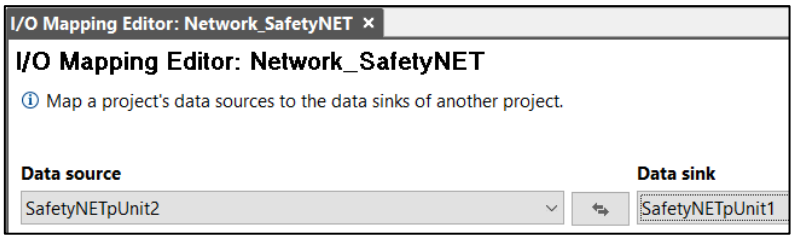


Figure 43: Swapped data source and data sink

- Finally, the mapping should look something like the following:

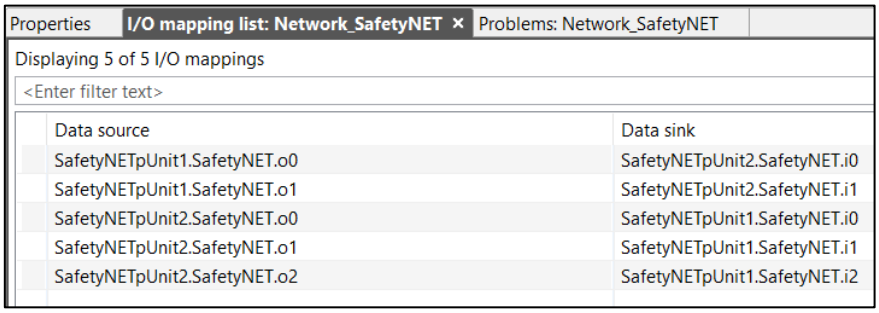


Figure 44: I/O mapping result

- Now the mapping is complete. Program 1 can be opened again.

INFORMATION

Program 1 copied from the computer must be opened from the folder of the SafetyNET p project. Please note the directory path in Figure 45.

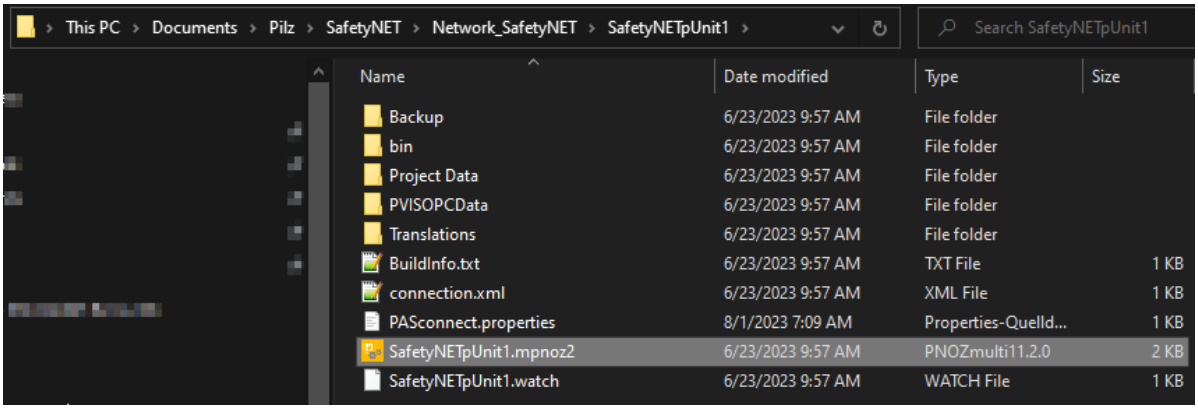


Figure 45: Open copied SafetyNET project

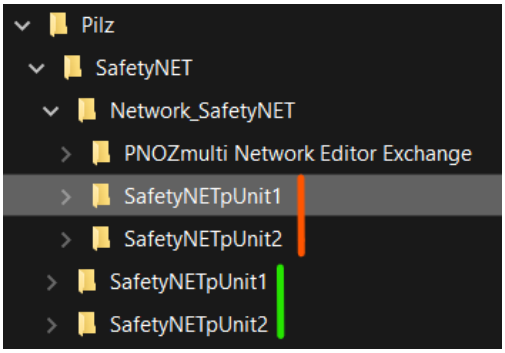


Figure 46: Green - Original project, Red - Copied SafetyNET project

- After opening, the password for level 1, which was previously assigned, is requested first:

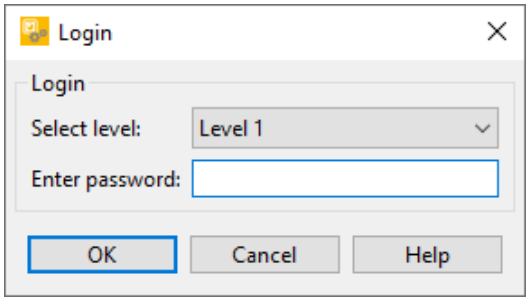


Figure 47: Login window

- The following message should now appear, which can be confirmed with "OK":

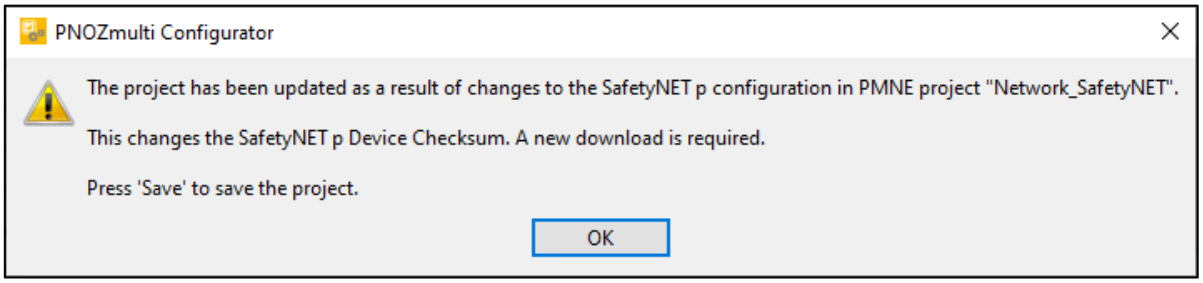


Figure 48: Note regarding changes

- The PNOZmulti Configurator project manager now has some icons as a background. This shows that the project has a SafetyNET p connection.

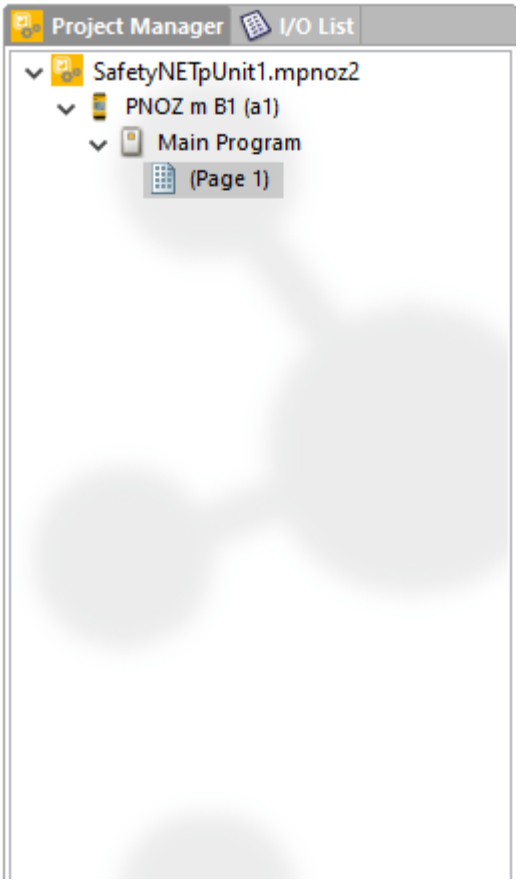


Figure 49: Project manager with background

- About Project → Project Properties... and then in the "SafetyNET details" tab this can also be checked. Project details should be found here.

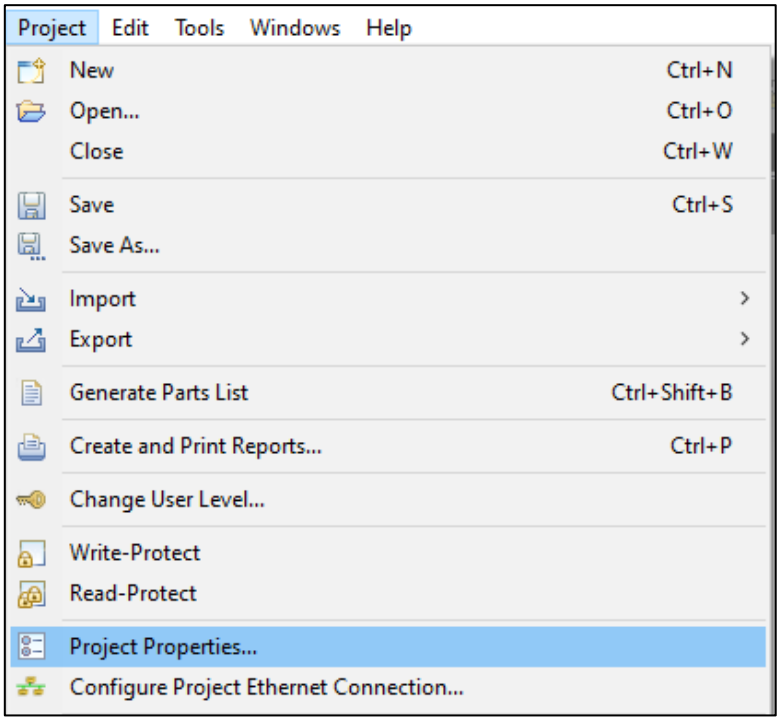


Figure 50: Project Properties

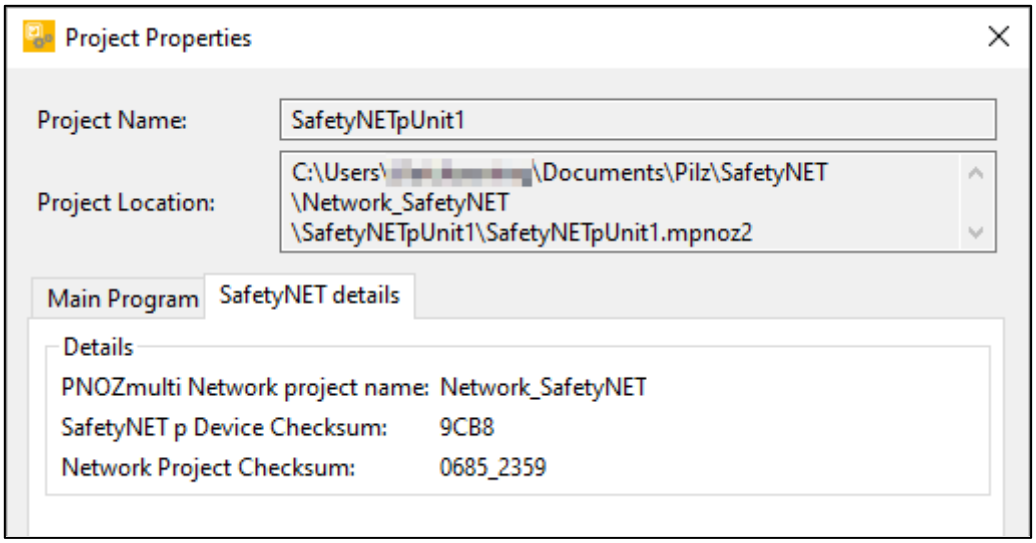


Figure 51: Project Properties, Tab "SafetyNET details"

- The window can be closed.
- Clicking on "Save" again and confirming the message with "OK" means that the project is ready for transfer.

4.3 Download projects to the devices

The download of the programs to the two devices is identical. For the purposes of transparency, only the download of program 1 is explained here.

- To download the program, an online connection must be established with the PNOZ mB1. To do this, select the correct interface, which was set up in Chapter 4.1.3 Change IP-Address (recommended) [📖 15].

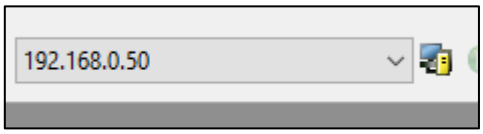


Figure 52: Select interface

- Then click the "Online" button (see Figure 19: Button "Online" [📖 15]).
- The project can now be transferred to the PNOZ m B1 via the project manager.

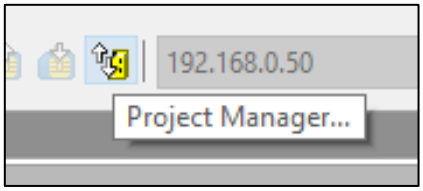


Figure 53: Button "Project Manager"

- The device data from the PNOZ m B1 must now be entered in the following confirmation prompt (See Figure 23: Enter device data [📖 16]).
- In the project manager, the program can now be saved to the USB memory.

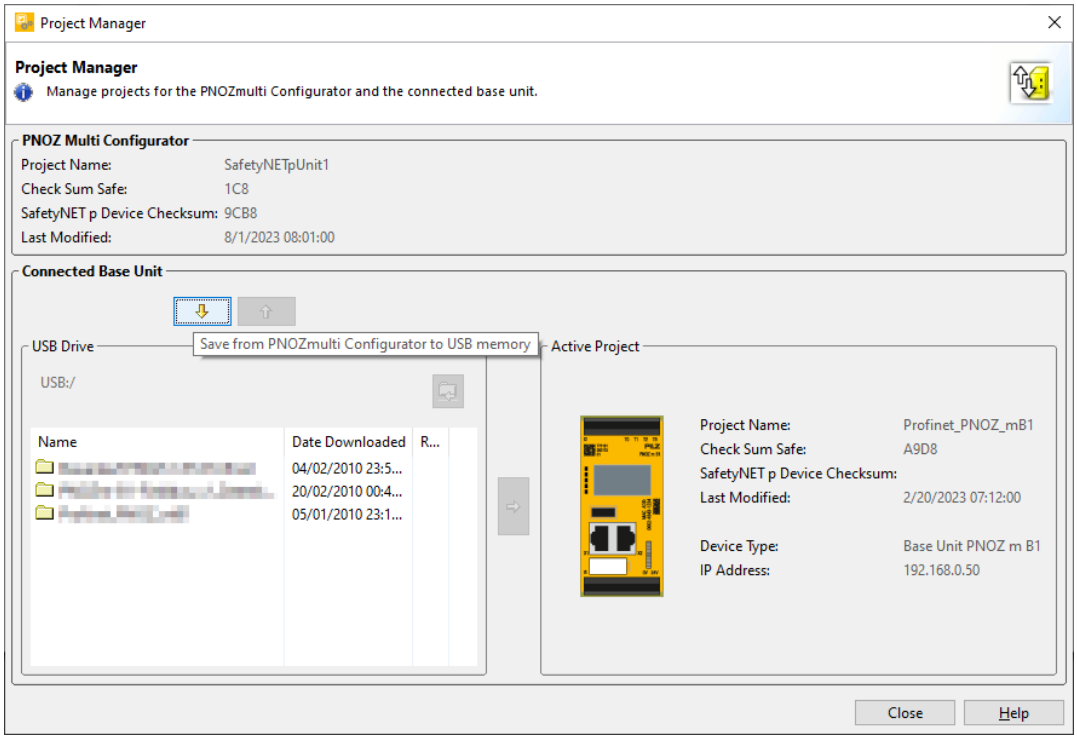


Figure 54: Project manager → Save to USB

- The unit should then activate the program. Thus, the upper option can remain selected.

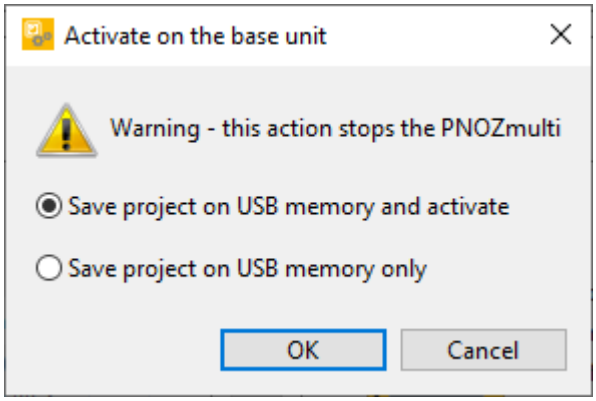


Figure 55: Activate program

- Restart unit.

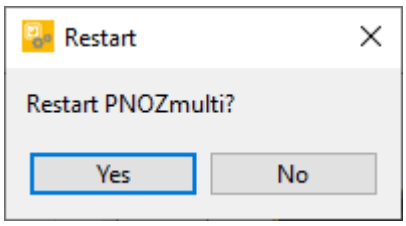


Figure 56: Restart unit

- Now the procedure from Chapter 4.3 must be repeated for program 2.

5 Testing of the SafetyNET p – Connection

- If everything is working properly, the O2 and O3 LEDs on the PNOZ m EF 4DI4DOR, program 1, light up.
- If 24V is now applied to input I0 of the PNOZ m EF4DI4DOR (program 2), its I0 LED lights up, as well as the output LEDs of both relay modules.
- The SafetyNET p connection has been established and is working.

6 Table of figures

Support

Technical support is available from Pilz round the clock.

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