

Build a SafetyNET p connection between two PNOZmulti 2 systems



Product

Type:Small controllersName:PNOZ m B1, PNOZ m ES SafetyNETManufacturer:Pilz GmbH & Co. KG, Safe Automation

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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 <u>www.pilz.com</u>. For a simple search, use our <u>content document (1002400)</u> or the <u>direct search function</u> in the download area.

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August 2023

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Abbreviations

Abbreviation / term	Description	Source
AN	Application Note	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	www.pilz.com > PSS
	(DE: Programmierbares Steuerungssystem)	
PSS u2	PSSu niversal, 2 nd generation	www.pilz.com > PSS u2
POU	Program Organization Unit	
NC	Normally Closed	
NO	Normally Open	
Equipment ID	Equipment Identifier	

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.

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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	772101	01.09.00	2
1	PNOZ m B1			
2	Hardware	772122	01.01.00	2
2	PNOZ m EF SafetyNET			
2	Hardware	772143	1.1	2
3	PNOZ m EF 4DI4DOR			
4	Hardware	380001		1
4	SN CAB RJ45s RJ45s, 0,5m			
E	Hardware	751016		2
5	Set4 Spring Terminals			
6	Hardware	751017		2
0	Set 5 Spring Terminals			
7	Hardware	783540		2
1	Spring terminals PNOZ mml2p			
0	Software		11.2.0	
0	PNOZmulti Configurator			
0	Online help		11.2.0	
9	PNOZmulti Configurator			

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.

Configured Hardware								
	Module Name	Version	Equipment Identifier	Location Description	I	0		
-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

1	INFORMATIC The placehold be used for lo	DN der in the le ogic blocks.	ft and right are re	eserved for	r input and out	put elements and canno	t
			LOGIC				

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



Figure 8: Select element

Accept with "OK"

Configure Logic Element		×
Logic element: AND Gate ③ Settings for configuration of the element	AND Gate.	&
General		
Inputs Number of inputs: 2 ~		
Negate Input 1 Input 2 Input 4 Input 5 Output Input 5	Input 3	
Equipment ID Enter equipment ID:		
ОК	Cancel Help	

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

Relay Output	Х
Output element: Redundant Relay	
Outputs General PVIS	
Number of outputs	
◯ Single output	
Feedback loop used	
Connections	
Output 1: Equipment ID: 4DI4DOR \sim I/O: o0 \sim	
Output 2: Equipment ID: 4DI4DOR \checkmark I/O: 01 \checkmark	
Output Allocation	
o0 = 13 / 14	
01 = 23 / 24	
o2 = 33 / 34	
o3 = 43 / 44	
OK Cancel Help)

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.

—					
-		🖳 Inse	ert Elen	nent	×
-		Inse Stat	rt Safety us	yNET p	
-		ا چ		چ ا	\$
		N	L.		
		8	j (3	

Figure 14: Add SafetyNET p status

> The standard configuration is sufficient here.

Configure SafetyNET p Status Element	×
SafetyNET p Status: Status element	
General PVIS	
Settings Select SafetyNET p Module: SafetyNET ~	
Element ID	
Activate diagnostics	
Select Element ID: 1 V	
Equipment ID	
Enter equipment ID:	
Location description	
Enter location description:	
OK Cancel Help	

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.

- ** 📰 🛔 🐌 🔠 🗐 象 🗊 💦 📕	• 4 4 • 6 6 • • • 0
	Configure Device Ethernet Connection

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:

PNOZmulti Configurator	×
Download successful	
ОК	

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.

Set Passwords X
Level 1
Password:
Confirmation:
Level 2
Password:
Confirmation:
Level 3
Password:
Confirmation:
OK Cancel Help

Figure 27: Set up passwords

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

Save	As	×
- Details Name	KafetyNFTnI Init1	1
Path:	C:\Users\ Documents\Pilz\SafetyNET	Browse
	ОК	Cancel

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....

Pro	ject	Edit	View	Tools	Simulation	PNOZmulti	Windows	Macro	Diagnostics	Help	
ĽĴ ⁄≧	Nev Ope	v en					Ctrl+N Ctrl+O	-	🗚 🖘 🕅 🕅) 🙆 🏠 👸 📔	169.254.60.1 (D
(T-T)	CIO	se					Ctrl+W	- 55			
	Sav	e e As					Ctri+S				
	Imp	ort						> RLO			
	Cre	ate an	d Print	Report	5		Ctrl+P	<u> </u>			
	Cha	inge U	lser Lev	el							
6	Wri	te-Pro	tect								
8	Pro	iect Pr	opertie	s				NET	. i 0 🔴 💶		
**	Cor	nfigure	e Projec	t Etherr	net Connectio	on		NET	.i1		
	PNC	DZmu	lti Netw	vork Edi	tor			>	Launch PNOZr	nulti Network	Editor
4	Exit						Alt+F4		-		

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.

0N	turadi Dania at		
create new Ne	twork Project		
Click "Finish" to o	reate the Network Project.		
Project name:	Network_SafetyNET		
Use default pro	ject directory		
Project directory:	C:\Users\		
Author:	the design of the second se		
Version:	0.1		
Date:	2023-08-01 07:01:48.376		
Comment:			^
			~

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.

Copy Sub-Projects into Network Project	×						
OneNote-Notizbücher	^						
> Outlook-Dateien							
> PAS4000							
PASconfig							
V Pilz							
SafetyNET							
> Network_SafetyNET							
> SafetyNETpUnit1							
> SafetyNETpUnit2							
	Ť						
Folder: SafetyNET							
Make New Folder OK Cancel							

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".

💽 Сор	oy Sub-Projects into Netwo	rk Project —		×
Copy S	Sub-Projects into Ne	work Project		
Select	the sub-projects that are to	be copied into the Project Manager.		
Source	directory: C:\Users\	\Documents\Pilz\SafetyNET		
	Project	Directory		
 Image: A start of the start of	SafetyNETpUnit1	C:\Users\ Documents\Pilz\SafetyNET\SafetyNET	pUnit1	
>	Safety/NETpUnit2	C:\Users\\Documents\Pilz\Safety/NET\Safety/NET	pUnit2	
Selec	ct/deselect all			
		ОК	Can	cel

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.

I/O Mapping Editor: Network_SafetyNET ×								
I/O Mapping Editor: Network_SafetyNET								
① Map a project's data sources to the data sinks of another project.								
Data source		Data sink						
SafetyNETpUnit1	\sim +	SafetyNETpUnit2						

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".

			es to the data sinks of another project.					
Data so	arce				Data sin	ık		
SafetyN	ETpUn	it1	~	*	SafetyN	ETpUr	iit2	
<enter< td=""><td>filter t</td><td>ext or press Ctrl</td><td>+ Spacebar></td><td></td><td><enter< td=""><td>filter t</td><td>ext or press Ctr</td><td>i + Spacebar></td></enter<></td></enter<>	filter t	ext or press Ctrl	+ Spacebar>		<enter< td=""><td>filter t</td><td>ext or press Ctr</td><td>i + Spacebar></td></enter<>	filter t	ext or press Ctr	i + Spacebar>
Number	of sele	ected rows: 1			Number	of sel	ected rows: 1	
		Device	Data source				Device	Data sink
	1	SafetyNET	SafetyNETpUnit1.SafetyNET.o0			1	SafetyNET	SafetyNETpUnit2.SafetyNET.i0
	2	SafetyNET	SafetyNETpUnit1.SafetyNET.o1			2	SafetyNET	SafetyNETpUnit2.SafetyNET.i1
				1.42	1			

Figure 38: Perform mapping

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

Pro	perties	I/O mapping list: Network_SafetyNET × Proble	ems: Network_SafetyNET						
Dis	Displaying 1 of 1 I/O mappings								
<	<enter filter="" text=""></enter>								
	Data source Data sink								
	SafetyN	ETpUnit1.SafetyNET.o0	SafetyNETpUnit2.SafetyNE	T.i0					

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).

Data source	Data sink	
SafetyNETpUnit1 ~	SafetyNETpUnit2 ~	
<select project=""> Show all projects</select>	<select project=""> Show all projects</select>	
SafetyNETpUnit2	SafetyNETpUnit2	
SafetyNETpUnit1 Device Data source	SafetyNETpUnit1	

Figure 41: Swap data source

Figure 42: Swap data sink

I/O Mapping Editor: Network_SafetyNET ×		
I/O Mapping Editor: Network_SafetyNET		
① Map a project's data sources to the data sinks of another project.		
Data source		Data sink
SafetyNETpUnit2 ~	+	SafetyNETpUnit1

Figure 43: Swapped data source and data sink

Finally, the mapping should look something like the following:

Properties I/O mapping list: Network_SafetyNET × P	roblems: Network_SafetyNET
Displaying 5 of 5 I/O mappings	
<enter filter="" text=""></enter>	
Data source	Data sink
SafetyNETpUnit1.SafetyNET.o0	SafetyNETpUnit2.SafetyNET.i0
SafetyNETpUnit1.SafetyNET.o1	SafetyNETpUnit2.SafetyNET.i1
SafetyNETpUnit2.SafetyNET.o0	SafetyNETpUnit1.SafetyNET.i0
SafetyNETpUnit2.SafetyNET.o1	SafetyNETpUnit1.SafetyNET.i1
SafetyNETpUnit2.SafetyNET.o2	SafetyNETpUnit1.SafetyNET.i2

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.

🔜 > This PC > Documents > Pilz > SafetyNET > Network_SafetyNET > SafetyNETpUnit1 > 🗸 💍				, ○ Search SafetyNETpUnit1	
	<u>^</u>	Name	Date modified	Туре	Size
			6/23/2023 9:57 AM	File folder	
		📊 bin	6/23/2023 9:57 AM	File folder	
	- H.	📊 Project Data	6/23/2023 9:57 AM	File folder	
-	- H.	PVISOPCData	6/23/2023 9:57 AM	File folder	
raman kasan		📊 Translations	6/23/2023 9:57 AM	File folder	
	- M. H.	🥁 BuildInfo.txt	6/23/2023 9:57 AM	TXT File	1 KB
		🥁 connection.xml	6/23/2023 9:57 AM	XML File	1 KB
		PASconnect.properties	8/1/2023 7:09 AM	Properties-Quelld	1 KB
		SafetyNETpUnit1.mpnoz2	6/23/2023 9:57 AM	PNOZmulti11.2.0	2 KB
		SafetyNETpUnit1.watch	6/23/2023 9:57 AM	WATCH File	1 KB

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:

📮 Login		×
Login		
Select level:	Level 1	~
Enter password:		
ОК	Cancel	Help

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

- Project Edit Tools Windows Help 📑 New Ctrl+N Ctrl+O 글 Open... Close Ctrl+W 🔚 Save Ctrl+S Save As... 🚵 Import > 🛃 Export > Generate Parts List Ctrl+Shift+B ≞ Create and Print Reports... Ctrl+P Change User Level... -Write-Protect ø Read-Protect 0-0-Project Properties... Configure Project Ethernet Connection... ***
- 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

Project Properties		×
Project Name:	SafetyNETpUnit1	
Project Location:	C:\Users\ \Network SafetyNET	ocuments\Pilz\SafetyNET
	\SafetyNETpUnit1\SafetyN	IETpUnit1.mpnoz2 v
Main Program Safe	yNET details	
Details		
PNOZmulti Networ	k project name: Network_Sa	fetyNET
SafetyNET p Device	Checksum: 9CB8	
Network Project Ch	ecksum: 0685_2359	

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].

192.168.0.50	~ 🖏

Figure 52: Select interface

- > Then click the "Online" button (see Figure 19: Button "Online" [1] 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.

🞴 Project Manager					×
Project Manager Manage projects for the PNOZmulti C	onfigurator and the o	connected base u	nit.		Ŷ
- PNOZ Multi Configurator	Tallaist				
Check Sum Safet	iponiti				
Safet /NET n Device Checksum: 9CB8					
Last Modified: 8/1/2023	08:01:00				
Connected Base Unit					
USB Drive Save from P USB:/ Name	NOZmulti Configurat Date Downloaded 04/02/2010 23:5 20/02/2010 00:4 05/01/2010 23:1	R	Active Project	Project Name: Check Sum Safe: SafetyNET p Device Checksun Last Modified: Device Type: IP Address:	Profinet_PNOZ_mB1 A9D8 2/20/2023 07:12:00 Base Unit PNOZ m B1 192.168.0.50
					Close <u>H</u> elp

Figure 54: Project manager \rightarrow Save to USB

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

Activate on the base unit	×			
Warning - this action stops the PNOZmulti				
Save project on USB memory and activate				
○ Save project on USB memory o	nly			
ОК	Cancel			

Figure 55: Activate program

Restart unit.				
🞴 Restart	×			
Restart PNOZmulti?				
Yes	No			

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.

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