Read Profinet Records from PNOZ m B1 with TIA-Portal

PILZ
THE SPIRIT OF SAFETY

Product

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

Document

Release Number: NN
Release Date: 17 August 2023

Important Note
Prerequisite is Application Note 1003896-EN-xx

Application Note – 1006663_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

All rights to this publication are reserved by Pilz GmbH & Co. KG.
We reserve the right to amend specifications without prior notice. Copies may be made for the user's internal purposes.
The names of products, goods and technologies used in this manual are trademarks of the respective companies. Please note the current information about the products, their licenses and registered trademarks in the documents listed in Chapter 1 Useful documentation [📖 6].

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.
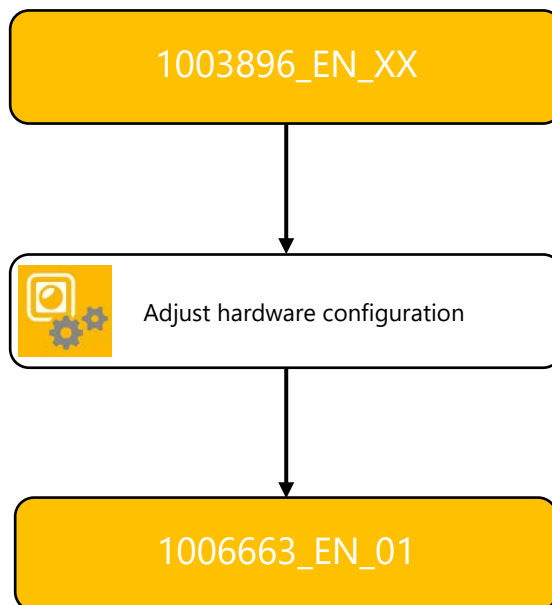
Documentation Guide

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 [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.

```
┌─────────────────────────┐
│     1003896_EN_XX       │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ ⚙ Adjust hardware       │
│    configuration        │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│     1006663_EN_01       │
└─────────────────────────┘
```

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
TIA	EN: **T**otally **I**ntegrated **A**utomation (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.

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	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 S7-1500 PLC in TIA Portal V13 "	www.pilz.com > Download 1003896

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	www.siemens.com > Safety Integrated
4	SIMATIC Industrial Software SIMATIC Safety - Configuring and Programming Programming and Operating Manual	A5E02714439-AL; 05/2021 support.industry.siemens.com > 54110126
	UNICODE Chart	-

2 Used hardware and software

2.1 Pilz products

No.	Descriptions	Order number	Version	Number
1	Hardware Base Unit PNOZ m B1	772101	0109	1
2	Hardware Electronic module PNOZ m ES Profinet	772138	2.3	1
3	Hardware Electronic module PNOZ m EF 4DI4DOR	772143	2.2	1
4	Hardware Clamp set Set4 Screw Terminals	750016	--	1
5	Hardware Clamp set Spring terminals PNOZ mmcxp, 1 pc Note: Also available in packages of 10 pieces.	783542	--	1
6	Hardware Clamp set Spring terminals PNOZ mml2p	783540	--	1
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	6ES7518-4FP00-0AB0	3.0	1
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)
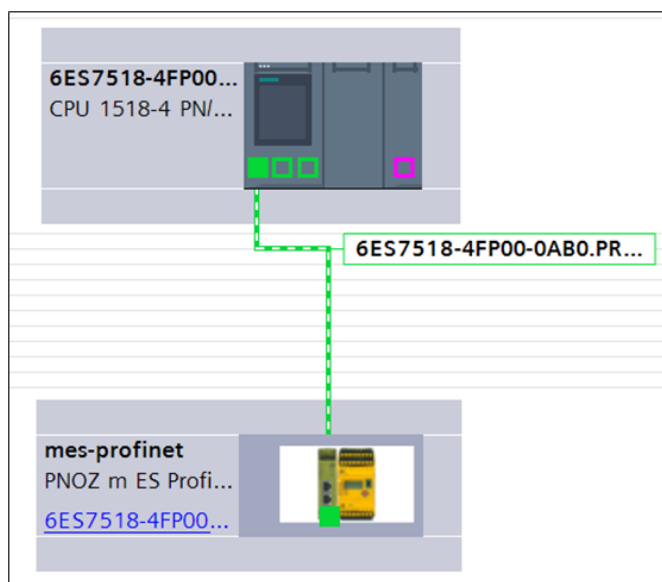
Figure 1: Application – Structure of the hardware (schematic)

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	✓	✓
Expansion modules right 1 … 6	✓	✓
Expansion modules right 7 … 12	-	from V1.1
Expansion modules left 1 … 4	✓	✓
ST expansion modules	-	from V1.1 [1]
▸ State of safe inputs i0 … i31	✓	✓
▸ State of safe outputs o0 … o31	✓	✓
▸ Status of system LEDs	✓	✓
▸ Status of IO LEDs	✓	✓
▸ 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	✓	✓
▸ State of virtual standard inputs i0 … i127	✓	✓
▸ State of virtual standard outputs o0 … o127	✓	✓
▸ Status of system LEDs	✓	✓
Connected devices		
▸ 1st device connection	-	from V1.5 [3]
▸ 2nd … 8th device connection	-	from V1.6 [3]
Diagnostic words	✓	✓
▸ Diagnostics	✓	✓
Enable elements	✓	-
▸ Element IDs	✓	-
Project data	✓	✓
▸ Check sums	✓	✓
▸ Date	✓	✓

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

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	
Profinet Records	Fieldbus modules from V2.0
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	✓	✓
Modbus Register	PNOZ m ES ETH V1.1	✓
SDOs		
Profinet Records	Not supported	Fieldbus modules from V2.0
Ethernet IP instances		

[3] Minimum requirements for addressing the device connections

Data	PNOZ m B1 from V1.5
Tables	✓
Modbus Register	✓
SDOs	
Profinet Records	Fieldbus modules from V2.0
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
	▸ Byte 1: 0B,
2	▸ Byte 2: C8,
3	▸ Byte 3: 04
4	Serial number, e.g. 123 456: 0001E240 (hex)
5	▸ Byte 4: 00
	▸ Byte 5: 01
6	▸ Byte 6: E2,
7	▸ 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.
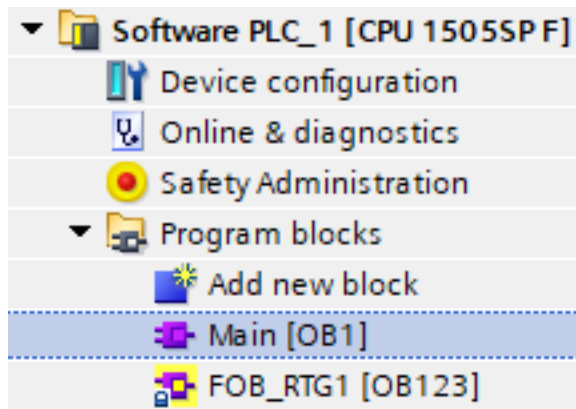
Figure 6: Open OB1

▶ Then the RDREC module can be searched for and inserted using the search function.
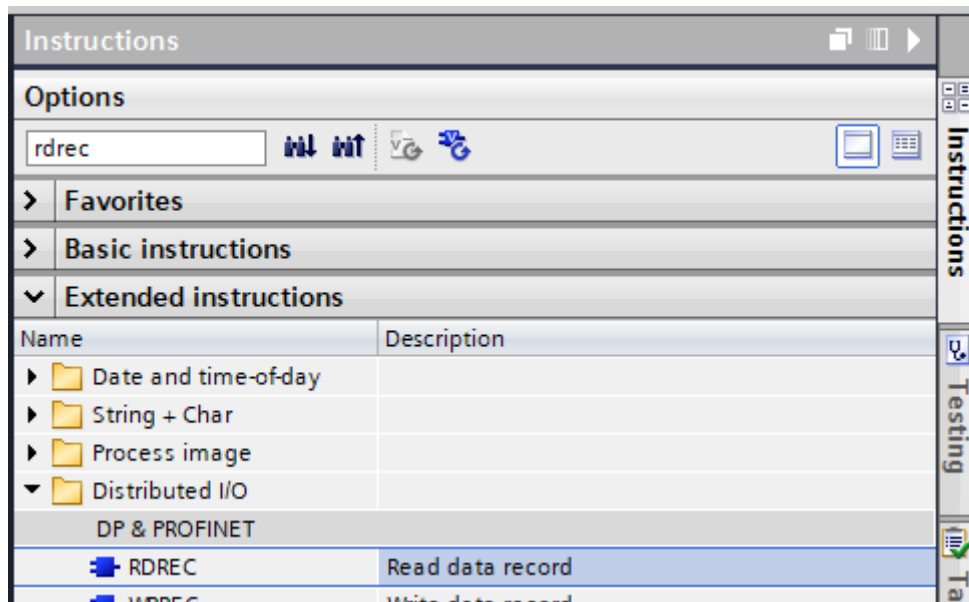
Figure 7: RDREC in Library

▶ 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.
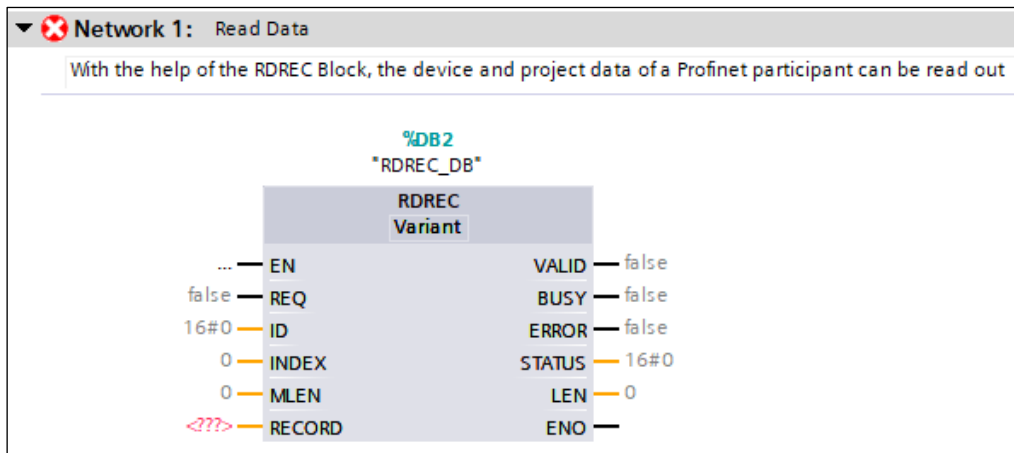
Figure 8: Create RDREC block

▶ A global DB must also be created, which contains the required variables.
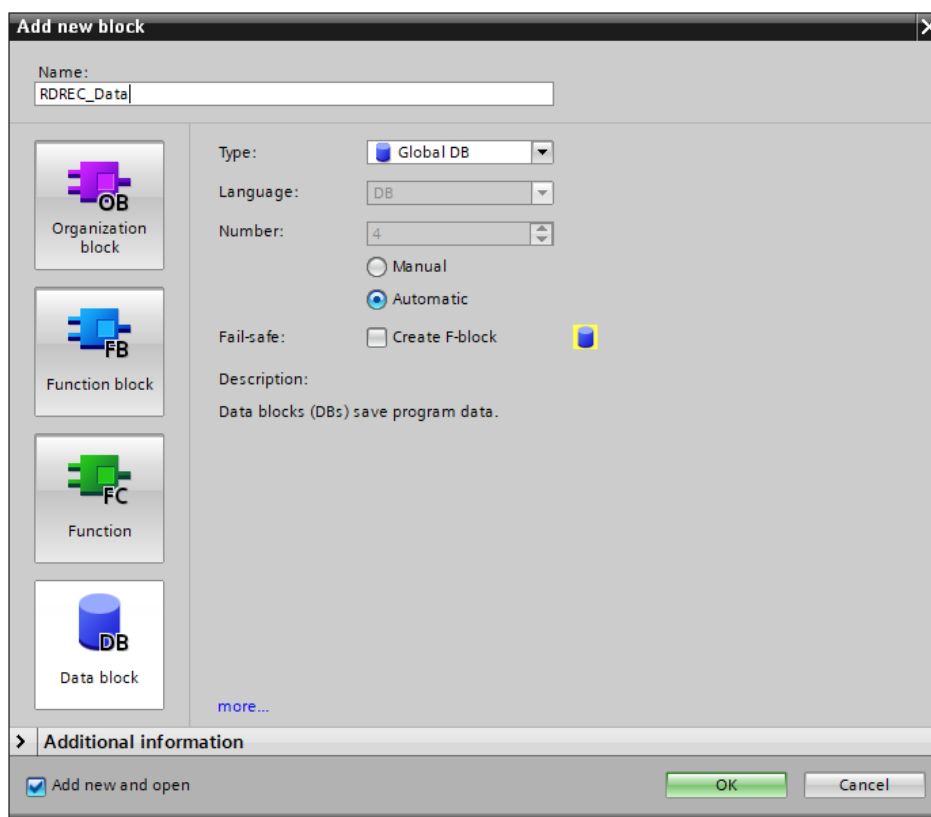
Figure 9: Create data block

	▼	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[0..35] 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".
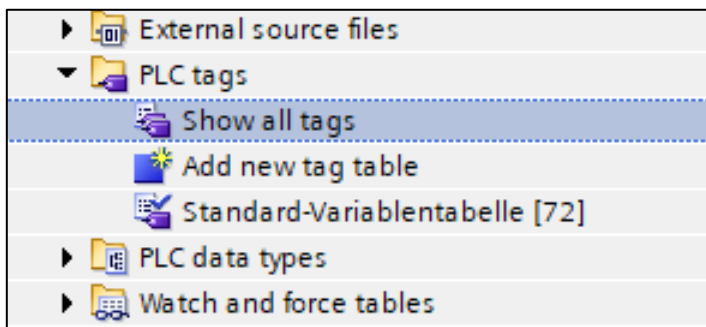
Figure 11: Show all variables
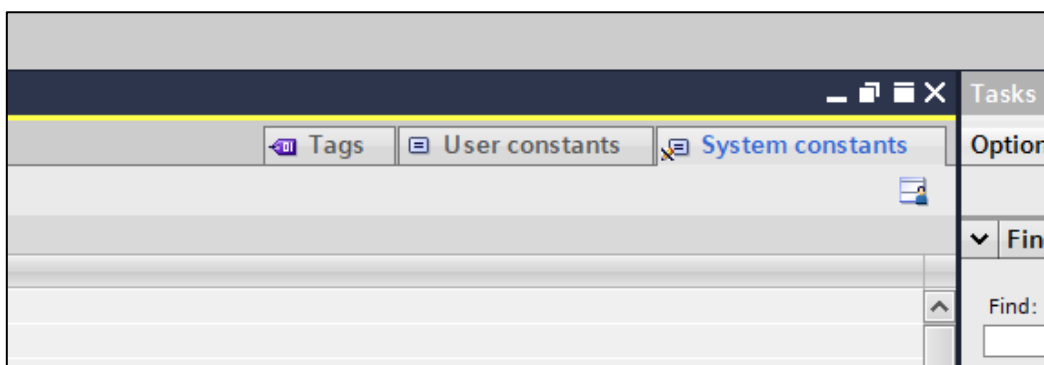
Figure 12: Open "System constants"

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.
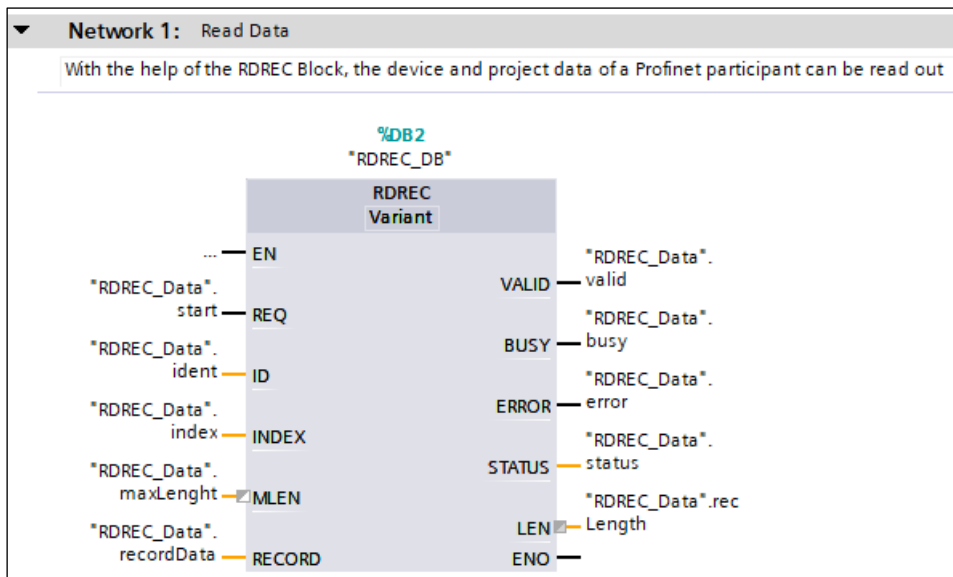
Figure 14: Variable assignment RDREC
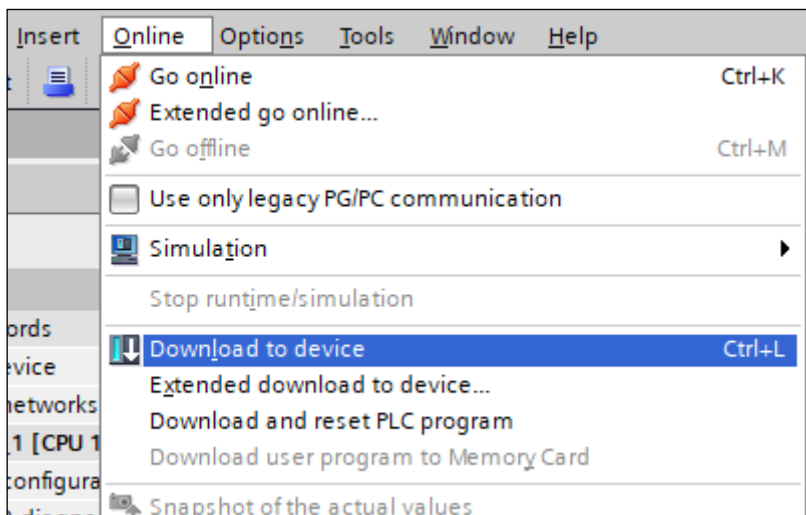
Figure 15: Download to device
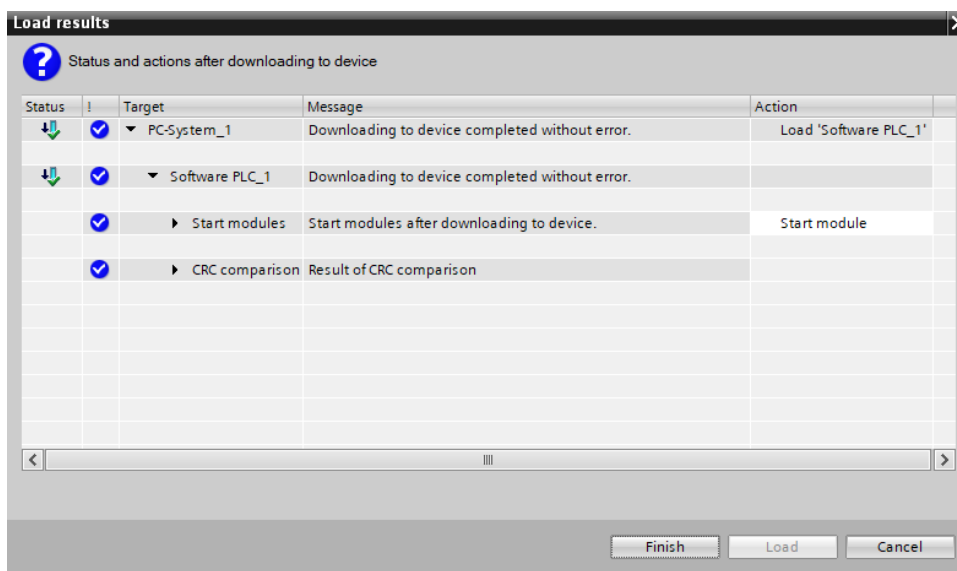
Figure 16: Load configuration into the device

▶ Create online connection
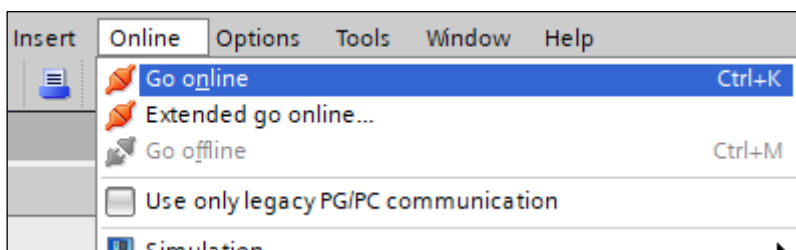
Figure 17: Create online connection

▶ "Monitor all" can now be selected in the database.
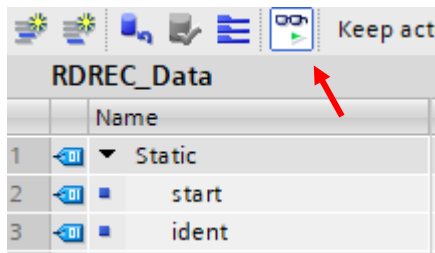
Figure 18: Activate "Monitor all"

▶ 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].

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.

Figure 21: Array "recordData" with project name

U+004F	O
U+0050	P
U+0051	Q

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.
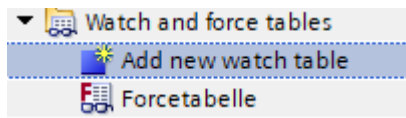

Figure 23: Create new watch table

▸ 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.
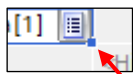
Figure 25: Dot in the corner

▸ 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	'r'
"RDREC_Data".recordData[5]	Character	'o'
"RDREC_Data".recordData[7]	Character	'f'
"RDREC_Data".recordData[9]	Character	'i'
"RDREC_Data".recordData[11]	Character	'n'
"RDREC_Data".recordData[13]	Character	'e'
"RDREC_Data".recordData[15]	Character	't'
"RDREC_Data".recordData[17]	Character	'_'
"RDREC_Data".recordData[19]	Character	'P'
"RDREC_Data".recordData[21]	Character	'N'
"RDREC_Data".recordData[23]	Character	'O'
"RDREC_Data".recordData[25]	Character	'Z'
"RDREC_Data".recordData[27]	Character	'_'
"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".

5   Table of figures

▶ Support

Technical support is available from Pilz round the clock.

Americas

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

Asia

China
+86 21 60880878-216
Japan
+81 45 471-2281
South Korea
+82 31 778 3300

Australia and Oceania

Australia
+61 3 95600621
New Zealand
+64 9 6345350

Europe

Austria
+43 1 7986263-0
Belgium, Luxembourg
+32 9 3217570
France
+33 3 88104003
Germany
+49 711 3409-444
Ireland
+353 21 4804983
Italy, Malta
+39 0362 1826711

Scandinavia
+45 74436332
Spain
+34 938497433
Switzerland
+41 62 88979-32
The Netherlands
+31 347 320477
Turkey
+90 216 5775552
United Kingdom
+44 1536 462203

You can reach our international hotline on:
+49 711 3409-222
support@pilz.com

Pilz develops environmentally-friendly products using ecological materials and energy-saving technologies. Offices and production facilities are ecologically designed, environmentally-aware and energy-saving. So Pilz offers sustainability, plus the security of using energy-efficient products and environmentally-friendly solutions.

We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.

Headquarters: Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: info@pilz.com, Internet: www.pilz.com

PILZ
THE SPIRIT OF SAFETY