

Read Profinet Records from PNOZ m B1 with TIA-Portal



Product

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

Document

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Important Note

Prerequisite is Application Note 1003896-EN-xx

Document Revision History

Release	Date	Changes	Chapter
01	2023-08-17	Creation	all

Validity of Application Note

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We are grateful for any feedback on the contents.

August 2023

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Industrial Security

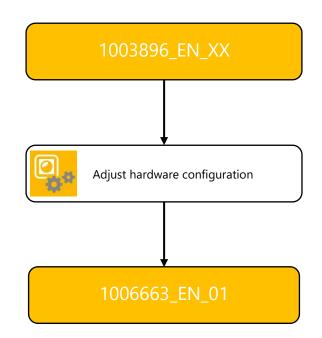
To secure plants, systems, machines and networks against cyberthreats it is necessary to implement (and continuously maintain) an overall <u>Industrial Security concept</u> that is state of the art. Perform a risk assessment in accordance with VDI/VDE 2182 or IEC 62443-3-2 and plan the security measures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

Documentation Guide

To handle this Application Note it is assumed that a Profinet connection between the base unit and the Siemens F-CPU has already been established. This procedure is explained in more detail in Application Note 1003896-EN-XX using a PNOZ m B0. In this Application Note, on the other hand, a PNOZ m B1 is used.

INFORMATION

For process data and device connections, Profinet records can only be used with a PNOZ m B1 base unit, unlike described in Application Note 1003896-EN-XX (see Chapter 2 Used hardware and software [1] 7]). The hardware configuration of the PNOZmulti program should be adapted accordingly. This is not necessary for reading out the device data and the project name, as described in this Application Note.



Abbreviations

Abbreviation / term	Description	Source
AN	Application Note	www.pilz.com > AN content (1002400)
PNOZ		www.pilz.com > PNOZ
	(DE: Pilz NOT-AUS-Zwangsgeführt)	
TIA	EN: Totally Integrated Automation (SIMATIC)	

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	Communication Interfaces PNOZmulti	www.pilz.com > Download 1002971
3	Operation Manual PNOZ m B1	www.pilz.com > Download 1003790
4	Operation Manual PNOZ m ES Profinet	www.pilz.com > Download 1003386
5	Operation Manual PNOZ m EF 4DI4DOR	www.pilz.com > Download 1002702
6	Application Note "PNOZmulti 2 Profinet communication with	www.pilz.com > Download 1003896
	S7-1500 PLC in TIA Portal V13 "	

1.2 Documentation from other sources of information

No.	Description	Item No. / Download
1	PI Portal (PROFIBUS and PROFINET International)	www.profibus.com
2	Profile Guidelines Part 1: Identification & Maintenance Functions	www.profibus.com > Download
3	Siemens Homepage, Safety integrated	<u>www.siemens.com > Safety</u> Integrated
4	SIMATIC Industrial Software	A5E02714439-AL; 05/2021
	SIMATIC Safety - Configuring and Programming	support.industry.siemens.com >
	Programming and Operating Manual	<u>54110126</u>
	UNICODE Chart	-

2 Used hardware and software

2.1 Pilz products

No.	Descriptions	Order number	Version	Number
1	Hardware Base Unit	772101	0109	1
1	PNOZ m B1			
2	Hardware Electronic module	772138	2.3	1
2	PNOZ m ES Profinet			
3	Hardware Electronic module	772143	2.2	1
5	PNOZ m EF 4DI4DOR			
1	Hardware Clamp set	750016		1
4	Set4 Screw Terminals			
	Hardware Clamp set	783542		1
5	Spring terminals PNOZ mmcxp, 1 pc			
	Note: Also available in packages of 10 pieces.			
6	Hardware Clamp set	783540		1
U	Spring terminals PNOZ mml2p			
7	Software PNOZmulti Configurator		11.2.0	

2.2 Third-party products

No.	Descriptions	Order number	Version	Number
1	Siemens SIMATIC S7-1518F-4 PN/DP	6ES7518-4FP00-	3.0	1
1		0AB0		
2	Software SIMATIC STEP 7 Professional		V17.0 Upd1	
3	Software SIMATIC STEP 7 Safety		V17.0	
4				

2.3 Structure of the application (schematic)

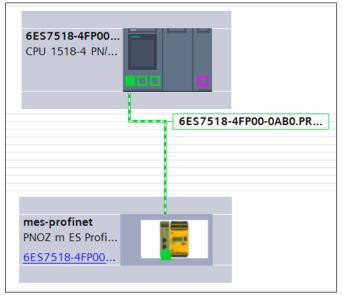


Figure 1: Application – Structure of the hardware (schematic)

3 Application description

The AN show how the device and project data can be read from a PNOZmulti 2 system using the Profinet records. A Siemens S7-1500 controller is used as Profinet master.

Configure a simple Profinet records data transfer in TIA Portal (see Chapter 4) based on Application Note 1003896-EN-XX. This is a prerequisite for further processing of the AN.

The basic hardware configuration for the Siemens PLC and the PNOZmulti is not part of this documentation. The procedure for successful basic configuration is shown 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 PNOZ multi 2 system with the order number 772101 and is not intended as a technical documentation for general use of SIMATIC STEP 7 Professional.

3.1 Prerequisites for the use of records

Data ranges:

	PNOZ m B0	PNOZ m B1
Process data for base unit and expansion modules: [🛄 82]		
Base unit	1	1
Expansion modules right 1 6	1	1
Expansion modules right 7 12	-	from V1.1
Expansion modules left 1 … 4	1	1
ST expansion modules	-	from V1.1 [1]
▶ State of safe inputs i0 … i31	1	~
▶ State of safe outputs o0 … o31	1	√
Status of system LEDs	1	1
Status of IO LEDs	1	1
Status of the expanded inputs i32 i127 when using the module PNOZ m EF SafetyNET	from V2.3	from V1.2
▶ Advanced data	from V2.3 [2]	from V1.1 [2]
Process data: Fieldbus and communication module	1	1
State of virtual standard inputs i0 i127	1	1
State of virtual standard outputs o0 o127	1	1
Status of system LEDs	1	1
Connected devices		
1st device connection	-	from V1.5 ^[3]
> 2nd 8th device connection	-	from V1.6 [3]
Diagnostic words	1	1
▶ Diagnostics	1	1
Enable elements	1	-
▶ Element IDs	1	-
Project data	1	1
▶ Check sums	1	1
▶ Date	1	1

	PNOZ m B0	PNOZ m B1
▶ Project name	1	~
Device data [🖵 132]		
Base unit	1	✓
Expansion modules right 1 … 6	1	✓
Expansion modules right 7 … 12	-	from V1.1
Expansion modules left 1 … 4	1	✓
ST expansion modules	-	from V1.1
▶ Product	1	✓
▶ Firmware	1	\checkmark
Operating hours	\checkmark	\checkmark

Figure 2: Prerequisites (Part 1) [p.80, Chapter 1.1 Nr.2]

[1] Minimum requirements for addressing the process data: ST expansion modules

Data	PNOZ m B1 V1.1	
Tables	√	
Modbus Register	√	
SDOs	Fieldbus modules from V2.0	
Profinet Records		
Ethernet IP instances		

[2] Minimum requirements for addressing the process data: Advanced data

Data	PNOZ m B0 V2.3	PNOZ m B1 V1.1	
Tables	\checkmark	\checkmark	
Modbus Register	PNOZ m ES ETH V1.1 ✓		
SDOs			
Profinet Records	Not supported	Fieldbus modules from	
Ethernet IP instances		V2.0	

[3] Minimum requirements for addressing the device connections

Data	PNOZ m B1 from V1.5	
Tables	√	
Modbus Register	√	
SDOs	Fieldbus modules from V2.0	
Profinet Records		
Ethernet IP instances		

Figure 3: Prerequisites (Part 2) [p.81, Chapter 1.1 Nr.2]

3.2 What are Profinet Records?

Record data are used to perform acyclic data exchange.

This includes the following information:

- Reading out diagnostic information
- Reading out identification information according to the "Identification and Maintenance (I&M)
- Functions".

- Reading back IO data

4 Application task

In the following instruction, the material number and the project name of the base unit are to be read out.

Using the "Communication interfaces" documentation from Chapter 1.1 Documentation from Pilz GmbH & Co. KG [[] 6], several pieces of information must be determined.

> The record index is required once.

Profinet Records

Device data		Profinet		
Info	Byte	Record	Byte	
Product	0 11	40	0 11	
Firmware	12 19	40	12 19	
Operating hours	24 27	40	24 27	

Figure 4: Profinet Records index determination [p.134]

In addition, the number and position of the bytes are required, which finally output the product number.

Product

Byte	Information
0	Product number, e.g. 772 100: 000BC804 (hex)
1	▶ Byte 0: 00
2	▶ Byte 1: 0B,
3	▶ Byte 2: C8,
Ľ	> Byte 3: 04
4	Serial number, e.g. 123 456: 0001E240 (hex)
5	▶ Byte 4: 00
6	▶ Byte 5: 01
7	▶ Byte 6: E2,
/	▶ Byte 7: 40
8	Device type, e.g. PNOZ m B0: 0060 (hex)
9	▶ Byte 8: 00
	▶ Byte 9: 60
	Device type, e.g. PNOZ m B1: 0061 (hex)
	▶ Byte 8: 00
	▶ Byte 9: 61
10	Unit version 20: 14 (hex)
11	▶ Byte 10: 00
	▶ Byte 11: 14

Figure 5: Profinet Records Byte determination [p.132]

- In the TIA Portal a RDREC block is created (function is explained in the screenshot).
- For this purpose the OB1 is opened.

Software PLC_1 [CPU 1505SP F]
Device configuration
🧏 Online & diagnostics
Safety Administration
🔻 🛃 Program blocks
💣 Add new block
📲 Main [OB1]
508_RTG1 [08123]

Figure 6: Open OB1

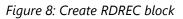
> Then the RDREC module can be searched for and inserted using the search function.

In	structions	a III)	
O	otions		
rd	irec ivit ivit	🖉 🗸	l Inst
>	Favorites		Instructions
>	Basic instructions		lions
~	Extended instructions		Ĩ
Na	me	Description	2
•	🛅 Date and time-of-day		-
•	🛅 String + Char		esting
•	🛅 Process image		ing
•	Distributed I/O		
	DP & PROFINET		
		Read data record	
		Write data record	່

Figure 7: RDREC in Library

This is a Siemens block that does not have to be adapted for this application. A more detailed description can be found in the online help.

▼ 🕃 Network 1: Read	Data	
With the help of the R	DREC Block, the device	and project data of a Profinet participant can be read out
	%DB2 *RDREC_DB	
	RDREC Variant	
—	EN	VALID — false
false —	REQ	BUSY — false
16#0 —	ID	ERROR — false
0 —	INDEX	STATUS — 16#0
0 —	MLEN	LEN 0
<m></m>	RECORD	ENO —



> A global DB must also be created, which contains the required variables.

Add new block			_		×
Name: RDREC_Data					
	Type:	🥃 Global DB	T		
OB	Language:	DB			
Organization block	Number:	4	÷		
DIOCK		🔘 Manual			
		 Automatic 			
FB	Fail-safe:	Create F-block	l.		
Function block	Description:				
	Data blocks (DBs) save program data.			
FC					
Function					
Data block					
	more				
> Additional inform	ation				
💽 Add new and open				ок	Cancel

Figure 9: Create data block

- 🗈	Static		
• 🗈	start	Bool	true
- 🗈	ident	HW_IO	271
- 🗈	index	DInt	40
- 🗈	maxLenght	DInt	0
- 🗈	valid	Bool	false
• 🗈	busy	Bool	false
- 🗈	error	Bool	false
• 🗈	status	DWord	16#0
- 🗈	recLength	DInt	0
- 🗈	recordData	Array[035] of Byte	

Figure 10: Create variables in the data block

- > The following variables get a start value:
 - start = true
 - The RDREC block should be constantly read the Records of PNOZmulti.
 - Ident 271
 - The ident variable is the hardware ID of the Profinet participant and can be found in TIA-Portal via "PLC tags" → "System constants".

External source files
🔻 🚂 PLC tags
着 Show all tags
📑 Add new tag table
🍯 Standard-Variablentabelle [72]
PLC data types
Watch and force tables

Figure 11: Show all variables

_ = = ×	Tasks
Tags 🗉 User constants 🔀 System constants	Option
	✓ Find
<u>^</u>	Find:

Figure 12: Open "System constants"

59	F	mes-profinet~PN-IO	Hw_Interface	268
60	<u>,</u>	mes-profinet~PN-IO~Port_1RJ45	Hw_Interface	269
61	F	mes-profinet~PN-IO~Port_2RJ45	Hw_Interface	270
62	x =	mes-profinet~Head	Hw_SubModule	271
63	F	mes-profinet~4_Input_BytesBits	Hw_SubModule	272
64	F	mes-profinet~4_Input_BytesBits	Hw_SubModule	273
65	F	mes-profinet~4_Input_BytesBits	Hw_SubModule	274
66	F	mes-profinet~4_Input_BytesBits	Hw_SubModule	275
67	F	mes-profinet~4_Output_BytesBi	Hw_SubModule	276
68	<u>,</u>	mes-profinet~4_Output_BytesBi	Hw_SubModule	277
60		mos profinat 4 Output Puter Pi	Hur SubMadula	279

Figure 13: HW-ID determine

- index = 40
 - index is the record index already determined.
- maxLenght = 0
 - maxLenght specifies the maximum length to be read back. If this is set to 0, the controller reads back the complete data set.
- The input and output data of the RDREC block must be assigned accordingly and then the program can be loaded onto the controller.

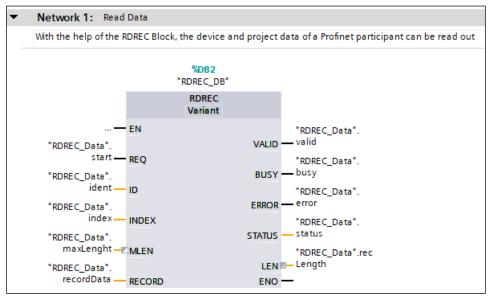


Figure 14: Variable assignment RDREC

<u>I</u> nsert	<u>O</u> nline Optio <u>n</u> s <u>T</u> ools <u>W</u> indow <u>H</u> elp	
: 昌	💋 Go o <u>n</u> line	Ctrl+K
:	💋 Extended go online	
	🔊 Go o <u>f</u> fline	Ctrl+M
	Use only legacy PG/PC communication	-
	🖳 Simula <u>t</u> ion	•
	Stop runtime/simulation	
ords	Download to device	Ctrl+L
vice	Extended download to device	
etworks	_ Download and reset PLC program	-
1 [CPU 1	Download user program to Memory Card	
configura		

Figure 15: Download to device

Status	!	Target	Message	Action
ψ	~	 PC-System_1 	Downloading to device completed without error.	Load 'Software PLC_1'
ψ	0	 Software PLC_1 	Downloading to device completed without error.	
	0	Start modules	Start modules after downloading to device.	Start module
	0	 CRC comparison 	Result of CRC comparison	
<				

Figure 16: Load configuration into the device

Create online connection

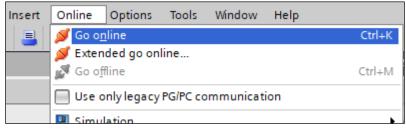


Figure 17: Create online connection

> "Monitor all" can now be selected in the database.

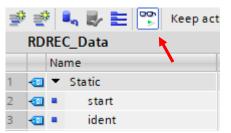


Figure 18: Activate "Monitor all"

▶ The records read out are now stored in the "recordData" array. The position and number of bytes were identified in Figure 5: Profinet Records Byte determination [p.132] [□ 11].

•	•	recordData	Array[035] of Byte		
	•	recordData[0]	Byte	16#0	16#00
	•	recordData[1]	Byte	16#0	16#0B
	•	recordData[2]	Byte	16#0	16#C8
	•	recordData[3]	Byte	16#0	16#05

Figure 19: Array "recordData" with product number

If you put the hex values together and convert them into decimal numbers, you get from 000BC805 the value 772101, which corresponds to the product number of the base unit.

> To read out the project name, only the index must be changed to 38.

Profinet records

Process data		Profinet		
Information	Byte	Record	Byte	
Check sums	0 3	37	0 3	
Date	12 23	37	12 23	
Project name	24 57	38	0 33	

Figure 20: Record index for project name [p.131 Chapter 1.1 Nr.2]

> With help of a Unicode Chart always 2 byte can be read together and translate to a character.

11	-	•	•	recordData	Array[035] of Byte		
12	-		•	recordData[0]	Byte	16#0	16#00
13	-00		•	recordData[1]	Byte	16#0	16#50
14	-00		•	recordData[2]	Byte	16#0	16#00
15	-00		•	recordData[3]	Byte	16#0	16#72
16	-		•	recordData[4]	Byte	16#0	16#00
17	-		•	recordData[5]	Byte	16#0	16#6F

Figure 21: Array "recordData" with project name

U+004F	0
U+0050	Р
TT: 0051	

Figure 22: Unicode 0050 results in "P"

So the first 6 bytes in Figure 21: Array "recordData" with project name results in "Pro".

The watch table can also be used to output the bytes as characters. For this purpose, a new watch table must be created.

▼ → Watch and force tables
Add new watch table
F→ Forcetabelle

Figure 23: Create new watch table

> The variable name is now entered here with [1] as the index in the display format "Character"

Name	Address	Display format
"RDREC_Data".recordData[1]		Character

Figure 24: Create variable in watch table

> This field can be dragged down with the dot in the lower right corner to continue the row.



Figure 25: Dot in the corner

- ▶ All lines with even index can then be deleted. The "Character" field can also be pulled down so that all variables are displayed as "Character", as shown in Figure 27 [□ 19].
- > With a click on "Monitor all" the name of the project is shown.



Figure 26: Button "Monitor all"

"RDREC_Data".recordData[1]	Character	'P'
"RDREC_Data".recordData[3]	Character	Υ.
"RDREC_Data".recordData[5]	Character	'o'
"RDREC_Data".recordData[7]	Character	ዋ
"RDREC_Data".recordData[9]	Character	Ψ.
"RDREC_Data".recordData[11]	Character	'n'
"RDREC_Data".recordData[13]	Character	'e'
"RDREC_Data".recordData[15]	Character	't'
"RDREC_Data".recordData[17]	Character	2
"RDREC_Data".recordData[19]	Character	'P'
"RDREC_Data".recordData[21]	Character	'N'
"RDREC_Data".recordData[23]	Character	'0'
"RDREC_Data".recordData[25]	Character	'Z'
"RDREC_Data".recordData[27]	Character	2
"RDREC_Data".recordData[29]	Character	'm'
"RDREC_Data".recordData[31]	Character	'B'

Figure 27: Program name in variable

▶ In this case the program name is "Profinet_PNOZ_mB1".

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