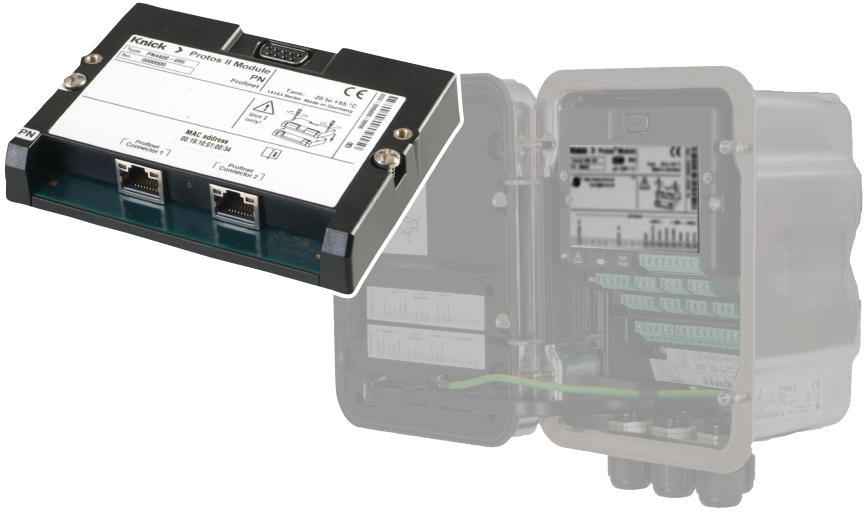
Knick

User Manual

Protos II 4400 (X)
Process Analysis System

Protos II PN4400-095
Communication Module
Communication Unit for PROFINET



Read before installation.
Keep for future use.

www.knick.de

Returns

Clean and securely package the product before returning it to Knick Elektronische Messgeräte GmbH & Co. KG if required.
If there has been contact with hazardous substances, the product must be decontaminated or disinfected prior to shipment.
The consignment must always be accompanied by a corresponding return form to prevent service employees being exposed to potential hazards.
Further information can be found at www.knick.de.

Disposal

The local codes and regulations must be observed when disposing of the product.

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PN4400-095 Module

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PN4400-095 Module

Safety

Read the user manuals for the basic unit (FRONT and BASE modules), observe the technical specifications, and follow the safety instructions in the safety guide (included with the Protos II 4400 basic unit package contents).

The user manual, safety guide, and other product information can be downloaded from www.knick.de.

Intended Use
The module is a PROFINET communication unit for Protos II 4400.
It features two RJ45 Ethernet sockets and can therefore be connected in a ring or star topology.

The module is only intended for operation in ordinary (non-hazardous) locations.

Maintenance
Protos modules cannot be repaired by the user. For inquiries regarding module repair, please contact Knick Elektronische Messgeräte GmbH & Co. KG at www.knick.de.

Abbreviations

AI	Analog input. Function block for providing input data.
AO	Analog output. Function block for processing output data.
AR	Application relation
CC-A/B/C/D	Conformance classes
CR	Communication relation
DCP	Discovery and basic configuration protocol: DCP is part of the PROFINET protocol and makes it possible to find and configure a device. If the device's MAC address and name of station are recognized by a process control system (PCS), the PCS can allocate the IP address to the device using DCP.
EMC	Electromagnetic compatibility
GSD	Generic station description (device master file)
GSDML	GSD markup language: GSDML file = Profinet device master file in XML format for configuring PLC systems
I&M	Identification and maintenance: Services that provide support during commissioning and maintenance.
I/O, IO	Input/output
IRT	Isochronous real time: Isochronous data exchange with PROFINET for real-time communication
MAC	Media access control: The MAC address is a unique address assigned to the device that is set by the manufacturer. It comprises three bytes to identify the manufacturer and three bytes to identify the device. The MAC address is printed on the terminal plate and can be viewed by going to the PN4400-095 Module Diagnostics menu ▸ Network Information.
PCS	Process control system
PLC	Programmable logic controller

Abbreviations

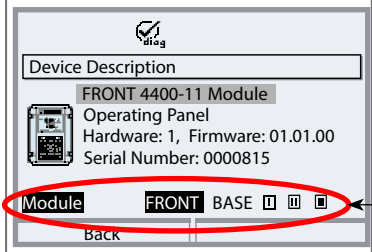
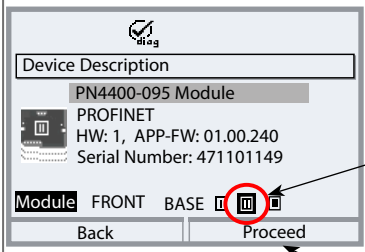
PROFINET	Process field network
RD	Received data
RT	Real time: channel for transmitting process data
TCP/IP	Transmission control protocol/Internet protocol: Protocols that form the basis for data exchange on the Internet and in other networks
TD	Transmitted data
TIA	Totally Integrated Automation: Siemens provides automation tools on its TIA Portal.

Firmware Version

PN4400-095 Module Firmware
Firmware version 01.xx.xxx

Module Compatibility
Protos II 4400 with FRONT firmware version 01.01.xx or higher

Query Current Device Firmware/Module Firmware
When the device is in measuring mode:
Press the **menu** key, open Diagnostics menu: Device Description

Menu	Display	Action
diag		**Device hardware and firmware versions** Provides information on all modules installed: Module type and function, serial number, hardware and firmware version, and device options. Select the different modules (FRONT, BASE, slots 1-3) using the arrow keys.
		**Query module firmware** PN4400-095 module, Hardware and firmware versions, Serial number, installed in slot 2. **Query stack firmware version** Press the "Next" softkey to show the Comm FW version.

PROFINET Technology

PROFINET is an open industrial standard for safe and fast data transmission via the industrial Ethernet. The standard was created and is managed by the PROFIBUS user organization PROFIBUS and PROFINET International (PI).
The PROFINET standard evolved from PROFIBUS – a fieldbus communication standard to support automation technology. PROFINET ensures correct and timely data transmission, even in demanding applications. In addition to cyclic user data exchange, PROFINET also offers additional functions for transmitting diagnostics, parameter settings, and alarms.

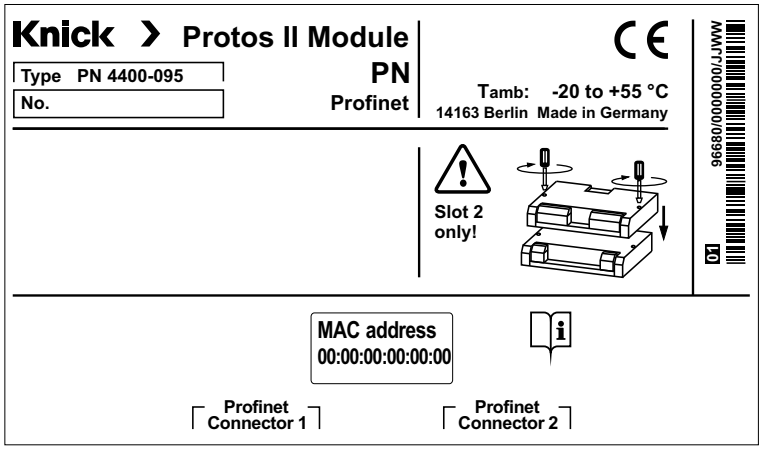
Conformance Classes
To address different requirements, there are four conformance classes (CC-A, CC-B, CC-C, CC-D), which build upon each other and feature a set of functions tailored to typical application areas.
The PN4400-095 module meets the requirements for class B (CC-B). This means that the devices and the network infrastructure are certified products and structured according to PROFINET IO guidelines.

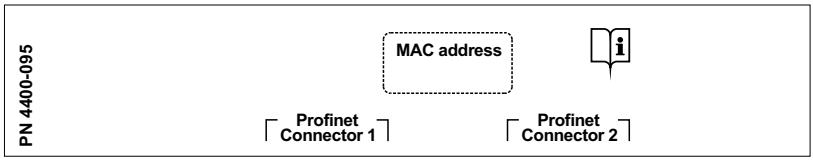
Basic functions in class B:
- RT communication
- Cyclic I/O data transfer
- Parameters
- Alarms
- Network diagnostics
- Topology information

Package Contents

- Communication module
- Installation Guide
- Test Report 2.2 acc. to EN 10204
- Adhesive label with terminal assignments and MAC address

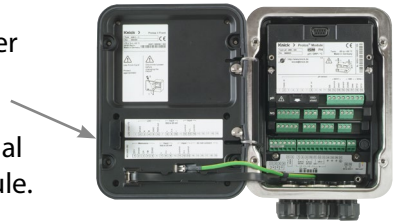
Terminal Plate





Terminal Plate Adhesive Label

The terminal plate adhesive labels for the lower modules can be attached to the inside door. This simplifies maintenance and service. The MAC address is also printed on the terminal plate adhesive label for the PN4400-095 module.

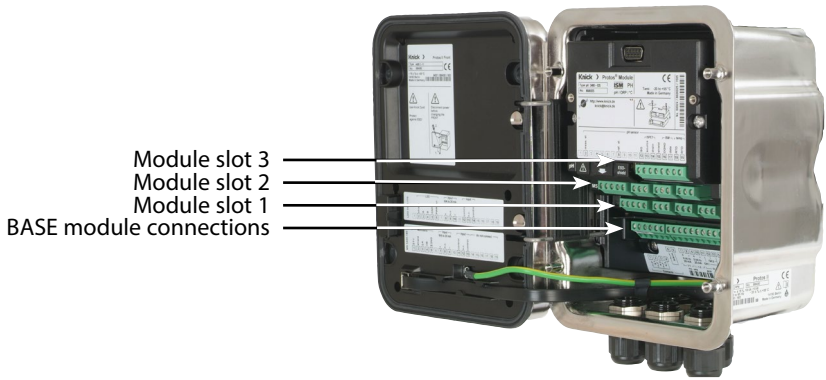


Inserting the Module

⚠ **CAUTION!** Electrostatic discharge (ESD).
The modules' signal inputs are sensitive to electrostatic discharge.
Take measures to protect against ESD before inserting the module and wiring the inputs.

Note: The PN4400-095 module must be installed in slot 2.

1) Switch off the power supply to the device.
2) Open the device (loosen the 4 screws on the front).
3) Plug the module into the slot 2 (D-SUB socket).
4) Tighten the module's fastening screws.
5) Connect the signal lines.
6) Check whether all connections are correctly wired.
7) Close the device and tighten the screws on the front.
8) Switch on the power supply.



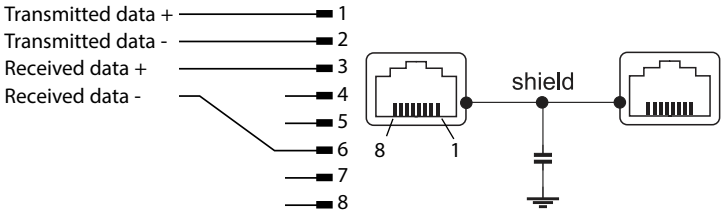
⚠ **CAUTION!** Risk of losing the specified ingress protection.
Fasten the cable glands and screw together the housing correctly.
Observe the permissible cable diameters and torques.
Insert blanking plugs or sealing inserts if necessary.

⚠ **CAUTION!** Incorrect parameter settings or adjustments can result in incorrect outputs.
Protos must therefore be commissioned by a system specialist, all its parameters must be set, and it must be fully adjusted.

Wiring

RJ45 Ethernet Sockets 1 and 2

Pin	Name	Description
1	TD+	Transmitted data +
2	TD-	Transmitted data -
3	RD+	Received data +
6	RD-	Received data -



The module can be connected in a ring or star topology.

Ring Topology
In this topology, terminal devices and control systems are connected in series. In addition, the first and last devices are connected to the control system, thereby forming a ring. The ring topology is redundant and therefore recommended for production environments that require a high level of availability.
Two Ethernet sockets are required for this topology.

Star Topology
A star topology uses a central hub that is connected to all the terminal devices. There is no direct connection between the separate terminal devices.

Initial Commissioning

PROFINET devices are identified in the network using the following parameters: IP address, MAC address, and device name (Name of Station).

- IP address on delivery: 0.0.0.0
- For the MAC address, see the terminal plate.
- Carry out IP configuration and set the device name with a suitable engineering tool.
  Configuration with the Siemens TIA Portal is specified on the following pages.

Application	Tool
Integration in PROFINET system	Engineering tool
Device name and IP address	Engineering tool
Device parameter setting	Local device
Back up / save device parameter setting	Data Card ZU1080-P-N-D

Installing the GSDML File

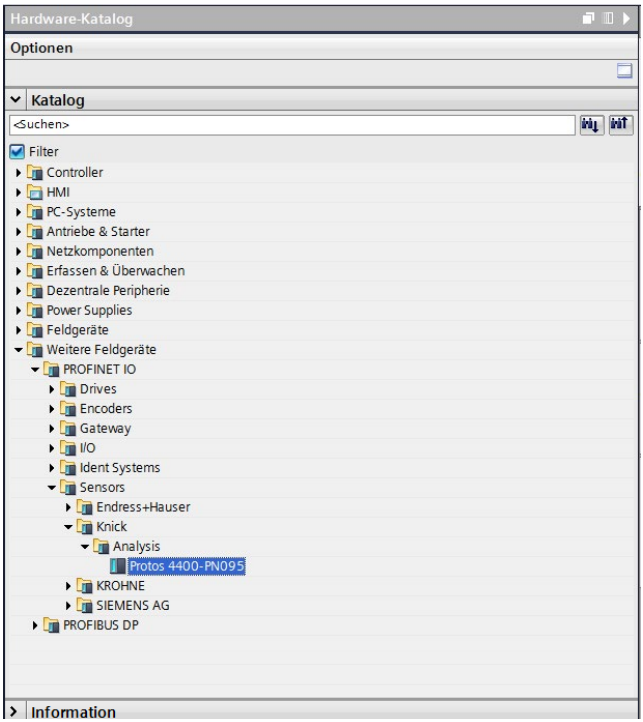
A PROFINET device master file (GSDML file) is required for system integration. The latest version of the GSDML file is available in the downloads section of the Knick website.

The procedure for installing the GSDML file varies depending on the engineering tool used. The Simatic TIA Portal V15 is used in the example.

1) Open the "Extras ▸ Manage General Station Description Files (GSD)" menu.
2) "Browse" button: Select the directory containing the GSDML file to be installed.
3) Select the GSDML file from the list.
4) "Install" button: The GSDML file is installed and added to the hardware catalog.

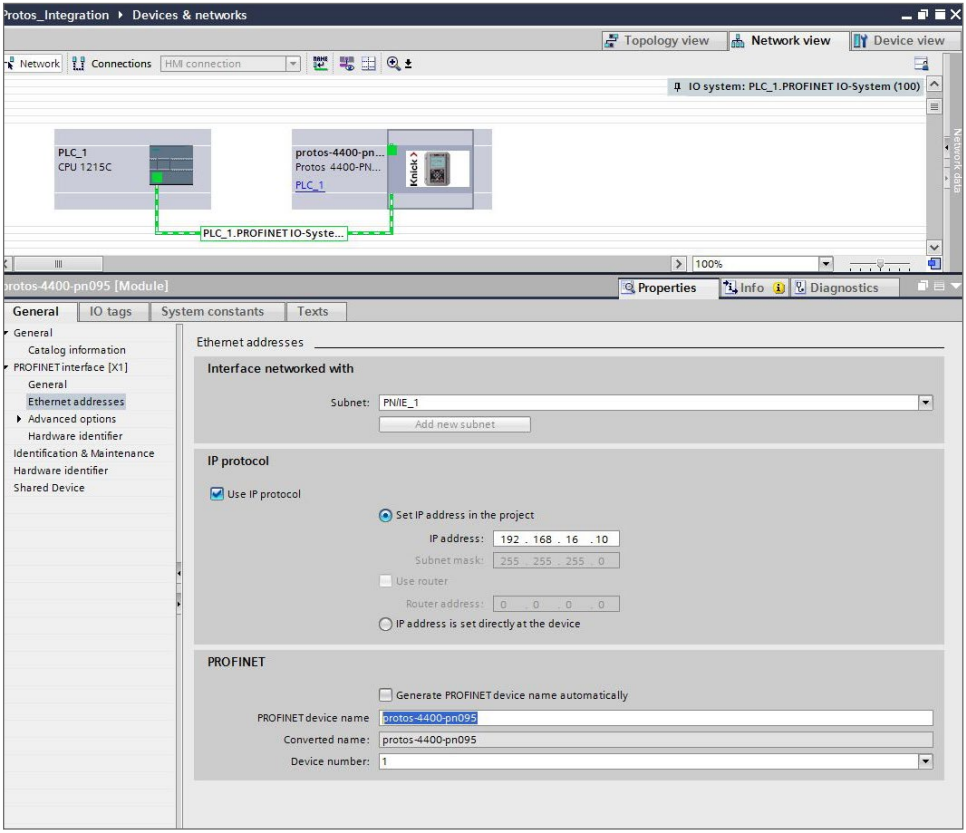
Configuration on the TIA Portal

1) In the PN4400-095 module hardware catalog, select the following:
   "Other Field Devices ▸ PROFINET IO ▸ Sensors ▸ Knick ▸ Analysis ▸ Protos 4400-PN095"



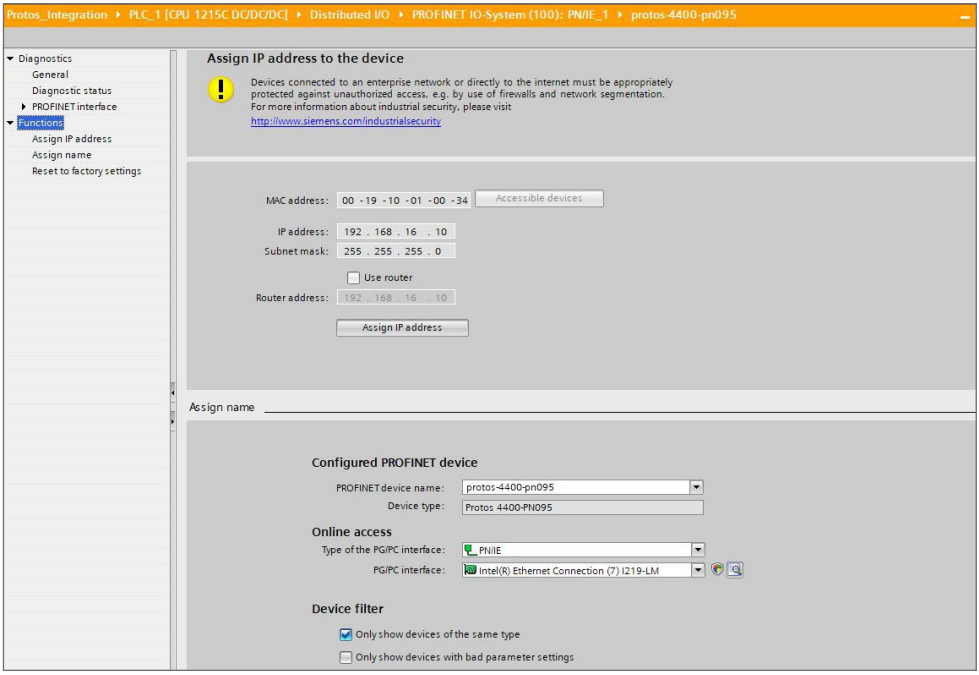
2) Drag and drop "Protos 4400-PN095" into the network view and position it next to the CPU icon (see figure below).
3) Assign the PN4400-095 module to the PROFINET IO controller:
   Click on the interface of the PN4400-095 module and, keeping the mouse button depressed, connect it to the CPU icon.
4) Double-click on "Protos 4400-PN095": The module properties are shown in the inspector window.
5) Configure the PROFINET interface of the PN4400-095 module:
   Set the IP address and PROFINET device name.

Note: The PROFINET controller and the field device must be in the same subnet.


rotos_Integration ▸ Devices & networks
Topology view
Network view
Device view
Network
Connections
HMI connection
IO system: PLC_1.PROFINET IO-System (100)
PLC_1
CPU 1215C
protos-4400-pn...
Protos 4400-PN...
PLC_1
PLC_1.PROFINET IO-Syste...
100%
rotos-4400-pn095 [Module]
Properties
Info
Diagnostics
General
IO tags
System constants
Texts
General
Catalog information
PROFINET interface [X1]
General
Ethernet addresses
Advanced options
Hardware identifier
Identification & Maintenance
Hardware identifier
Shared Device
Ethernet addresses
Interface networked with
Subnet:
PN/IE_1
Add new subnet
IP protocol
Use IP protocol
Set IP address in the project
IP address:
192 . 168 . 16 . 10
Subnet mask:
255 . 255 . 255 . 0
Use router
Router address:
0 . 0 . 0 . 0
IP address is set directly at the device
PROFINET
Generate PROFINET device name automatically
PROFINET device name
protos-4400-pn095
Converted name:
protos-4400-pn095
Device number:
1

Assigning Device Name and IP address Online

1) Connect the device to the PROFINET network.
2) TIA Portal: ▸ ▸ Project Navigation ▸ Devices ▸ Online Access.
3) Select the device's network interface.
4) Double-click on "Update Accessible Devices".
   Accessible devices are shown with their MAC addresses.
5) Select the device.
6) Online & Diagnostics menu ▸ Functions:
   Assign the IP address and device name.



7) Then download the project and check whether communication functions correctly.

Replacing the Device

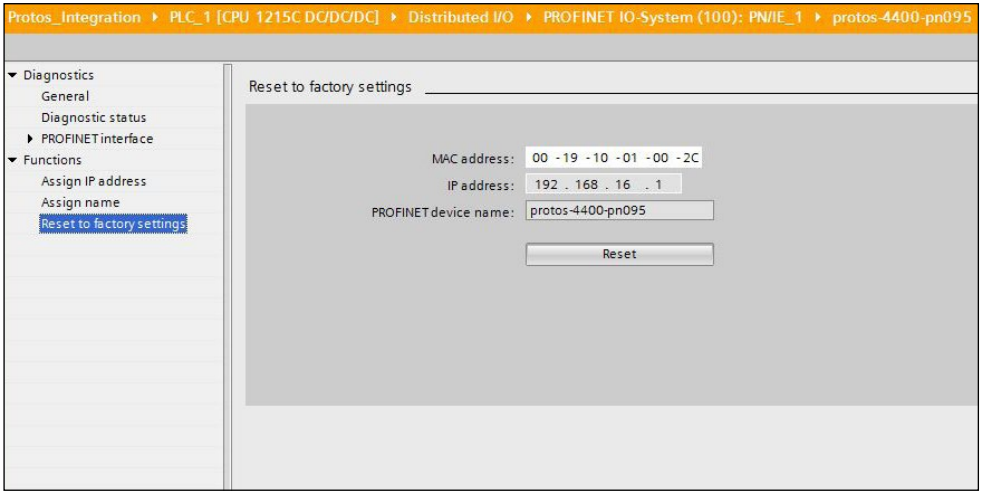
By using the neighborhood detection function, the control system assigns the PROFINET device name and the IP address to the newly added device (PN4400-095 module).

Note: All current settings are automatically applied if only the PN4400-095 module is replaced. If the entire Protos II 4400 device is replaced, the remaining device parameter settings are not automatically applied. In this case, save the parameter settings on a Data Card ZU1080-P-N-D prior to replacing the device (see the user manual for the Protos II 4400 basic unit).

Resetting the Device

Resetting the Device Parameters
In the Protos device menu:
Parameter Setting ▸ System Control ▸ Restore Factory Settings
The reset function in the device menu does not reset the PROFINET network settings.

In the TIA Portal:
Functions ▸ Reset to factory settings
The reset function via PROFINET in the device menu does not reset the Protos to its factory settings.

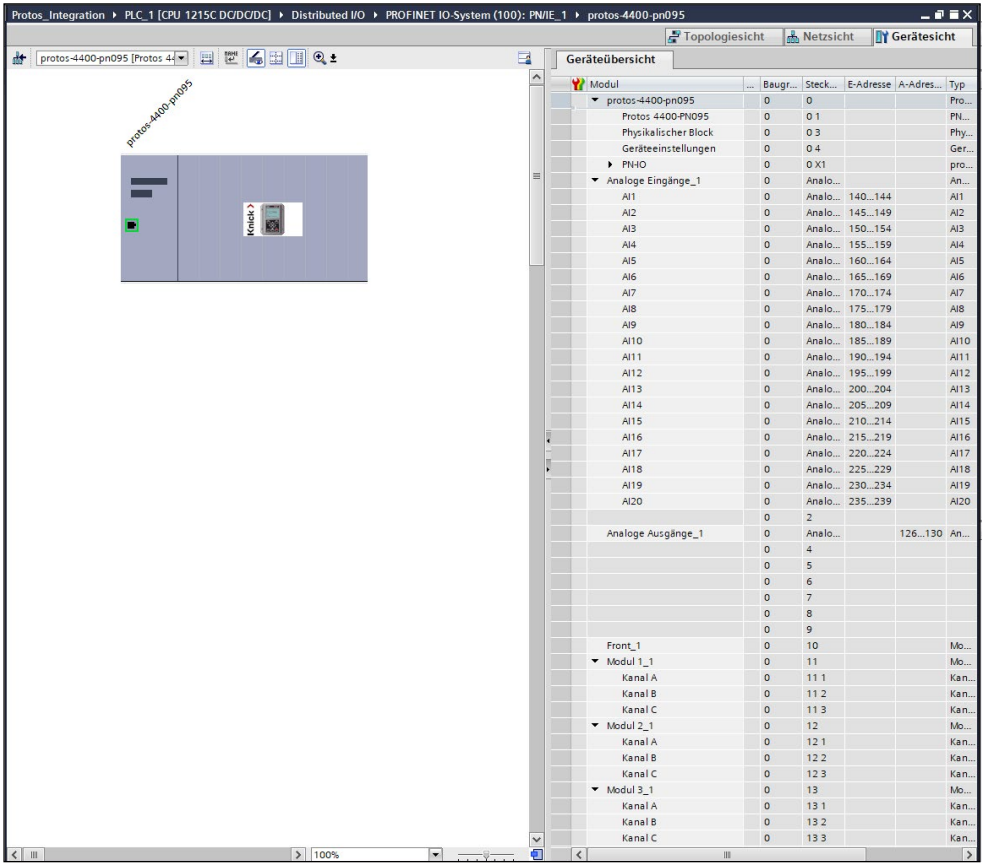


Resetting the PROFINET Network Settings
In the engineering tool using the DCP service command RESET_COMMUNICATION_PARAMETER.

Function Blocks (AI, AO)

The module provides 20 analog input blocks (AI 1 ... AI 20) and one analog output block.

The function blocks have fixed positions in the GSDML file and cannot be removed. This makes it possible to add additional process variables to the cyclic I/O data in the device menu without having to adjust the PROFINET project with the engineering tool.



Cyclic Data Transfer

Cyclic data transfer has two transport directions:

- **Input data**
  Data transfer from the field device (Device) to the process control system (Controller): Input data are provided by the analog input function blocks; see p. 23 ff.
- **Output data**
  Data transfer from the process control system (Controller) to the field device (Device): Output data are processed by analog output function blocks; see p. 28 and p. 36.

Coding Cyclic Commands (I/O Data)

Input Frame: (Device -> Controller): 140 bytes

AIx (Module n Channel X)		IOPSx	IOCSx
DS-101			
Value	Status		
Float32 (4 byte)	(1 byte)	Unsigned8 (1 byte)	Unsigned8 (1 byte)

AIx: 1 to 20
Module n: 1 to 3
Channel X: A to C

Output Frame (Controller -> Device): 7 bytes

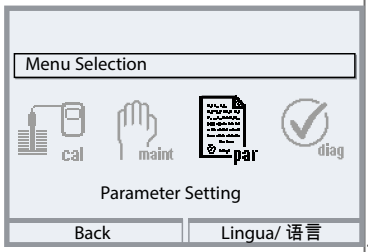
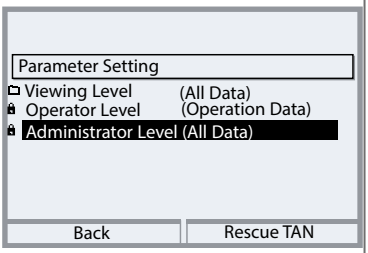
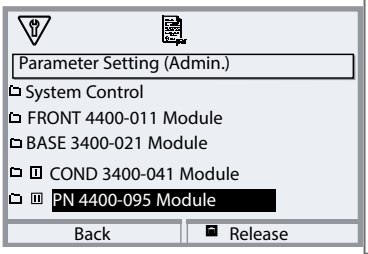
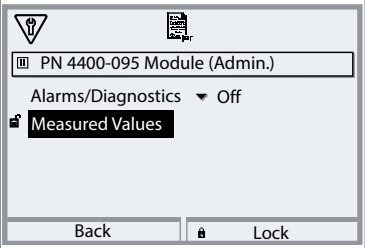
AO1		IOPS1	IOCS1
DS-101			
Value	Status		
Float32 (4 byte)	Unsigned8 (1 byte)	Unsigned8 (1 byte)	Unsigned8 (1 byte)

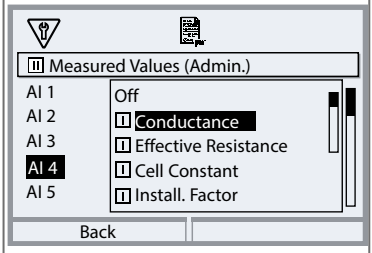
Analog Input Blocks

The module provides 20 analog input blocks (AI 1 ... AI 20).
The measured values to be transmitted by an AI are assigned on the device; see the following pages.

Analog Input Blocks

Assignment of process variables to analog input blocks on the device
Note: Function check (HOLD) active

Menu	Display	Action
par		**Open Parameter Setting** From the measuring mode: Press **menu** key to select menu. Select Parameter Setting using arrow keys, press **enter** to confirm.
		**Select administrator level:** Access to all functions, also passcode setting. Releasing or blocking functions for access from the operator level. **Note:** Administrator level is always passcode-protected.
		Select PROFINET module.
		Select the Measured Values menu.

Menu	Display	Action
		Assign process variables to the separate analog input blocks. The process variables available depend on the installed modules. For available measured values, see p. 50

Slot	Subslot	Index	Access	Parameters	Description
Device settings:					
0	4	0	rd/wr	LOCAL_OP_ENABLE	Local Operation Enable / Key Lock 1 byte ENUM Byte = 0 (Key Lock) Byte = 1 (Local Operation Enable)
Device configuration:					
0	3	0	rd	DEVICE_CONFIG	Current module / sensor channel configuration in Protos 4 byte flag register Flag register[0]: Flag 0: Module 1 channel A Flag 1: Module 1 channel B Flag 2: Module 1 channel C Flag 3: Module 2 channel A Flag 4: Module 2 channel B Flag 5: Module 2 channel C Flag 6: Module 3 channel A Flag 7: Module 3 channel B Flag register[1]: Flag 0: Module 3 channel C Flag 1-7: unused Sensor channel available: Flag = 1 Flag register[2]: Flag 0: Sensor at module 1 channel A Flag 1: Sensor at module 1 channel B Flag 2: Sensor at module 1 channel C Flag 3: Sensor at module 2 channel A Flag 4: Sensor at module 2 channel B Flag 5: Sensor at module 2 channel C Flag 6: Sensor at module 3 channel A Flag 7: Sensor at module 3 channel B Flag register[3]: Flag 0: Sensor at module 3 channel C Flag 1-7: unused Sensor connected Flag = 1

Slot	Subslot	Index	Access	Parameters	Description
Input frame (cyclic data: device -> controller)					
1	1	-	rd	AI1	Measured value 1: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	2	-	rd	AI2	Measured value 2: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	3	-	rd	AI3	Measured value 3: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	4	-	rd	AI4	Measured value 4: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	5	-	rd	AI5	Measured value 5: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	6	-	rd	AI6	Measured value 6: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	7	-	rd	AI7	Measured value 7: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	8	-	rd	AI8	Measured value 8: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	9	-	rd	AI9	Measured value 9: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	10	-	rd	AI10	Measured value 10: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	11	-	rd	AI11	Measured value 11: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	12	-	rd	AI12	Measured value 12: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	13	-	rd	AI13	Measured value 13: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status

Slot	Subslot	Index	Access	Parameters	Description
1	14	-	rd	AI14	Measured value 14: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	15	-	rd	AI15	Measured value 15: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	16	-	rd	AI16	Measured value 16: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	17	-	rd	AI17	Measured value 17: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	18	-	rd	AI18	Measured value 18: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	19	-	rd	AI19	Measured value 19: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
1	20	-	rd	AI20	Measured value 20: From module n channel n 4 byte FLOAT – measured value 1 byte U8 – status
Output frame (cyclic data: controller -> device)					
3	1	-	wr	AO1	External process pressure measured value 4 byte FLOAT – measured value 1 byte U8 – status
Product calibration module 1 channel A:					
11	1	60	rd	SNS_DESC_1A	1A: Sensor ID 64 bytes ASCII Byte 0... 31: Sensor ID Byte 32... 63: Sensor serial number
11	1	62	rd/wr	CAL_PRD_MODE_1A	1A: Product calibration mode 1 byte ENUM Mode = 0: Standard Mode = 1: Alternative
11	1	63	rd/wr	CAL_PRD_SAMPLE_1A	1A: Take sample value, cancel 1 byte ENUM Sample = 0x00: No action (default) Sample = 0x01: Triggers step 1 prod. cal. Sample = 0xA5: Cancels running prod. cal.

Slot	Subslot	Index	Access	Parameters	Description
11	1	64	rd	CAL_PRD_STORED_ VAL_1A	1A: Query saved sample value 4 byte FLOAT Sample value
11	1	65	rd/wr	CAL_PRD_TRUE_ VAL_1A	1A: Transfer lab value, calculate calibration values 4 byte FLOAT Lab value: Triggers step 2 prod. cal.
11	1	66	rd	CAL_PRD_STEP_1A	1A: Current product calibration step 1 byte ENUM Step = 0 or 1: Prod. cal. not running Step = 3: Sample value was taken Step = 2,4,5: Intermediate states Step = 255: Prod. cal. not supported
11	1	67	rd	CAL_CAL_RESULT_1A	1A: Result of calibration 1 byte ENUM Result = 0: Successful Result = 1: Error or canceled
Product calibration module 1 channel B:					
11	2	60	rd	SNS_DESC_1B	1B: Sensor ID *See product calibration module 1 channel A*
11	2	62	rd/wr	CAL_PRD_MODE_1B	1B: Product calibration mode *See product calibration module 1 channel A*
11	2	63	rd/wr	CAL_PRD_SAMPLE_1B	1B: Take sample value, cancel *See product calibration module 1 channel A*
11	2	64	rd	CAL_PRD_STORED_ VAL_1B	1B: Rwead saved sample value *See product calibration module 1 channel A*
11	2	65	rd/wr	CAL_PRD_TRUE_ VAL_1B	1B: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
11	2	66	rd	CAL_PRD_STEP_1B	1B: Current product calibration step *See product calibration module 1 channel A*
11	2	67	rd	CAL_CAL_RESULT_1B	1B: Result of calibration *See product calibration module 1 channel A*

Slot	Subslot	Index	Access	Parameters	Description
Product calibration module 1 channel C:					
11	3	60	rd	SNS_DESC_1C	1C: Sensor ID *See product calibration module 1 channel A*
11	3	62	rd/wr	CAL_PRD_MODE_1C	1C: Product calibration mode *See product calibration module 1 channel A*
11	3	63	rd/wr	CAL_PRD_SAMPLE_1C	1C: Take sample value, cancel *See product calibration module 1 channel A*
11	3	64	rd	CAL_PRD_STORED_ VAL_1C	1C: Read saved sample value *See product calibration module 1 channel A*
11	3	65	rd/wr	CAL_PRD_TRUE_ VAL_1C	1C: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
11	3	66	rd	CAL_PRD_STEP_1C	1C: Current product calibration step *See product calibration module 1 channel A*
11	3	67	rd	CAL_CAL_RESULT_1C	1C: Result of calibration *See product calibration module 1 channel A*
Product calibration module 2 channel A:					
12	1	60	rd	SENSOR_DESC_2A	2A: Sensor ID *See product calibration module 1 channel A*
12	1	62	rd/wr	CAL_PRD_MODE_2A	2A: Product calibration mode *See product calibration module 1 channel A*
12	1	63	rd/wr	CAL_PRD_SAMPLE_2A	2A: Take sample value, cancel *See product calibration module 1 channel A*
12	1	64	rd	CAL_PRD_STORED_ VAL_2A	2A: Read saved sample value *See product calibration module 1 channel A*
12	1	65	rd/wr	CAL_PRD_TRUE_ VAL_2A	2A: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
12	1	66	rd	CAL_PRD_STEP_2A	2A: Current product calibration step *See product calibration module 1 channel A*
12	1	67	rd	CAL_CAL_RESULT_2A	2A: Result of calibration *See product calibration module 1 channel A*

Slot	Subslot	Index	Access	Parameters	Description
Product calibration module 2 channel B:					
12	2	60	rd	SNS_DESC_2B	2B: Sensor ID *See product calibration module 1 channel A*
12	2	62	rd/wr	CAL_PRD_MODE_2B	2B: Product calibration mode *See product calibration module 1 channel A*
12	2	63	rd/wr	CAL_PRD_SAMPLE_2B	2B: Take sample value, cancel *See product calibration module 1 channel A*
12	2	64	rd	CAL_PRD_STORED_ VAL_2B	2B: Read saved sample value *See product calibration module 1 channel A*
12	2	65	rd/wr	CAL_PRD_TRUE_ VAL_2B	2B: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
12	2	66	rd	CAL_PRD_STEP_2B	2B: Current product calibration step *See product calibration module 1 channel A*
12	2	67	rd	CAL_CAL_RESULT_2B	2B: Result of calibration *See product calibration module 1 channel A*
Product calibration module 2 channel C:					
12	3	60	rd	SNS_DESC_2C	2C: Sensor ID *See product calibration module 1 channel A*
12	3	62	rd/wr	CAL_PRD_MODE_2C	2C: Product calibration mode *See product calibration module 1 channel A*
12	3	63	rd/wr	CAL_PRD_SAMPLE_2C	2C: Take sample value, cancel *See product calibration module 1 channel A*
12	3	64	rd	CAL_PRD_STORED_ VAL_2C	2C: Read saved sample value *See product calibration module 1 channel A*
12	3	65	rd/wr	CAL_PRD_TRUE_ VAL_2C	2C: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
12	3	66	rd	CAL_PRD_STEP_2C	2C: Current product calibration step *See product calibration module 1 channel A*
12	3	67	rd	CAL_CAL_RESULT_2C	2C: Result of calibration *See product calibration module 1 channel A*

Slot	Subslot	Index	Access	Parameters	Description
Product calibration module 3 channel A:					
13	1	60	rd	SNS_DESC_3A	3A: Sensor ID *See product calibration module 1 channel A*
13	1	62	rd/wr	CAL_PRD_MODE_3A	3A: Product calibration mode *See product calibration module 1 channel A*
13	1	63	rd/wr	CAL_PRD_SAMPLE_3A	3A: Take sample value, cancel *See product calibration module 1 channel A*
13	1	64	rd	CAL_PRD_STORED_ VAL_3A	3A: Read saved sample value *See product calibration module 1 channel A*
13	1	65	rd/wr	CAL_PRD_TRUE_ VAL_3A	3A: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
13	1	66	rd	CAL_PRD_STEP_3A	3A: Current product calibration step *See product calibration module 1 channel A*
13	1	67	rd	CAL_CAL_RESULT_3A	3A: Result of calibration *See product calibration module 1 channel A*
Product calibration module 3 channel B:					
13	2	60	rd	SNS_DESC_3B	3B: Sensor ID *See product calibration module 1 channel A*
13	2	62	rd/wr	CAL_PRD_MODE_3B	3B: Product calibration mode *See product calibration module 1 channel A*
13	2	63	rd/wr	CAL_PRD_SAMPLE_3B	3B: Take sample value, cancel *See product calibration module 1 channel A*
13	2	64	rd	CAL_PRD_STORED_ VAL_3B	3B: Read saved sample value *See product calibration module 1 channel A*
13	2	65	rd/wr	CAL_PRD_TRUE_VAL 3B	3B: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
13	2	66	rd	CAL_PRD_STEP_3B	3B: Current product calibration step *See product calibration module 1 channel A*
13	2	67	rd	CAL_CAL_RESULT_3B	3B: Result of calibration *See product calibration module 1 channel A*

Slot	Subslot	Index	Access	Parameters	Description
Product calibration module 3 channel C:					
13	3	60	rd	SNS_DESC_3C	3C: Sensor ID *See product calibration module 1 channel A*
13	3	62	rd/wr	CAL_PRD_MODE_3C	3C: Product calibration mode *See product calibration module 1 channel A*
13	3	63	rd/wr	CAL_PRD_SAMPLE_3C	3C: Take sample value, cancel *See product calibration module 1 channel A*
13	3	64	rd	CAL_PRD_STORED_ VAL_3C	3C: Read saved sample value *See product calibration module 1 channel A*
13	3	65	rd/wr	CAL_PRD_TRUE_ VAL_3C	3C: Transfer lab value, calculate calibration values *See product calibration module 1 channel A*
13	3	66	rd	CAL_PRD_STEP_3C	3C: Current product calibration step *See product calibration module 1 channel A*
13	3	67	rd	CAL_CAL_RESULT_3C	3C: Result of calibration *See product calibration module 1 channel A*

Product Calibration

If the sensor cannot be removed – e.g., for sterility reasons – calibration can be performed by sampling (“product calibration”). For a description, see the user manual for the measuring module.

Slot	Subslot	Index	Parameter	Object Type	Data Type	Store	Size	Access	Parameter Usage / Kind of Transport
11 ... 13	1 ... 3	62	CAL_PRD_MODE_nX	Simple	Unsigned8	Static	1	Read / Write	Contained / acyclic
11 ... 13	1 ... 3	63	CAL_PRD_SAMPLE_nX	Simple	Unsigned8	Dynamic	1	Read / Write	Contained / acyclic
11 ... 13	1 ... 3	64	CAL_PRD_STORED_VAL_nX	Simple	Float	Dynamic	4	Read	Contained / acyclic
11 ... 13	1 ... 3	65	CAL_PRD_TRUE_VAL_nX	Simple	Float	Dynamic	4	Read / Write	Contained / acyclic
11 ... 13	1 ... 3	66	CAL_PRD_STEP_nX	Simple	Unsigned8	Dynamic	1	Read	Contained / acyclic
11 ... 13	1 ... 3	67	CAL_CAL_RESULT_nX	Simple	Unsigned8	Dynamic	1	Read	Contained / acyclic

n: 1 to 3 (module)
X: A to C (channel)
See the tables on p. 28 ff.

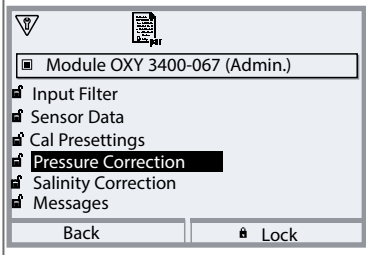
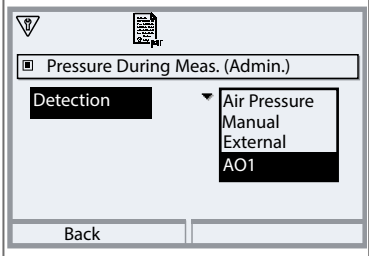
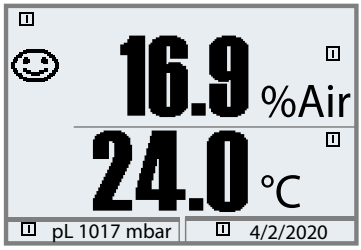
Product Calibration Procedure

Parameters	Description
CAL _PRD _MODE_nX	Calibration mode: pH, Cond, Condl: 0 is the only admissible value Oxy: 0: Saturation, 1: Concentration
CAL_PRD _ SAMPLE_nX	Take a sample. Writing 1 to this parameter causes Protos to save the current process value for later correction. Writing 165 (0xA5) cancels a calibration procedure currently running.
CAL_PRD_STORED_VAL_nX	Read the value that was saved by writing 1 to CAL_PRD_SAMPLE_nX. Returns NaN if no sample was taken.
CAL_PRD_TRUE_VAL_nX	The actual process value measured at the time of sampling can be entered with this parameter. New calibration values are calculated and activated from the difference between CAL_PRD_STORED_VAL_nX and CAL_PRD_TRUE_VAL_nX.
CAL _PRD _STEP_nX	Indicates product calibration progress: 0 or 1: Product calibration not started (= calibration ended) 3: A sample was saved and Protos is waiting for input of the actual value. 2, 4, 5: Intermediate states. 255: Product calibration is not supported.
CAL_CAL_RESULT_nX	Shows whether the last calibration was successful or not. This parameter applies to all types of calibration, not just product calibration. 0: Success 1: Error or canceled

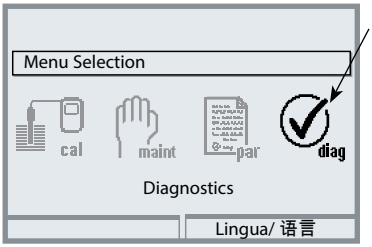
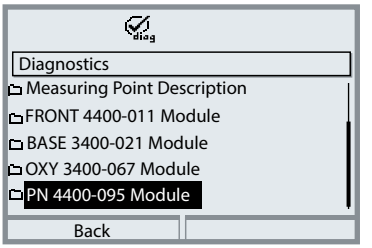
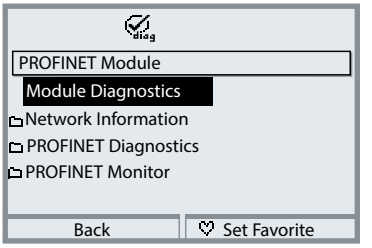
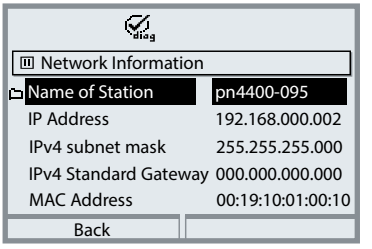
Key Lock

A key lock activated via the process control system is indicated on the device by the following pop-up window: "Keys Locked by DCS".
The message "F234 Key Lock is Active" also appear in the message list and in the logbook.
To release the key lock, see p. 26.

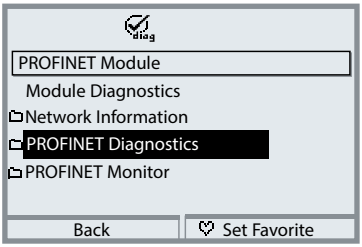
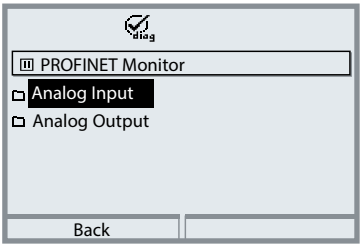
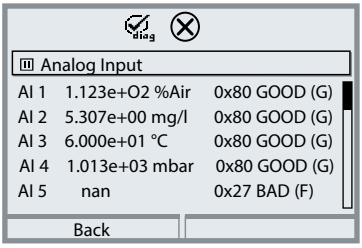
Pressure Compensation via Bus (AO1)

Menu	Display	Action
		**Oxy module parameter setting** Select "Pressure Correction" in the settings for the oxygen module
		**Pressure during measurement** The AO1 block provides the analog value for pressure compensation.
		**Display the compensated pressure in measuring mode** The compensated value "pL" can be displayed by pressing a softkey.

Diagnostic Functions

Menu	Display	Action
		**Open the Diagnostics menu** From the measuring mode: Press **menu** key to select menu. Select Diagnostics using arrow keys, press **enter** to confirm.
diag		The "Diagnostics" menu gives an overview of all functions available. Functions which have been set as "Favorite" can be directly accessed from the measuring mode.
	Diagnostics ▸ PN4400-095 Module:	
		**Module diagnostics** Internal function test: • Communication • Flash Checksum • EEPROM Checksum
		**Network information** • Device name (name of station): If too long to show here, display the full device name by pressing **enter** or the right arrow key. • IP address • IPv4 subnet mask • IPv4 gateway • MAC address [1)]

1) Unique address assigned to the device (cannot be changed).

Menu	Display	Action
		**PROFINET diagnostics** The values below indicate functioning PROFINET communication: Stack State 0x000000FB Last Error 0x00000000 Phy Link State OK Config State Application Comm State Operate Comm Error 0x00000000
		**PROFINET monitor** Displays values transferred in cyclic data transfer. Analog input: AIs transferred from the field device (device) to the process control system (controller): Analog output: AOs transferred from the process control system (controller) to the field device (device):
		See the following page for measured value status overview. "nan" = Not a number (no measured value available)

Measured Value Status

Description	Hex value / display	NE107 signal
BAD Maintenance Alarm [1]	0x24 ... 0x27 BAD (F)	Failure
BAD Process Related	0x28 ... 0x2B BAD (F)	Failure
UNCERTAIN Invalid Process Condition	0x78 ... 0x7B	Out of specification
UNCERTAIN Maintenance Demanded	0x68 ... 0x7B	Maintenance request
GOOD Maintenance Demanded	0xA8 ... 0xAB	Maintenance request
BAD Function Check [2]	0x3C	Function check
GOOD Function Check [2]	0xBC	Function check
GOOD ok [3]	0x80 ... 0x83 GOOD (G)	Good

1) If AI configuration = off: Status 0x27
2) If function check is active
3) If value is good or message is disabled

Communication Status

Display
Active PROFINET communication is indicated by the PN icon in the device's status display.

LEDs
(at Ethernet socket)

LED	Name	Meaning		
Yellow	TX/RX	Receive/transmit	Off	Device does not transmit/ receive any Ethernet frames
			On (flickers)	Device transmitting/receiving Ethernet frames
Green	LINK	Connection	Off	Connection not active
			On	Connection active
			Flashing	Data transmission

I&M Functions

The PN4400-095 module supports the following standardized I&M functions. I&M functions provide device data in a manufacturer-independent format. Data transfer is acyclic.

I&M_0: Index 0xAFF0, Access: Read only

Element	Name	Description
1	VendorIDHigh	0
2	VendorIDLow	0x61 (97) = Knick
3	Order ID	096680
4	IM_Serial_Number	
5	IM_Hardware_Revision	
6	IM_Software_Revision	
7	IM_RevisionCounter	
8	IM_Profile_ID	
9	IM_Profile_Specific_Type	5 (Generic Device).
10	IM_Version	
11	IM_Supported	

I&M_1: Index 0xAFF1, Access: Read/Write

Element	Name	Data type	Description
1	IM_Tag_Function	VisibleString(32)	Device function Presetting = empty string
2	IM_Tag_Location	VisibleString(22)	Device location Presetting as in Protos device menu: Parameter Setting ▸ System Control ▸ Meas. Point Description ▸ Meas. Point

I&M_2: Index 0xAFF2, Access: Read/Write

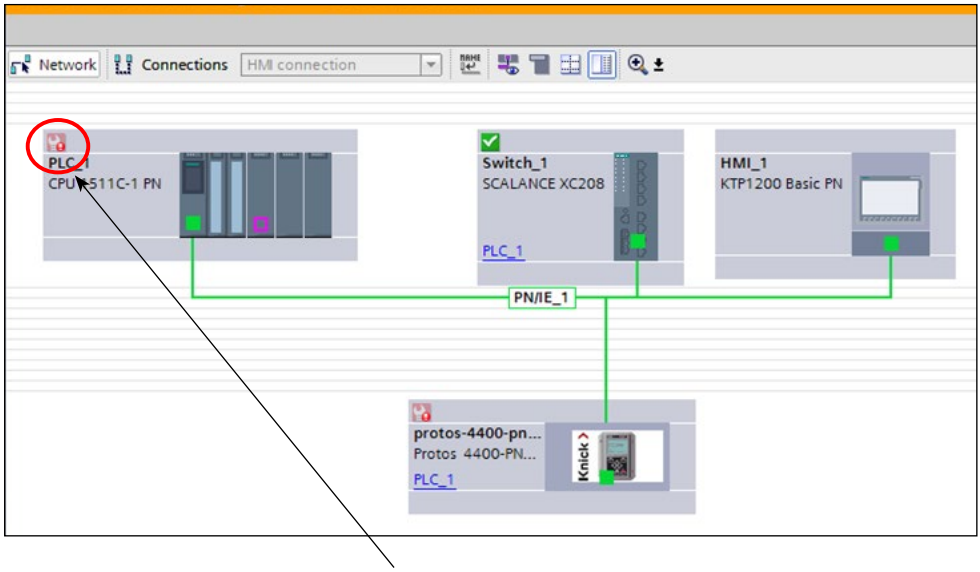
Element	Name	Data type	Description
1	IM_Date	VisibleString(16)	Installation date Presetting = empty string

I&M_3: Index 0xAFF3, Access: Read/Write

Element	Name	Data type	Description
1	IM_Descriptor	VisibleString(54)	Description Presetting as in Protos device menu: Parameter Setting ▸ System Control ▸ Meas. Point Description ▸ Annotation

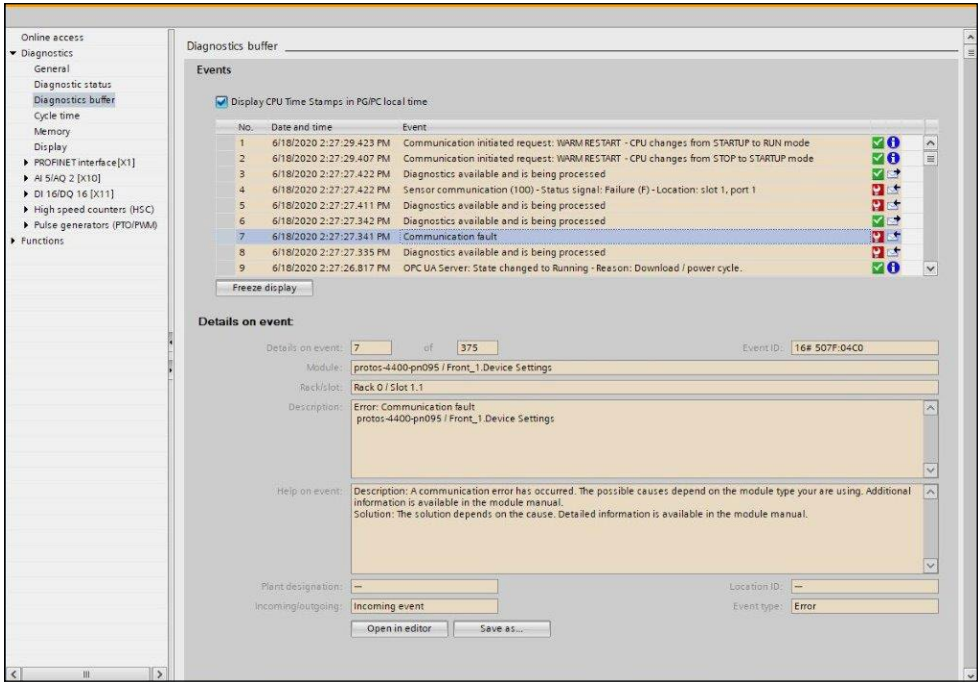
PROFINET Diagnostic Information

Diagnostic events are reported to the PROFINET controller and displayed, for example, in the TIA Portal. Every event generates an entry in the diagnostics buffer.

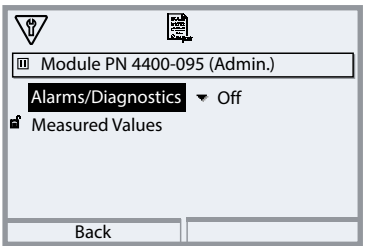


Details of the event can be displayed by double-clicking on the red icon by the controller icon (see following page).

Diagnostics Buffer Menu (TIA Portal)



Transmission of diagnostic information can be enabled or disabled in the Protos device menu:
Parameter Setting ▸ PN 4400-095 Module ▸ Alarms/Diagnostics



PROFINET Diagnostic Information

Overview

Source	Error Type	Extended Error Type	State	Maintenance	Error Text
FRONT	300		Error	D	Firmware Error
FRONT	301		Error	D	System Failure
FRONT	302		Error	D	FRONT Indicates an Error
FRONT	303		Error	D	Internal Bus Error
FRONT	304		Error	D	Adjustment Data
FRONT	305		Error	D	Configuration Data Loss
FRONT	307		Error	D	Value out of Specification
FRONT	309		Alarm	MD	Value out of Range
FRONT	311		Alarm	MD	Inconsistent Parameter Setting
FRONT	312		Warning	MR	Value out of Range
FRONT	313		Warning	MR	Device is in Maintenance
FRONT	314		Warning	MR	Measurement Recorder Full
FRONT	315		Warning	MR	Memory Card Full
FRONT	316		Warning	MR	Memory Card
FRONT	317		Warning	MR	Audit Trail Card
FRONT	318	1	Info	QD	In Function Check
MODULE / SENSOR	400		Error	D	Firmware Error
MODULE / SENSOR	401		Error	D	Configuration Data Loss
MODULE / SENSOR	403		Error	D	No Sensor Connected
MODULE / SENSOR	404		Error	D	Wrong Sensor Connected
MODULE / SENSOR	405		Error	D	Sensor Devaluated
MODULE / SENSOR	406		Error	D	Sensor Defective
MODULE / SENSOR	407		Error	D	Adjustment Data
MODULE / SENSOR	408		Error	D	Sensor Memory (Cal Data)
MODULE / SENSOR	409		Error	D	Value out of Specification

PROFINET Diagnostic Information

Overview

Source	Error Type	Extended Error Type	State	Maintenance	Error Text
MODULE / SENSOR	410		Alarm	MD	Value out of Range
MODULE / SENSOR	411		Alarm	MD	Man. Value out of Specification
MODULE / SENSOR	412		Alarm	MD	New Sensor – Adjustment Required
MODULE / SENSOR	414		Alarm	MD	TTM Maintenance Timer
MODULE / SENSOR	415		Alarm	MD	O2 Measurement OFF (Temp)
MODULE / SENSOR	416		Warning	MR	Value out of Range
MODULE / SENSOR	417		Warning	MR	Calibration Mode Active
MODULE / SENSOR	418		Warning	MR	CIP Counter
MODULE / SENSOR	419		Warning	MR	SIP Counter
MODULE / SENSOR	420		Warning	MR	Autoclaving Counter
MODULE / SENSOR	421	1	Info	QD	Function Check Active in Calibration Mode
MODULE / SENSOR	422	1	Info	QD	Error in Buffer Table
PN095	500		Error	D	Firmware Error
PN095	501		Error	D	Configuration Data Loss
PN095	502		Error	D	EEPROM Error
PN095	19	1	Error	D	KBUS Communikation

D = Diagnosis
MD = Maintenance Demanded
MR = Maintenance Required
QD = Qualified Diagnosis

Error Messages/Troubleshooting

Error/message (Diagnostics menu: Message List)	Possible causes	Remedy
Display is blank.	FRONT or BASE power supply interrupted. Input fuse has tripped. Display switch-off is active.	Check the power supply. Replace the fuse (500 mA T). Disable display switch-off.
No measurement, no error message	Module not plugged in correctly.	Install the module correctly, check the measurement display in Parameter Setting ▸ Administrator Level ▸ FRONT Module
No PROFINET connection	PROFINET cable not connected or connected incorrectly. Protos menu Diagnostics ▸ PN4400-095 Module ▸ PROFINET Diagnostics**:** Phy Link State: No Link	Check the connection, connect the cable correctly.
	Incorrect IP address. Protos menu Diagnostics ▸ PN4400-095 Module ▸ PROFINET Diagnostics**:** Comm State: Stop	Check and correct the address.
	Incorrect or non-unique name of station Protos menu Diagnostics ▸ PN4400-095 Module ▸ PROFINET Diagnostics**:** Comm State: Stop	Check and correct the name of station.
	Incorrect GSDML used. Protos menu Diagnostics ▸ PN4400-095 Module ▸ PROFINET Diagnostics**:** Comm State: Stop	Check GSDML, select correct GSDML.
Device does not respond to key presses. F234 Key Lock is Active	Key lock is active.	Disable key lock via PCS: Slot 1, subslot 1, index 1, see p. 26
N008 EEPROM Error N009 Firmware Error	Error in EEPROM/ error in the firmware:	Switch off device. Wait around 10 s and turn back on. For N009: Reload the firmware. If the message persists, send in the device.
F232 Module Configuration Ex/Non Ex	Ex and Non Ex modules have been inserted.	Use the same types of modules appropriate to the basic unit (either Ex or Non Ex).

Specifications

PN4400-095 Module

PROFINET	
IO specification	V2.34
Conformance class	B (CC-B)
Network load class	2
Vendor ID	0x61 (= Knick)
Device ID	0x0020
Min. cycle times	1 ms
Identification & maintenance	I&M1-3, 0
Serial interface standard	100BASE-TX (IEEE 802.3, IEC 61158, IEC 61784)
Number of AIs	20
Number of AOs	1
100BASE-TX Communication Interface	
Connection socket type (1 and 2)	RJ45
Input and output impedance	100 Ω
Serial data rate	125 Mbits/s
Data encoding	4B/5B
Cable encoding	MLT-3 (Multi Level Transmission – 3 levels)
Galvanic isolations, RJ45 port	MDI and cable shield to ground potential (device housing)
Insulation strength	
MDI (all 8 internal RJ45 ports)	2250 V DC /1.5 kV AC (50/60 Hz) for 60 s
Cable shield	1000 V DC /700 V AC (50/60 Hz) for 60 s
Current consumption	≤ 146 mA

Protos II 4400 General Specifications

RoHS conformity	According to EU directive 2011/65/EU
EMC	EN 61326-1, EN 61326-2-3 NAMUR NE 21
Emitted interference	Industrial applications[1)]
Interference immunity	(EN 55011 Group 1 Class A) Industrial applications
Lightning protection	to EN 61000-4-5, Installation class 2
Rated operating conditions (module installed)	
Ambient temperature	-20 ... 55 °C / -4 ... 131 °F
Relative humidity	5 ... 95 %
Climatic class	3K5 according to EN 60721-3-3
Location class	C1 according to EN 60654-1
Transport/storage temperature	-20 ... 70 °C / -4 ... 158 °F
Screw clamp connectors	Single or stranded wires 0.2 ... 2.5 mm^2
	Tightening torque 0.5 ... 0.6 Nm
Wiring	Stripping length max. 7 mm
	Temperature resistance > 75 °C / 167 °F

1) This equipment is not designed for domestic use, and is unable to guarantee adequate protection of the radio reception in such environments.

Measured Values Available for PROFINET

Measured values than can be assigned to analog input blocks (AIs)

Note: Not all values can be used. The available selection depends on the sensor type used.

PH Module Types

Measured value	Unit of measurement	Measurement status
pH value	pH	Variable
ORP	mV	Variable
Temperature	°C or °F	Variable
pH voltage	mV	Variable
rH value	rH	Variable
Glass impedance	MΩ	Variable
Ref. impedance	kΩ	Variable
pH zero point	pH	Fixed (0x80)
pH slope	mV/pH	Fixed (0x80)
ISFET operating point	mV	Fixed (0x80)
ORP offset	mV	Fixed (0x80)
Sensoface		Fixed (0x80)
Wear	%	Variable
Calibration timer [1)]	h	Variable
Remaining lifetime [2)]	h	Variable
TTM maintenance timer	h	Variable
Operating time	h	Fixed (0x80)
SIP counter		Fixed (0x80)
CIP counter		Fixed (0x80)
Autoclaving counter		Fixed (0x80)

1) ISM: ACT calibration timer
2) ISM: DLI Lifetime Indicator

Measured Values Available for PROFINET

Measured values than can be assigned to analog input blocks (AIs)

pH/pH Calculation Blocks

Measured value	Unit of measurement	Measurement status
Temperature diff.	°C or °F	Variable
pH diff.	pH	Variable
pH voltage diff.	mV	Variable
ORP diff.	mV	Variable

Measured Values Available for PROFINET

Measured values than can be assigned to analog input blocks (AIs)

Note: Not all values can be used. The available selection depends on the sensor type used.

OXY Module Types

Measured value	Unit of measurement	Measurement status
Saturation %air	%	Variable
Saturation $\%O_2$	%	Variable
Temperature	°C or °F	Variable
Conc. (liquids)	mg/l or ppm	Variable
Conc. (gas)	%	Variable
Sensor current	nA	Variable
Partial pressure	mbar or mmHg	Variable
Sensor current (25 °C)	nA	Variable
Process pressure	mbar or psi or kPa	Variable
Oxy zero	nA	Fixed (0x80)
Oxy slope	nA	Fixed (0x80)
Stern-Volmer constant		Fixed (0x80)
Phase angle	°	Fixed (0x80)
DO offset	mbar or mmHg	Fixed (0x80)
Sensoface		Fixed (0x80)
Wear	%	Variable
Membrane wear	%	Fixed (0x80)
Interior body wear	%	Fixed (0x80)
Calibration timer [1)]	h	Variable
Remaining lifetime [2)]	h	Variable
TTM maintenance timer	h	Fixed (0x80)
Operating time	h	Fixed (0x80)

1) ISM: ACT calibration timer
2) ISM: DLI Lifetime Indicator

Measured Values Available for PROFINET

Measured values than can be assigned to analog input blocks (AIs)

Measured value	Unit of measurement	Measurement status
SIP counter		Fixed (0x80)
CIP counter		Fixed (0x80)
Autoclaving counter		Fixed (0x80)
Impedance	kΩ	Variable

O_2 / O_2 Calculation Block

Measured value	Unit of measurement	Measurement status
Temperature diff.	°C or °F	Variable
Saturation %air diff.	%	Variable
Saturation %O_2 diff.	%	Variable
Concentration (liq.) diff.	mg/l or ppm	Variable
Concentration (gas) diff.	%	Variable

Measured Values Available for PROFINET

Measured values than can be assigned to analog input blocks (AIs)

Note: Not all values can be used. The available selection depends on the sensor type used.

COND/CONDI Module Types

Measured value	Unit of measurement	Measurement status
Conductivity	µS/cm	Variable
Temperature	°C or °F	Variable
Salinity	g/kg	Variable
Concentration	%	Variable
Resistivity	MΩ * cm	Variable
USP value	%	Variable
TDS	mg/l	Variable
Conductance	µS	Variable
Effective resistance	Ω	Variable
Cell constant	1/cm	Fixed (0x80)
Zero point	µS	Fixed (0x80)
Install. factor		Fixed (0x80)
Sensoface		Fixed (0x80)
Operating time	h	Fixed (0x80)
SIP counter		Fixed (0x80)
CIP counter		Fixed (0x80)
Flow	L/h	Variable
Current input	mA	Variable

Measured Values Available for PROFINET

Measured values than can be assigned to analog input blocks (AIs):

COND / COND Calculation Block

Measured value	Unit of measurement	Measurement status
Temperature diff.	°C or °F	Variable
Conductivity diff.	µS/cm	Variable
Resistivity diff.	MΩ * cm	Variable
Ratio		Variable
Passage	%	Variable
Rejection	%	Variable
Deviation	%	Variable
Concentration alkalizing agent (ion exchanger)	ppm	Variable
pH value	pH	Variable
Degassed conductivity	µS/cm	Variable
Rem. capacity (ion exchanger)	%	Variable
Remaining time (ion exchanger)	s	Variable

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PN4400-095 Module

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Knick
Elektronische Messgeräte
GmbH & Co. KG

Headquarters
Beuckestraße 22 • 14163 Berlin
Germany
Phone: +49 30 80191-0
Fax: +49 30 80191-200
info@knick.de
www.knick.de

Local Contacts
www.knick-international.com

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