Knick

User Manual

Protos II 4400(X)

Basic Unit: FRONT and BASE Modules

Read before installation.
Keep for future use.

www.knick-international.com

Supplemental Directives

READ AND SAVE THIS DOCUMENT FOR FUTURE REFERENCE. BEFORE ATTEMPTING TO ASSEMBLE, INSTALL, OPERATE OR MAINTAIN THE PRODUCT, PLEASE ENSURE A COMPLETE UNDERSTANDING OF THE INSTRUCTIONS AND RISKS DESCRIBED HEREIN. ALWAYS OBSERVE ALL SAFETY INFORMATION. FAILURE TO COMPLY WITH INSTRUCTIONS IN THIS DOCUMENT COULD RESULT IN SERIOUS INJURY AND/OR PROPERTY DAMAGE. THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE.

These supplemental directives explain how safety information is laid out in this document and what content it covers.

Safety Chapter

This document's safety chapter is designed to give the reader a basic understanding of safety. It illustrates general hazards and gives strategies on how to avoid them.

Warnings

This document uses the following warnings to indicate hazardous situations:

Icon	Category	Meaning	Remark
⚠	**WARNING!**	Designates a situation that can lead to death or serious (irreversible) injury.	The warnings contain information on how to avoid the hazard.
⚠	**CAUTION!**	Designates a situation that can lead to slight or moderate (reversible) injury.	
Without	**NOTICE!**	Designates a situation that can lead to property or environmental damage.	

Symbols Used in this Document

Icon	Meaning
→	Reference to additional information
✓	Interim or final result in instructions for action
▶	Sequence of figures attached to an instruction for action
①	Item number in a figure
(1)	Item number in text

Table of Contents

1 Safety

This document contains important instructions for the use of the product. Always follow all instructions and operate the product with caution. If you have any questions, please contact Knick Elektronische Messgeräte GmbH & Co. KG (hereinafter sometimes referred to as "Knick") using the information provided on the back page of this document.

1.1 Intended Use

Protos II 4400(X) (hereinafter also referred to as "product" or "device") is an industrial transmitter for recording and processing electrochemical variables in liquids and gases.

The Protos II 4400(X) has a modular design and consists of the following components:

- FRONT Module (front unit with display, keypad, and firmware)
- BASE Module (power supply, inputs and outputs, contacts)
- Modules for measuring and communication

The defined rated operating conditions must be observed when using this product.
→ *Specifications, p. 117*

USE CAUTION AT ALL TIMES WHEN INSTALLING, USING, MAINTAINING OR OTHERWISE INTERACTING WITH THE PRODUCT. ANY USE OF THE PRODUCT EXCEPT AS SET FORTH HEREIN IS PROHIBITED, AND MAY RESULT IN SERIOUS INJURY OR DEATH, AS WELL AS DAMAGE TO PROPERTY. THE OPERATING COMPANY SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGES RESULTING FROM OR ARISING OUT OF AN UNINTENDED USE OF THE PRODUCT.

Applications

Protos II 4400(X) has been developed for the industrial sector. It is available as Protos II 4400(X)C in a powder-coated stainless steel enclosure and Protos II 4400(X)S in a polished stainless steel enclosure.

Up to three modules for measuring and communication can be installed in the slots. The process variables depend on the measuring modules used.

1.2 Personnel Requirements

The operating company shall ensure that any personnel using or otherwise interacting with the product is adequately trained and has been properly instructed.

The operating company shall comply and cause its personnel to comply with all applicable laws, regulations, codes, ordinances, and relevant industry qualification standards related to the product. Failure to comply with the foregoing shall constitute a violation of operating company's obligations concerning the product, including but not limited to an unintended use as described in this document.

1.3 Safety Training

Upon request, Knick Elektronische Messgeräte GmbH & Co. KG will provide safety briefings and product training during initial commissioning of the product. More information is available from the relevant local contacts.

1.4 Residual Risks

The product has been developed and manufactured in accordance with generally accepted safety rules and regulations. The following residual risks remain:

- Ambient conditions with chemically corrosive substances may prevent the system from working properly.
- Access to the operator and administrator level has not been sufficiently protected from incorrect operation. → *Passcode Entry, p. 58*

1.5 Installation and Commissioning

Electrical installation must be in accordance with all applicable local codes and standards, in the United States, for example, the National Electrical Code (NEC) ANSI/NFPA-70.

Cable

Only use cables with a suitable temperature resistance.

Cable temperature resistance: > 75 °C (> 167 °F)

Mains Connection

The device does not have a power switch. An appropriately arranged and accessible disconnecting device must be present in the system installation. The disconnecting device must disconnect all non-grounded, current-carrying wires. The disconnecting device must be labeled in such a way that enables the associated device to be identified.

The power cord may carry dangerous touch voltages. Touch protection must be ensured by proper installation.

Protection Rating

The device enclosure is dust-tight and provides protection against water jets (nozzle) from any angle.

- Europe: IP65
- USA: NEMA 4X

1.6 Operation

Whenever it is likely that protection has been impaired, the device must not be switched on or the device must be switched off correctly and secured against unintended operation. Reasons for this could be:

- Visible damage to the device
- Failure of the electrical function

Before recommissioning the device, a professional routine test must be performed by the manufacturer.

Manipulations of the device other than the handling described in the user manual are not permitted.

Function Check Mode (HOLD Function)

Operations must not be carried out while the device is in the function check mode (HOLD), as the system may behave unexpectedly and put users at risk.

The function check (HOLD) is active:

- For calibration (only the selected channel)
- For maintenance (current source, measuring point)
- For parameter setting on the operator and administrator level
- During an automated rinse cycle in conjunction with the Unical 9000(X) or Uniclean 900(X) controllers

Relay Contacts

The permitted load capability of the relay contacts must not be exceeded, even during switching operations. The relay contacts are subject to electrical erosion. With inductive and capacitive loads in particular, this will reduce the service life of the contacts. → *Relay Contacts: Protective Wiring, p. 33*

1.6.1 Operation in Explosive Atmospheres

Protos II 4400X is certified for operation in hazardous locations.

- EU Type Examination Certificate KEMA 03ATEX2530
- IECEx Certificate of Conformity IECEx DEK 11.0054

During installation in potentially explosive atmospheres, observe the information in the appendix to the certificates or the installation instructions of the Control Drawing.

The electrical parameters are indicated in the attachment to Certificate of Conformity IECEx DEK11.0054.

Observe all applicable local and national codes and standards for the installation of electrical equipment in hazardous locations. For further guidance, consult the following:

- IEC 60079-14
- EU directives 2014/34/EU and 1999/92/EC (ATEX)

The product may be operated in various types of protection. The operating company must define and document the applied type of protection during installation. For this purpose, the checkboxes on the nameplate can be used.

Modules which have already been used shall be subjected to a professional routine test before they may be operated in another type of protection.

Prior to commissioning, the operating company must verify the intrinsic safety in accordance with the installation regulations of IEC 60079-14 for the complete interconnection of all equipment involved, including the connecting cables.

Opening and Configuring the Device

The front unit of the Protos II 4400X may be briefly opened during operation to replace the memory cards. The power terminal cover may only be removed if the device is voltage-free.

Replacing components may affect intrinsic safety. Protos II 4400X may only be equipped with approved modules; see appendix to the certificates.

Disconnect the device from the power supply before replacing modules.

Further information → *Electrical Installation, p. 27*, → *Memory Card, p. 98*.

Ex Markings

Information about the Ex markings can be found in the appendix to the certificates.

Electrostatic Discharge

Observe the following notes to avoid electrostatic discharge:

- Clean non-metallic components with a damp cloth only, and allow them to dry.
- Connect the equipotential bonding clamp (on the underside of the enclosure) with the equipotential bonding of the system.

Certificates

The applicable certificates are available in their current version on the www.knick-international.com.

2 Product

2.1 Package Contents

- Basic unit Protos II in the version ordered (front unit and rear unit with BASE Module)
- Bag containing small accessory parts (2× reduction sealing insert, 1× multiple sealing insert, 2× blanking plug)
- Wall-mount kit (2× wall-mount bracket, 4× hexagon bolt M6×10, stainless steel A4)
- Test Report 2.2 in accordance with EN 10204
- Installation guide
- Safety guide

For Ex version Protos II 4400X:

- Appendix to certificates (KEMA 03ATEX2530, IECEx DEK 11.0054)
- Control Drawing 201.003-170
- EU Declaration of Conformity

Note: Check all components for damage upon receipt. Do not use damaged parts.

Modules for measuring and communication are not included in the basic unit's package contents.

2.2 Product Identification

The model designation is specified on the nameplate, the delivery note, and the product packaging.
→ *Nameplates, p. 11*

The Diagnostics menu provides information about all connected modules: Module type and function, hardware and firmware version, and serial number: Menu Selection ▸ Diagnostics ▸ Device Description
→ *Device Description, p. 80*

Basic unit, non-Ex	Model designation
Protos II 4400S (basic unit, polished stainless steel), broad-range power supply	4400S
Protos II 4400C (basic unit, coated stainless steel), broad-range power supply	4400C

Basic unit, Ex	Model designation
Protos II 4400XS (basic unit, polished stainless steel, broad-range power supply)	4400XS/VPW
Protos II 4400XS (basic unit, polished stainless steel, 24 V AC/DC)	4400XS/24 V
Protos II 4400XC (basic unit, coated stainless steel, broad-range power supply)	4400XC/VPW
Protos II 4400XC (basic unit, coated stainless steel, 24 V AC/DC)	4400XC/24 V

Modules for Measuring and Communication

Measuring module, non-Ex	Model designation
pH value and ORP measurement with pH differential probes (Pfaudler)	PH3400-033
pH value and ORP measurement with analog sensors	PH3400-035
Contacting conductivity measurement with analog sensors	COND3400-041
Inductive conductivity measurement with analog sensors	CONDI3400-051
Oxygen measurement with analog sensors	OXY3400-067
Oxygen measurement with SE740 optical sensor	LDO4400-170
pH/ORP/conductivity/oxygen measurement with Memosens sensors and Unical controller	MSU4400-180

Measuring module, Ex	Model designation
pH value and ORP measurement with pH differential probes (Pfaudler)	PH3400X-033
pH value and ORP measurement with analog sensors	PH3400X-035
Contacting conductivity measurement with analog sensors	COND3400X-041
Inductive conductivity measurement with analog sensors	CONDI3400X-051
Oxygen measurement with analog sensors	OXY3400X-067
pH/ORP/conductivity/oxygen measurement with Memosens sensors and Unical controller	MSU4400X-180

Communications module, non-Ex	Model designation
Output module with 2 current outputs and 4 switch outputs	OUT3400-071
Output module with 4 current outputs and a HART communication channel	OUT4400-072
PID controller module with 2 current outputs and 4 switch outputs	PID3400-121
Communication unit for PROFIBUS PA	COMPA4400-082
Communication unit for FOUNDATION Fieldbus	COMFF3400-085
Communication unit for PROFINET	PN4400-095

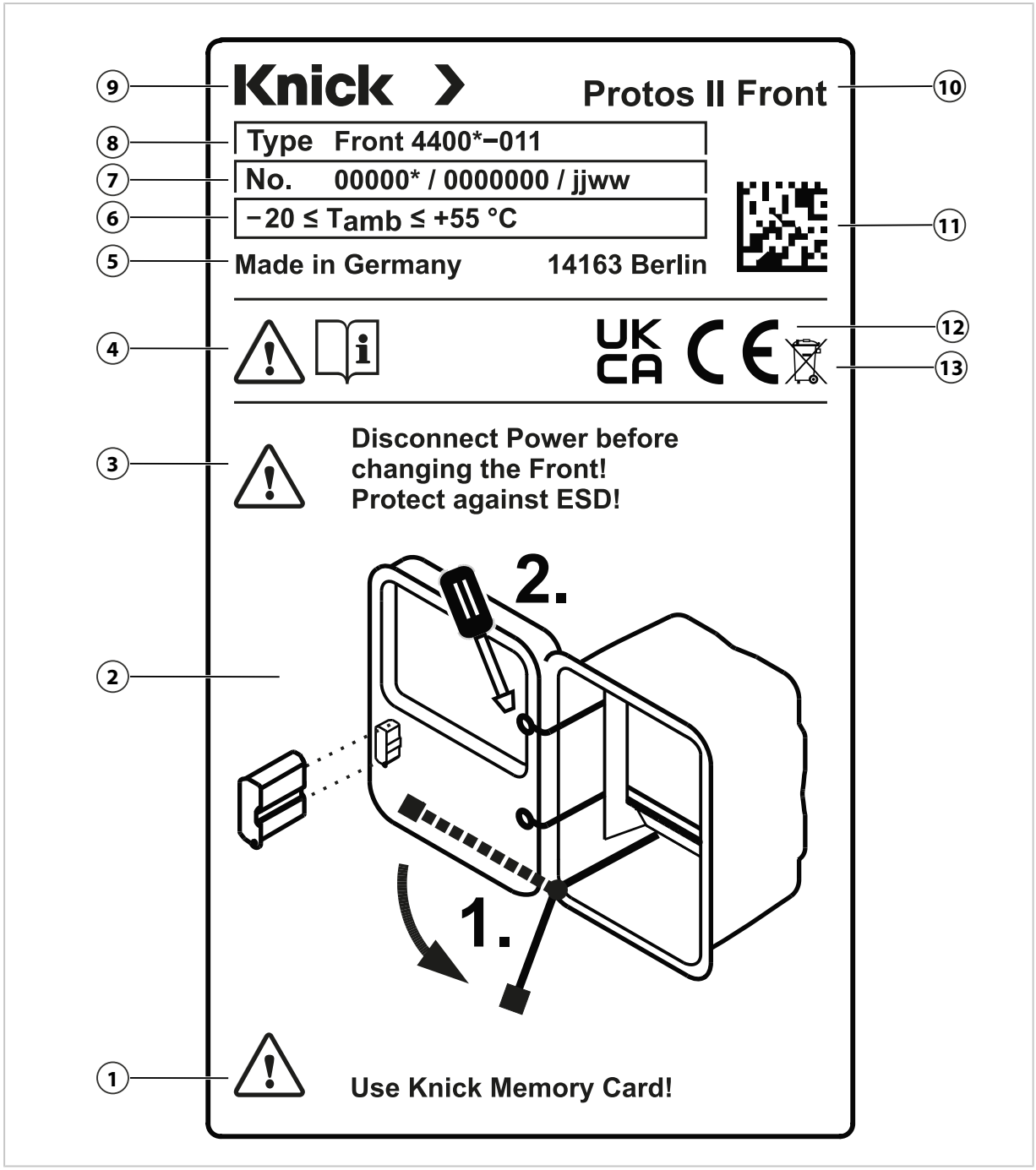
Communications module, Ex	Model designation
Output module with current output and 4 switch outputs	OUT3400X-071
PID controller module with 2 current outputs and 4 switch outputs	PID3400X-121
Communication unit for PROFIBUS PA	COMPA4400X-082
Communication unit for FOUNDATION Fieldbus	COMFF3400X-085

2.3 Nameplates

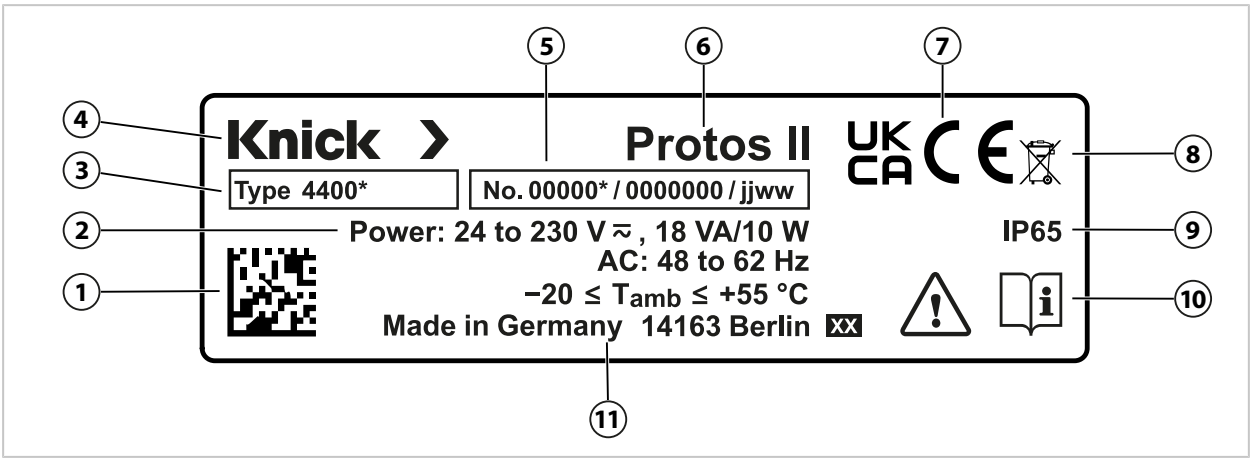
Protos II 4400(X) is identified by nameplates on the inside of the front unit and the outside of the enclosure. The information on the nameplates varies depending on the version.

Version Without Ex Approval

Example:



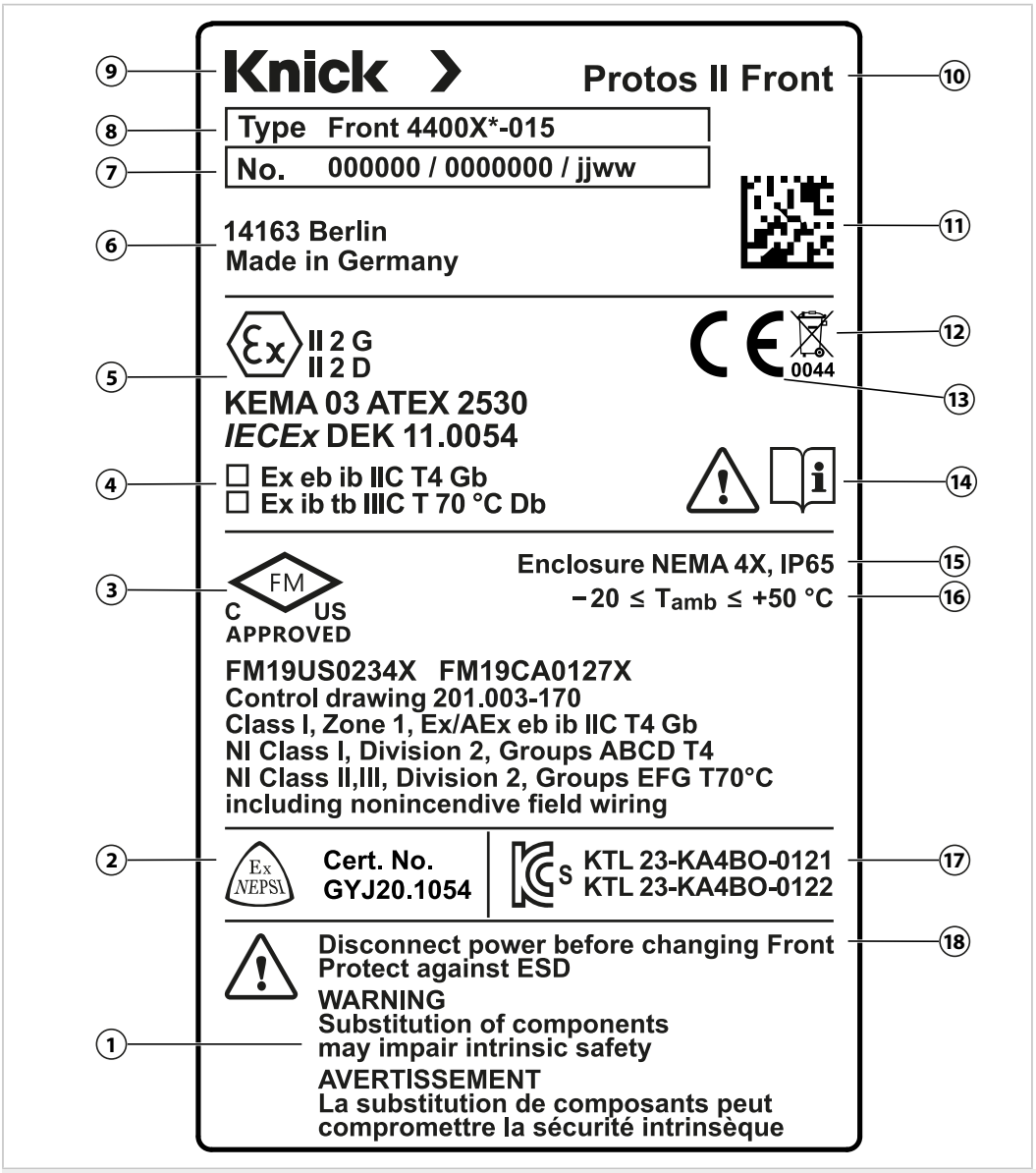
1	Note: Only use Knick memory cards.	8	FRONT Module model designation
2	FRONT Module installation instructions	9	Manufacturer
3	Warning: Disconnect from the power supply before replacing the front unit. Take ESD protective measures.	10	Product family
4	Special conditions, reference to product documentation	11	Data matrix code with item and serial numbers
5	Manufacturer address with designation of origin	12	CE mark
6	Permitted ambient temperature (operation)	13	WEEE mark
7	Item number/serial number/production year and week		



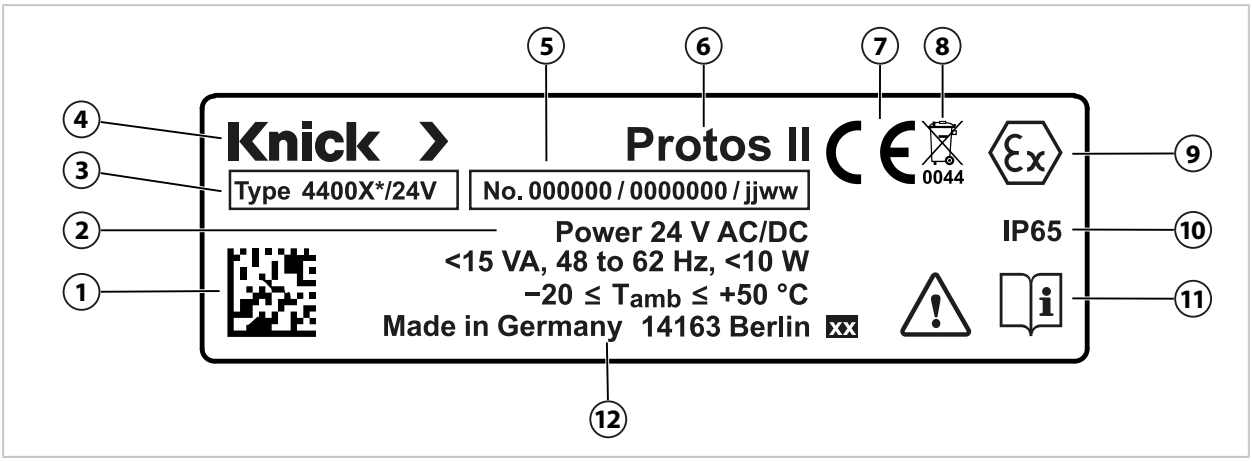
1	Data matrix code with item and serial numbers	7	CE mark
2	Power supply, permitted ambient temperature (operation)	8	WEEE mark
3	Model designation	9	Enclosure protection rating
4	Manufacturer	10	Special conditions, reference to product documentation
5	Item number/serial number/production year and week	11	Manufacturer address with designation of origin
6	Product family		

Version with Ex Approval

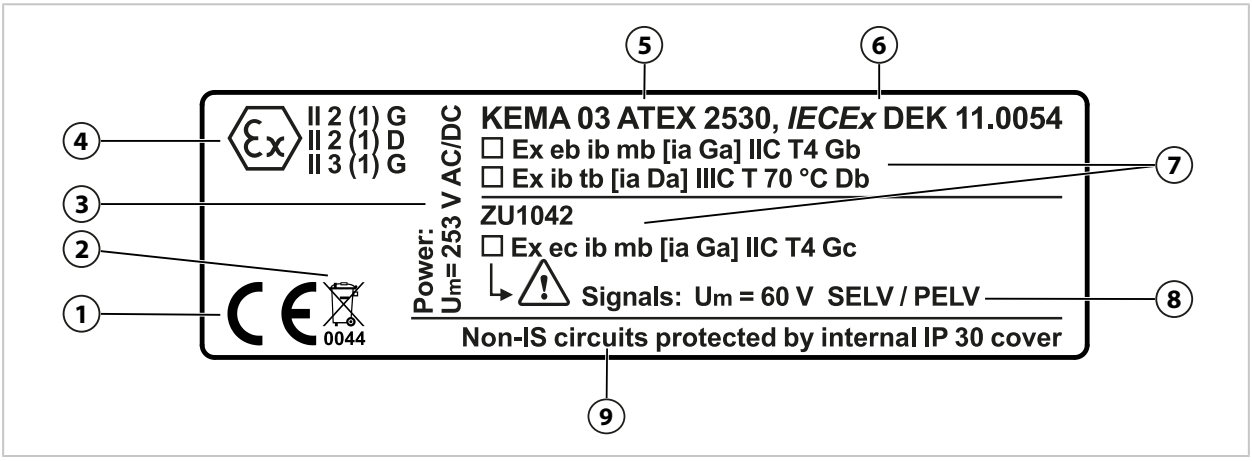
Examples:



1	Warning: Replacing components may affect intrinsic safety.	10	Product family
2	NEPSI mark for operation in potentially explosive atmospheres in China	11	Data matrix code with item and serial numbers
3	FM mark for the USA and Canada with information on the hazardous location and the Control Drawing number	12	WEEE mark
4	Selection fields for customer-specific marking of the respective use	13	CE mark with identification number of the notified body
5	ATEX and IECEx mark	14	Special conditions, reference to product documentation
6	Manufacturer address with designation of origin	15	Enclosure protection rating
7	Item number/serial number/production year and week	16	Permitted ambient temperature (operation)
8	Model designation	17	KCs mark for operation in potentially explosive atmospheres in Korea
9	Manufacturer	18	Warning: Disconnect from the power supply before replacing the device front. Take ESD protective measures.



1	Data matrix code with item and serial numbers	7	CE mark with identification number of the notified body
2	Power supply, permitted ambient temperature (operation)	8	WEEE mark
3	Model designation	9	ATEX mark
4	Manufacturer	10	Enclosure protection rating
5	Item number/serial number/production year and week	11	Special conditions, reference to product documentation
6	Product family	12	Manufacturer address with designation of origin



1	CE mark with identification number of the notified body	6	IECEx certificate
2	WEEE mark	7	Selection fields for marking the respective use
3	Power Supply	8	Special conditions for the signal terminals → *With ZU1042 Terminal Cover (Optional), p. 32*
4	ATEX mark	9	Non-intrinsically safe circuits protected by internal IP30 cover.
5	EU Type Examination Certificate		

2.4 Symbols and Markings on the Product

	Special conditions and danger points! Observe the safety instructions and instructions on safe use of the product as outlined in the product documentation.
	Refer to the product documentation.
	CE mark
	CE mark with identification number[1] of the notified body involved in the production control.
	Waste devices must be separated from unsorted municipal waste before disposal.
	ATEX marking[1] of the European Union for operation in hazardous locations → *Operation in Explosive Atmospheres, p. 8*
	IECEx mark[1] for operation in potentially explosive atmospheres
	FM mark[1] for operation in potentially explosive atmospheres in the USA and Canada
	NEPSI mark[1] for operation in potentially explosive atmospheres in China
	KCs mark[1] for operation in potentially explosive atmospheres in Korea

[1] Dependent on the ordered version

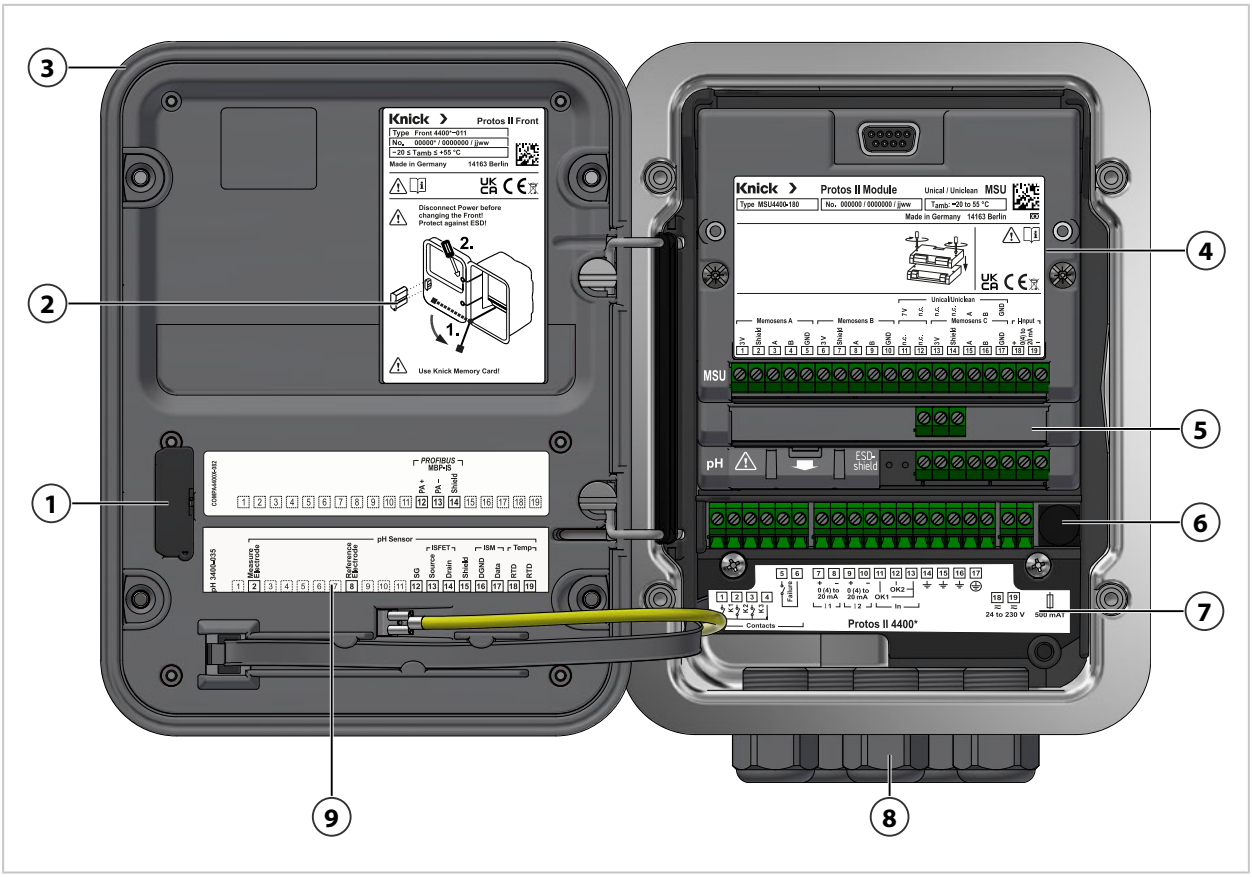
2.5 Design and Function

Protos II 4400(X) is a modular industrial transmitter.
The basic unit consists of the modules FRONT (front unit with a display, keypad, and firmware) and BASE (rear unit with a power supply, inputs and outputs, contacts). It features three slots that can be equipped with any combination of modules for measuring and communication. Thanks to add-on functions (TAN options), the firmware functionality of the device can be expanded.

The ProgaLog 4000 software can be used to configure the measurement system from a Windows computer.

Modules and add-on functions must be ordered separately. The add-on functions are delivered with a device-specific TAN for activation.

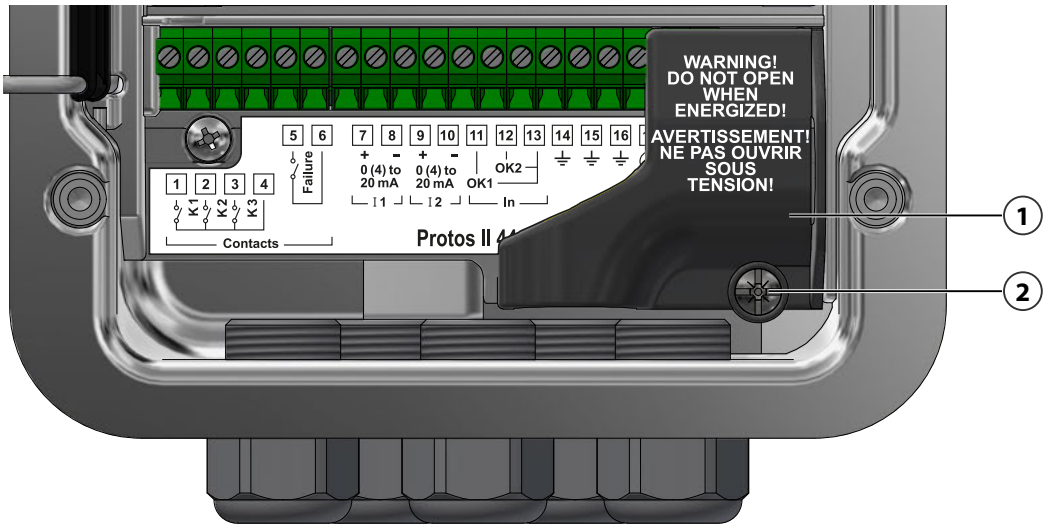
2.5.1 View of the Opened Device



1	Card slot	6	Fuse 500 mA T
2	Nameplate	7	BASE Module terminal plate
3	Circumferential seal	8	5 cable glands
4	Terminal plate of the top module	9	Sticker showing the terminal assignment of the concealed modules (slot 1 and 2)
5	Up to three modules for measuring and communication		

Protos II 4400X with Power Terminal Cover

For Protos II 4400X with BASE 4400X-025/VPW Module, the terminals for the power supply are covered.



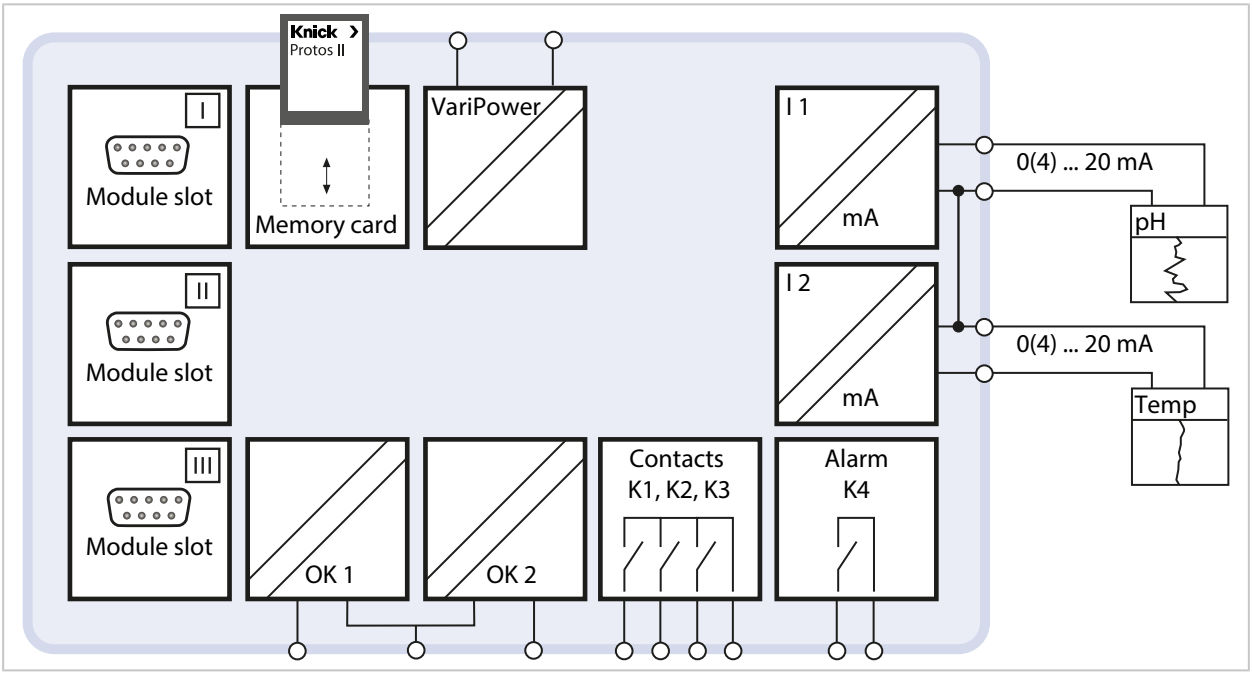
1 Power terminal cover	2 Phillips screw

See also

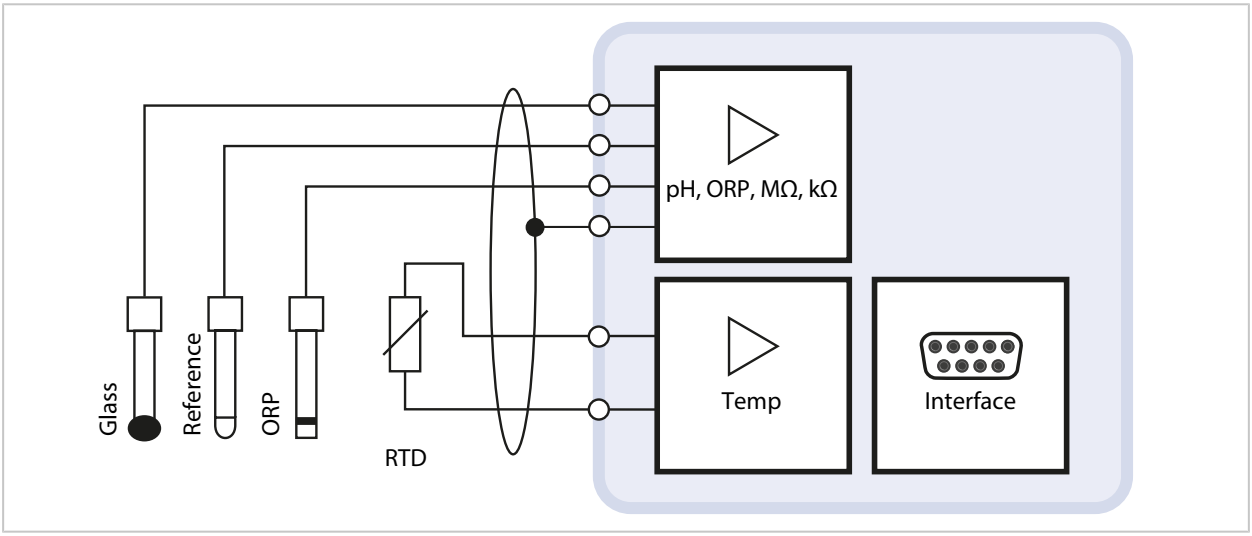
→ *Electrical Installation, p. 27*
→ *Wiring for Protos II 4400X, p. 31*

2.6 System Overview

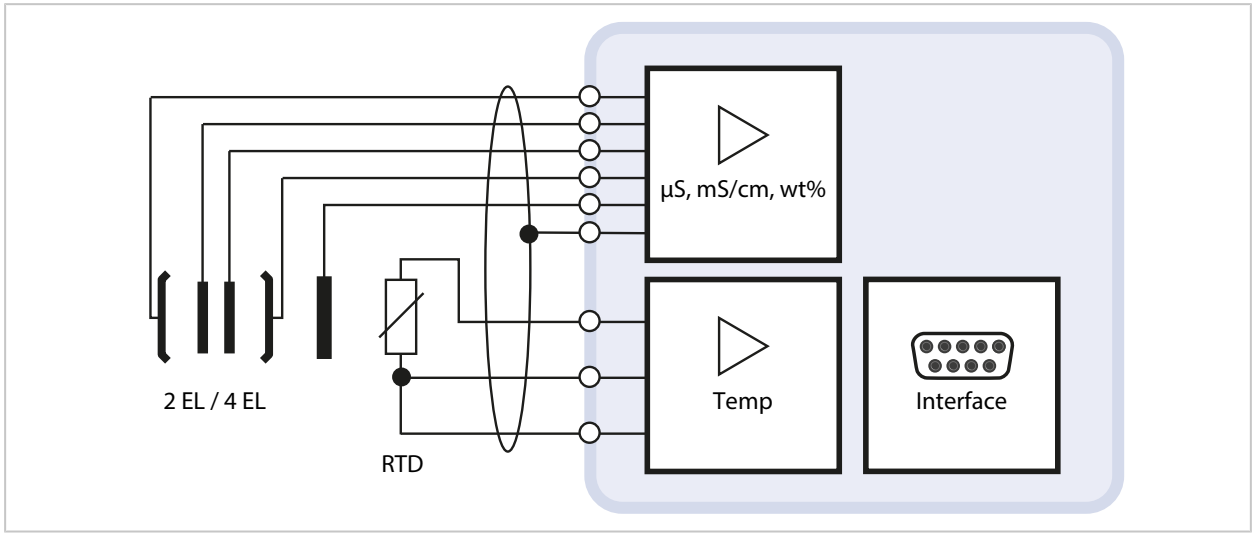
Modular Protos II 4400(X) Process Analysis System



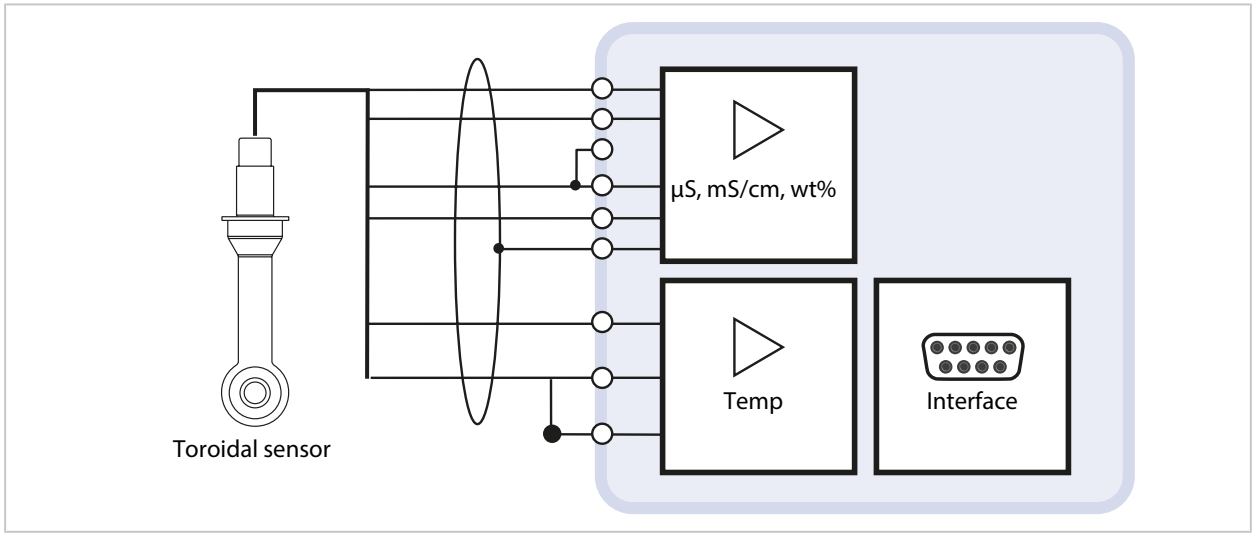
PH3400(X)-033/-035 Module: pH/ORP Measurement with Analog Sensors



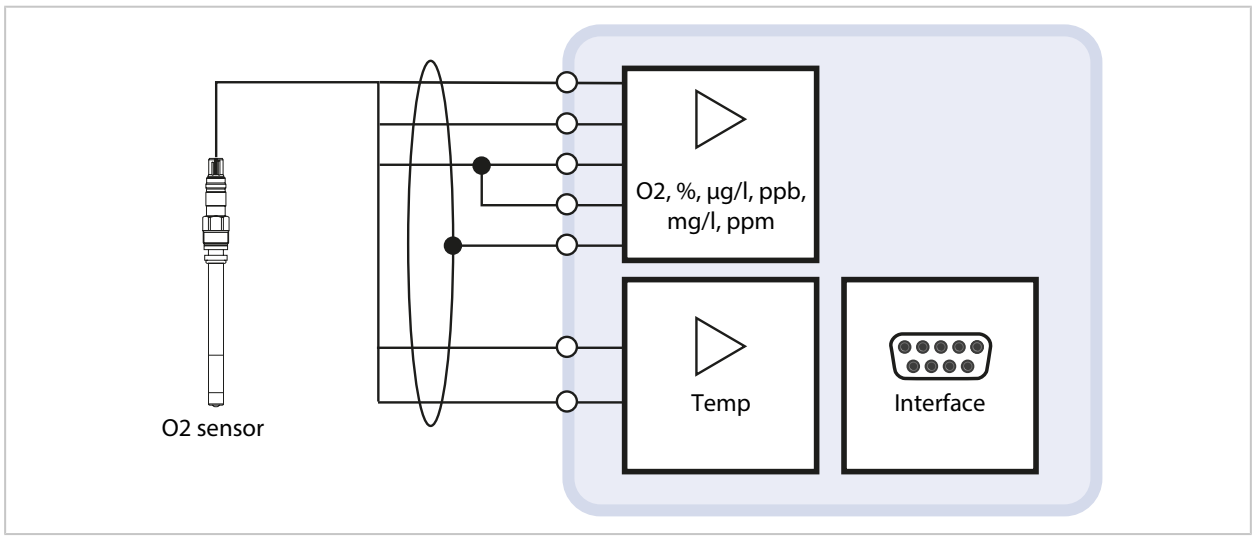
COND3400(X)-041 Module: Contacting Conductivity Measurement with Analog Sensors



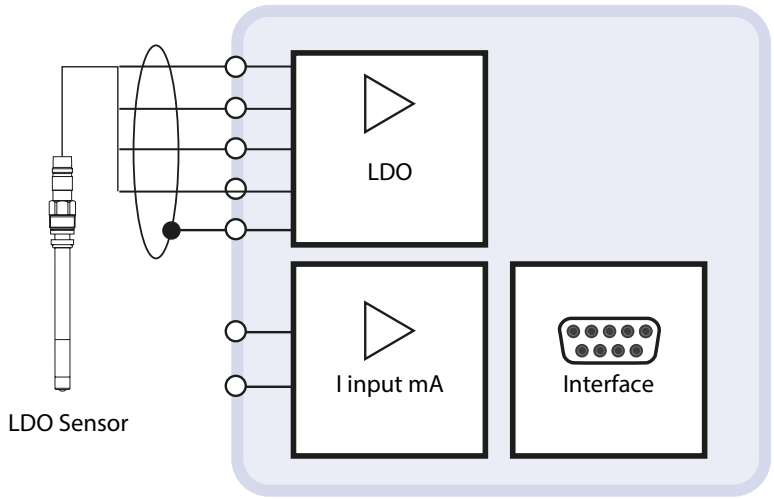
CONDI3400(X)-051 Module: Inductive Conductivity Measurement with Analog Sensors



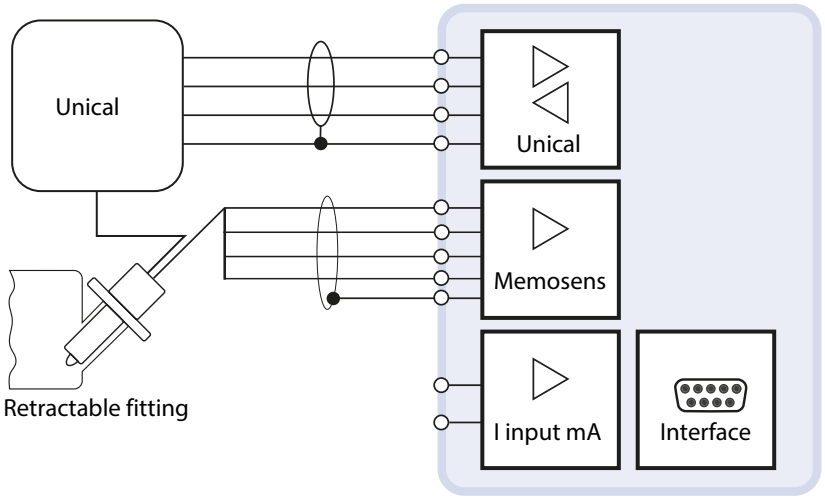
OXY3400(X)-067 Module: Oxygen Measurement with Analog Sensors



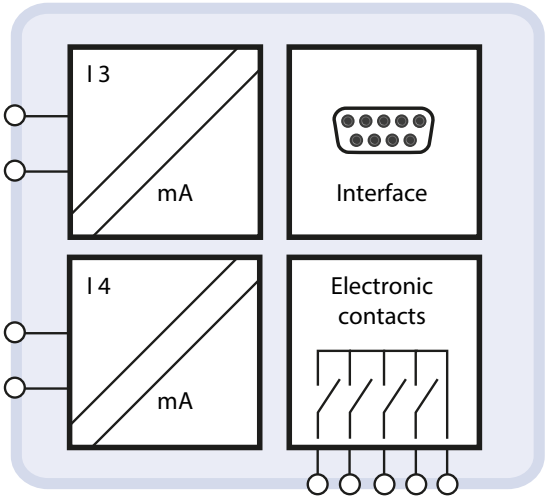
LDO3400-170/LDO4400-170 Module: Oxygen Measurement with SE740 Optical Sensor



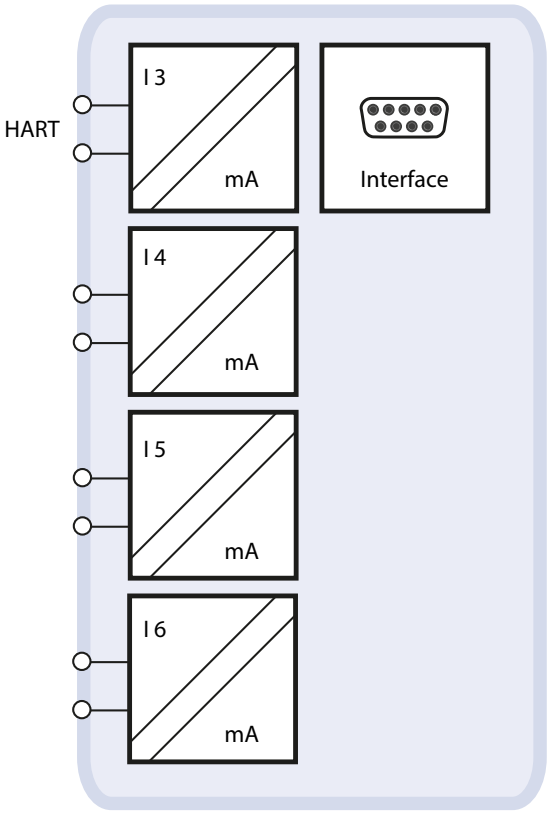
MSU4400(X)-180 Module: pH/ORP/Conductivity/Oxygen Measurement with Memosens Sensors and Unical Controller



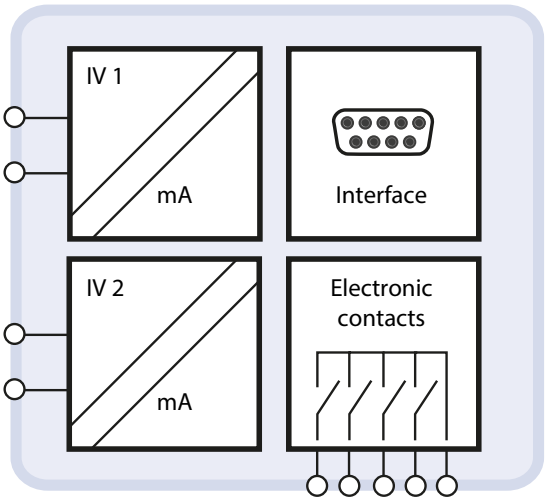
OUT3400(X)-071 Module: 2 Current Outputs, 4 Switch Outputs



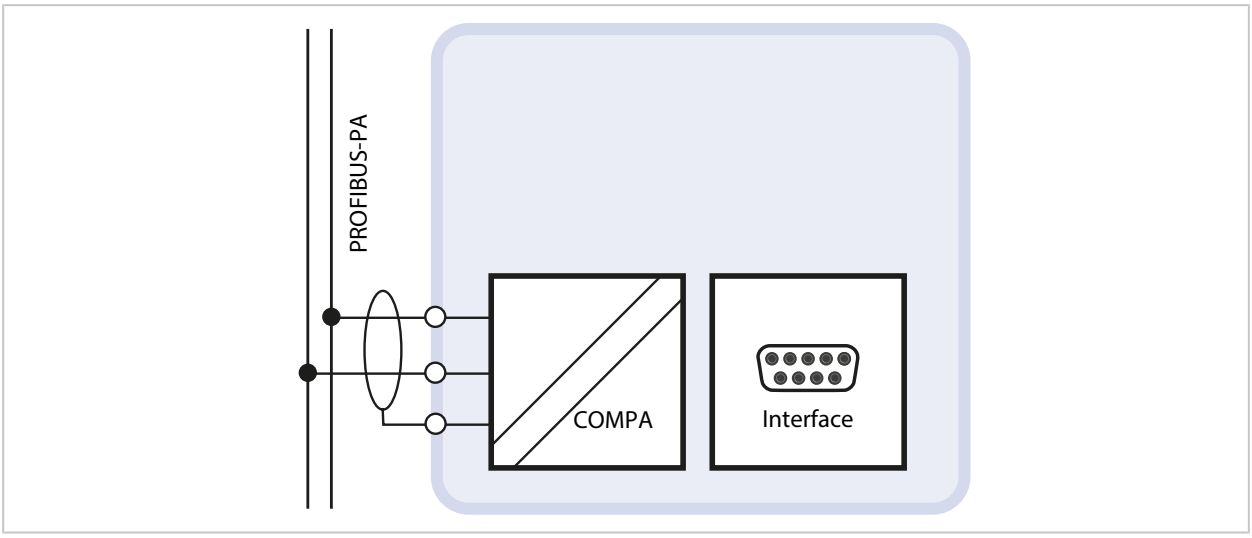
OUT4400(X)-072 Module: 4 Current Outputs, HART Communication



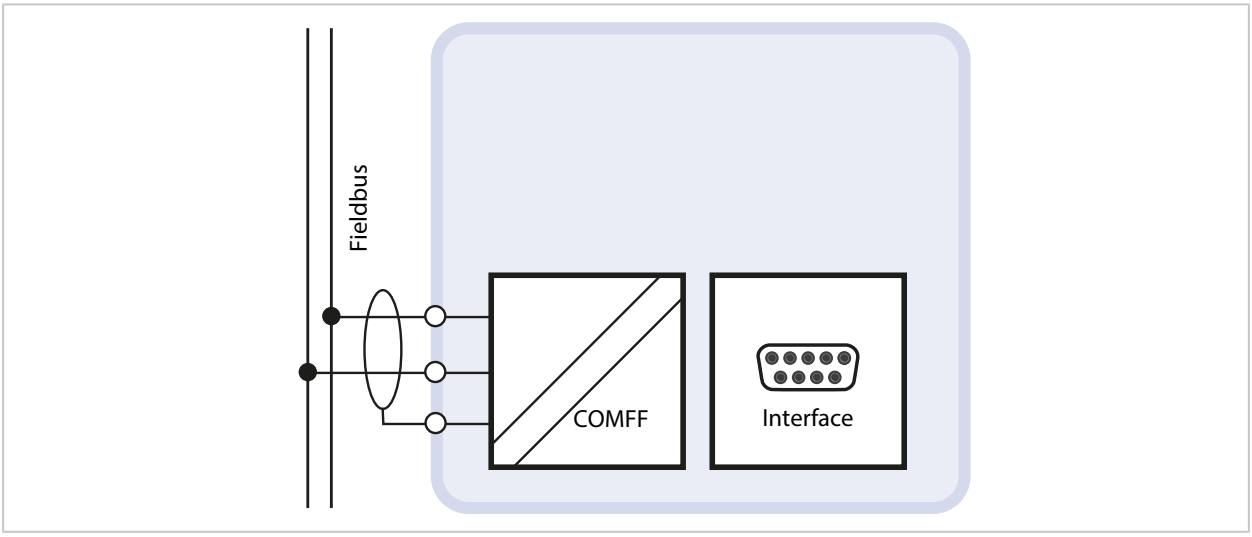
PID3400(X)-121 Module: PID Controller with 2 Current Outputs and 4 Switch Outputs



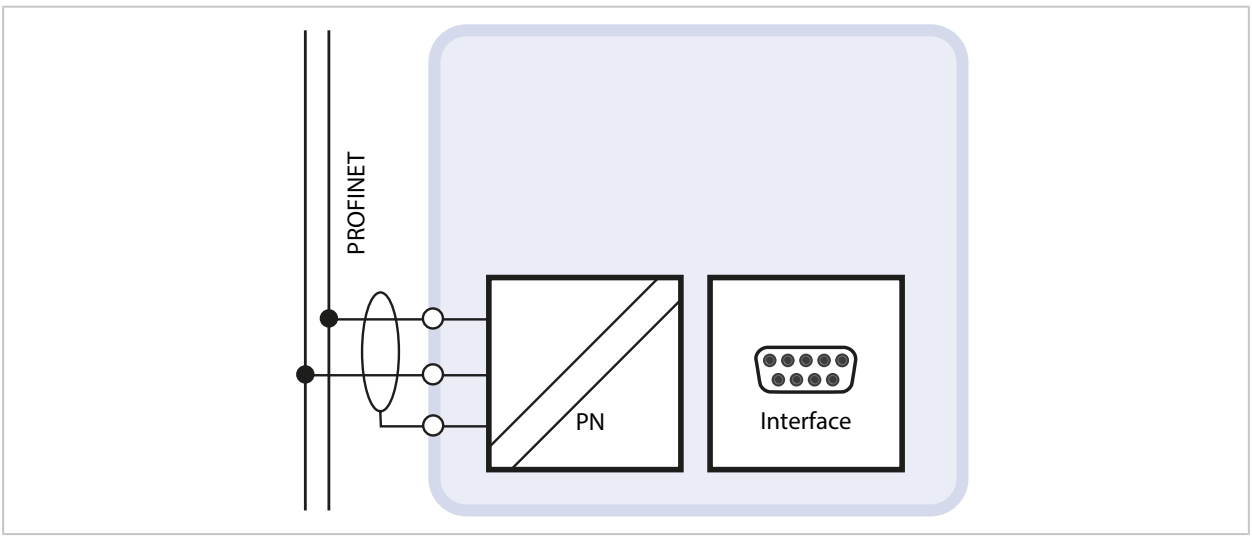
COMPA4400(X)-082 Module: Communication Unit for PROFIBUS PA



COMFF3400(X)-085 Module: Communication Unit for FOUNDATION Fieldbus



PN4400(X)-095 Module: Communication Unit for PROFINET



3 Installation

3.1 General Installation Notes

- Protos II 4400(X) can be mounted on a wall, pipe, or control panel.
- The mounting location must have sufficient strength and be free from vibrations.
- For outdoor installation, observe the ambient temperature → *Ambient Conditions, p. 119*
  Take protective measures where necessary, such as installing a protective hood.
  → *ZU0548/ZU1178 Protective Hood, p. 97*

Note: At ambient temperatures below 0 °C (32 °F) or under strong, direct sunlight, the readability of the LCD may be limited. The ability of the device to measure is not impacted by this.

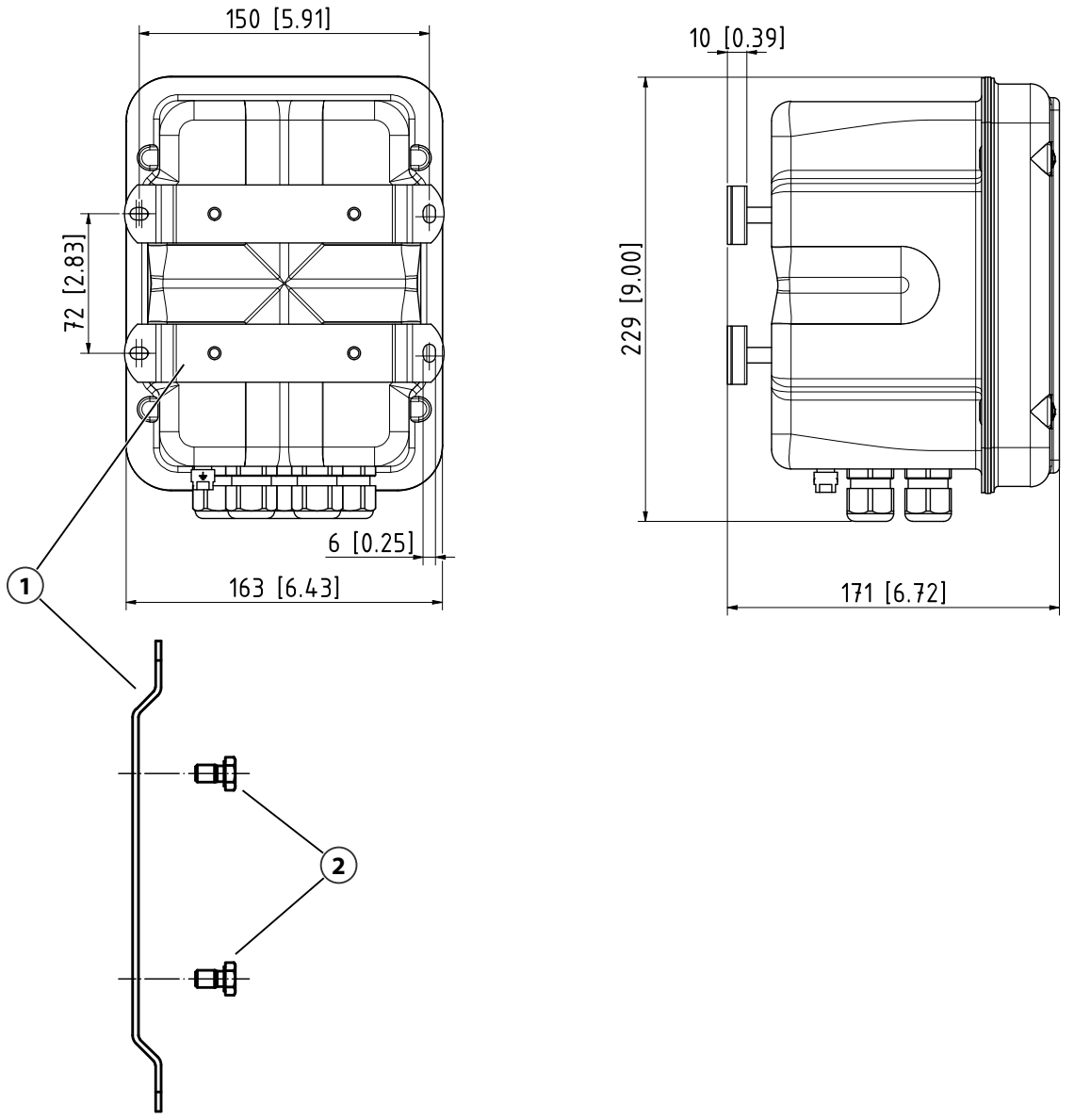
⚠ **CAUTION! Risk of losing the specified ingress protection.** Observe the permissible cable diameters and tightening torques. Fasten the cable glands and screw together the enclosure correctly. Do not contaminate or damage the circumferential seal.

NOTICE! Possible product damage. Use only a suitable Phillips head screwdriver to open and close the enclosure. Do not use sharp or pointed objects. Tighten the screws with a torque of 0.5 ... 2 Nm.

3.2 Mechanical Installation

3.2.1 Wall Mounting

Note: All dimensions are listed in millimeters [inches].



1 2× wall-mount bracket (stainless steel A4) 2 4× hexagon bolt M6×10 (A/F 10, stainless steel A4)

01. Check the Protos II 4400(X) for damage.
02. Prepare the holes according to the dimension drawing. → *Dimension Drawing, p. 121*
03. Attach the two wall-mount brackets **(3)** to the rear of the device with the four hexagon bolts **(4)**.
04. Use the screws and, if necessary, washers[1)] to attach the wall-mount bracket to the wall.
05. Check that it is securely fastened.

1) Not included in the package contents.

3.2.2 Pipe Mounting

The ZU0544 pipe-mount kit can be used to mount the Protos II 4400(X) to a pipe.
→ *ZU0544 Pipe-Mount Kit, p. 95*

3.2.3 Control Panel Mounting

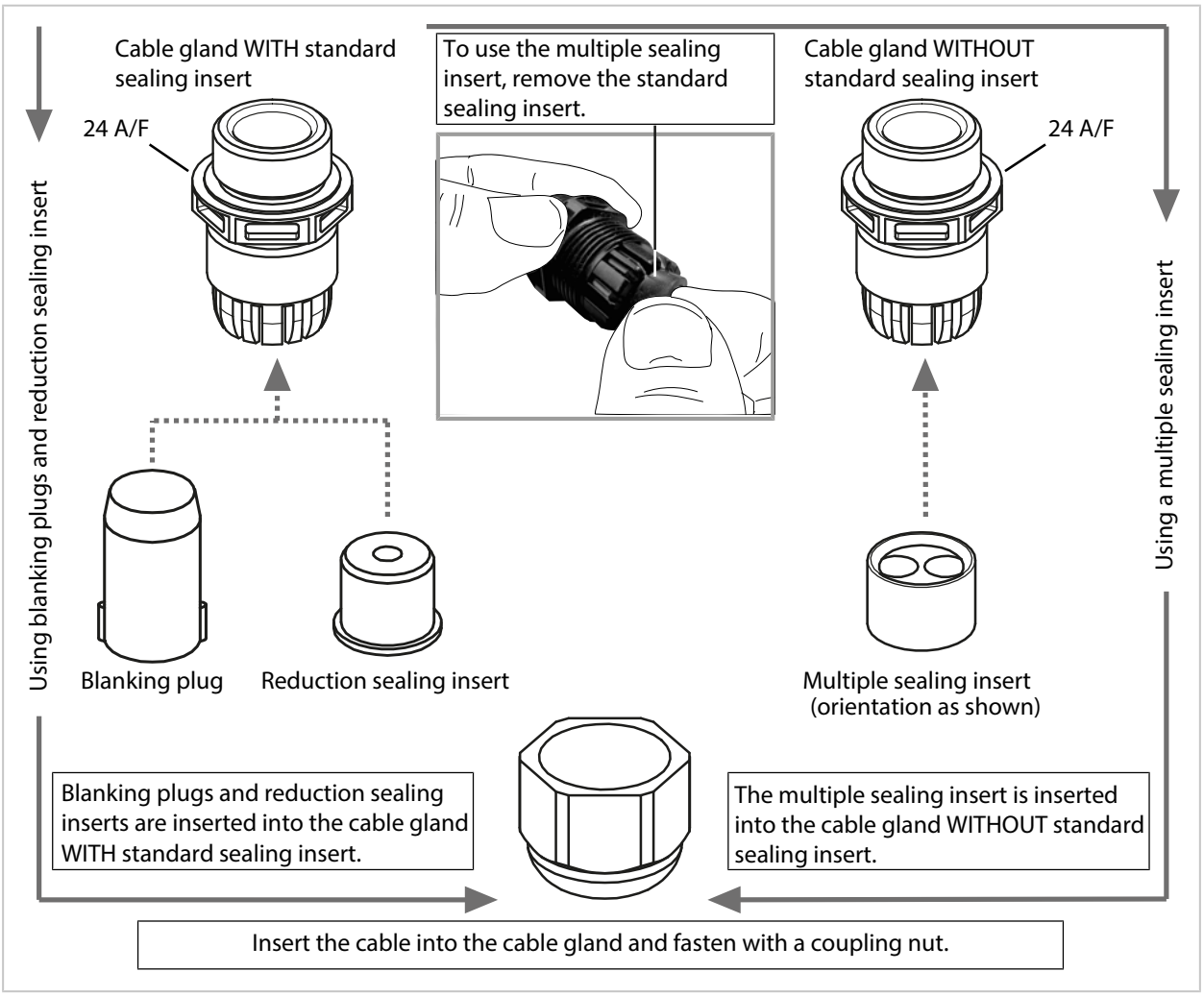
The ZU0545 panel-mount kit can be used to mount the Protos II 4400(X) in a control panel.
→ *ZU0545 Panel-Mount Kit, p. 96*

3.2.4 Blanking Plugs, Reduction Sealing Inserts, Multiple Sealing Inserts

Only use suitable and certified cable glands with suitable approvals in a hazardous location, e.g., WISKA Type ESKE/1 M20.

As delivered, each cable gland includes a standard sealing insert. Reduction sealing inserts and multiple sealing inserts are available for the tight insertion of one or two thinner cables. The clasp can be tightly sealed using a blanking plug. Proceed as shown below.

⚠ **CAUTION! Risk of losing the specified ingress protection.** Fasten the cable glands and screw together the enclosure correctly. Observe the permissible cable diameters and tightening torques. Only use original accessories and spare parts.



3.3 Electrical Installation

The BASE Module pre-installed in the basic unit is available in three versions.

- BASE4400-029 module (standard version, non-Ex location):
  VariPower broad-range power supply, 24 (– 15 %) ... 230 (+ 10 %) V AC/DC
- BASE4400X-025/VPW module (Ex version):
  VariPower broad-range power supply, 100 ... 230 V AC (– 15 %, + 10 %)
- BASE4400X-026/24V module (Ex version):
  Power supply 24 V AC (– 15 %, + 10 %) or 24 V DC (– 15 %, + 20 %)

Wiring → *Terminal Assignment, p. 28*

⚠ WARNING! The device does not have a power switch. An appropriately arranged and accessible disconnecting device for the transmitter must be present in the system installation. The disconnecting device must disconnect all non-grounded, current-carrying wires and be labeled such that the associated transmitter can be identified.

⚠ WARNING! The power cord may carry voltages that are dangerous to touch. Only install the product in a voltage-free state. Secure the system against accidental restart.

01. Use a Phillips head screwdriver to unscrew the enclosure screws of the front unit and open the device.
02. Guide the required cables through.
03. Seal unused cable glands with blanking plugs.
    → *Blanking Plugs, Reduction Sealing Inserts, Multiple Sealing Inserts, p. 26*
04. Connect the BASE Module: → *Terminal Assignment, p. 28*
    (Deactivate unused connections later in the parameter setting menu.)

NOTICE! Strip the insulation from the wires using a suitable tool to prevent damage.
Stripping length max. 7 mm.

NOTICE! Damage to the screw terminals due to excessive tightening torque. Tighten the screw terminals with a maximum torque of 0.6 Nm.

05. Connect the current outputs.
06. Connect the relay contacts and inputs if required.
07. For the Ex version: Remove the power terminal cover.
    → *Protos II 4400X with Power Terminal Cover, p. 17*
08. Connect the power supply and connect the protective ground connection of the BASE Module (terminal 17 or "PE") to the protective ground conductor in the mains connection cable.
09. For the Ex version: Connect the equipotential bonding clamp (on the underside of the enclosure) to the equipotential bonding of the equipment. → *Dimension Drawing, p. 121*
10. For the Ex version: Reattach the power terminal cover.

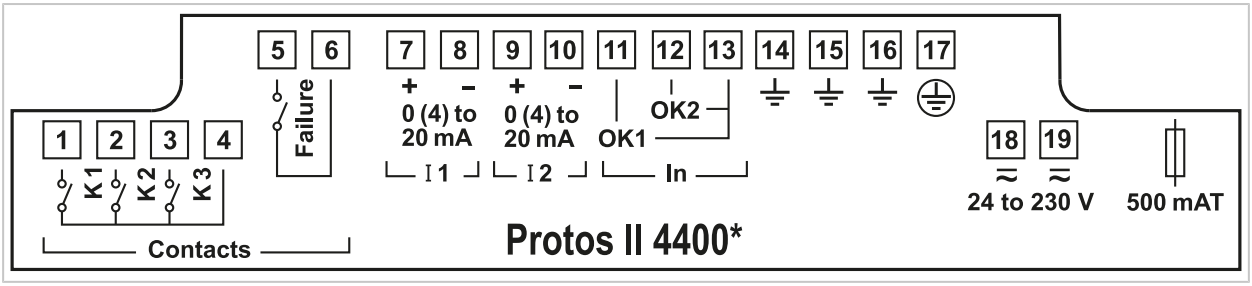
⚠ CAUTION! Electrostatic discharge (ESD). The modules' signal inputs are sensitive to electrostatic discharge. Take measures to protect against ESD before inserting the module and connecting the inputs.

11. Insert the module(s) into the module slot (D-SUB plug) and tighten the fastening screws.
12. Connect the sensor(s) (see the module installation guide).
13. Check whether all connections are correctly connected.
14. Close the device and tighten the enclosure screws in a crosswise pattern.
    Tightening torque 0.5 ... 2 Nm.
15. Before switching on the power supply, make sure its voltage is within the specified range (values → *Terminal Assignment, p. 28*).
16. Switch on the power supply.

3.3.1 Terminal Assignment

BASE4400-029 Module

Standard version, non-Ex area

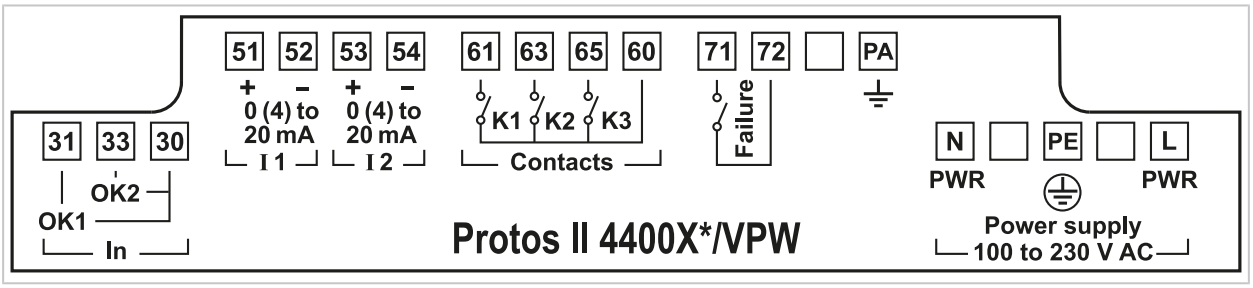


Terminal	Description
1	Relay contacts, freely assignable
2	
3	
4	
5	Relay contact failure
6	
7	Current Output 1 0(4) ... 20 mA
8	
9	Current Output 2 0(4) ... 20 mA
10	
11	Optocoupler input
12	
13	
14	Ground
15	
16	
17	Protective ground[1)]
18	Power supply 24 ... 230 V AC/DC
19	

1) Must be connected with the protective ground conductor in the mains connection cable.

BASE4400X-025/VPW Module

Ex version with VariPower power supply unit

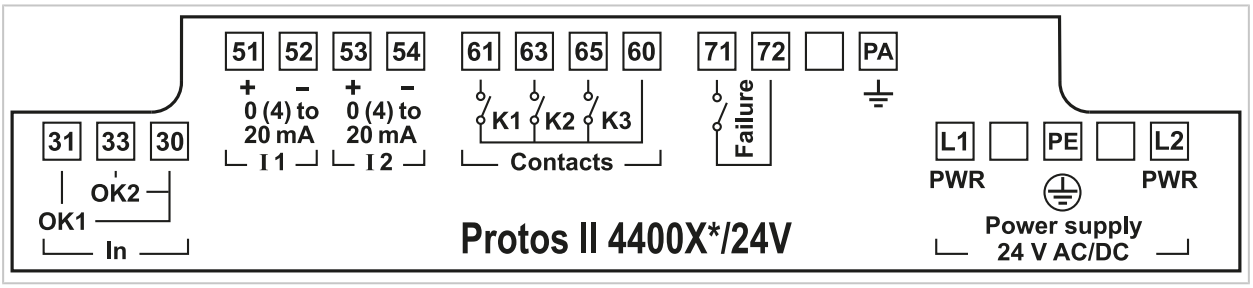


Terminal	Description
31	Optocoupler input
33	
30	
51 +	Current Output 1 0(4) ... 20 mA
52 -	
53 +	Current Output 2 0(4) ... 20 mA
54 -	
61	Relay contacts, freely assignable
63	
65	
60	
71	Relay contact
72	
PA	Ground (equipotential bonding)
N	Power supply 100 ... 230 V AC
PE	Protective ground[1)]
L	Power supply 24 ... 230 V AC/DC

1) Must be connected with the protective ground conductor in the mains connection cable.

BASE4400X-26/24V Module

Ex version with 24 V power supply unit



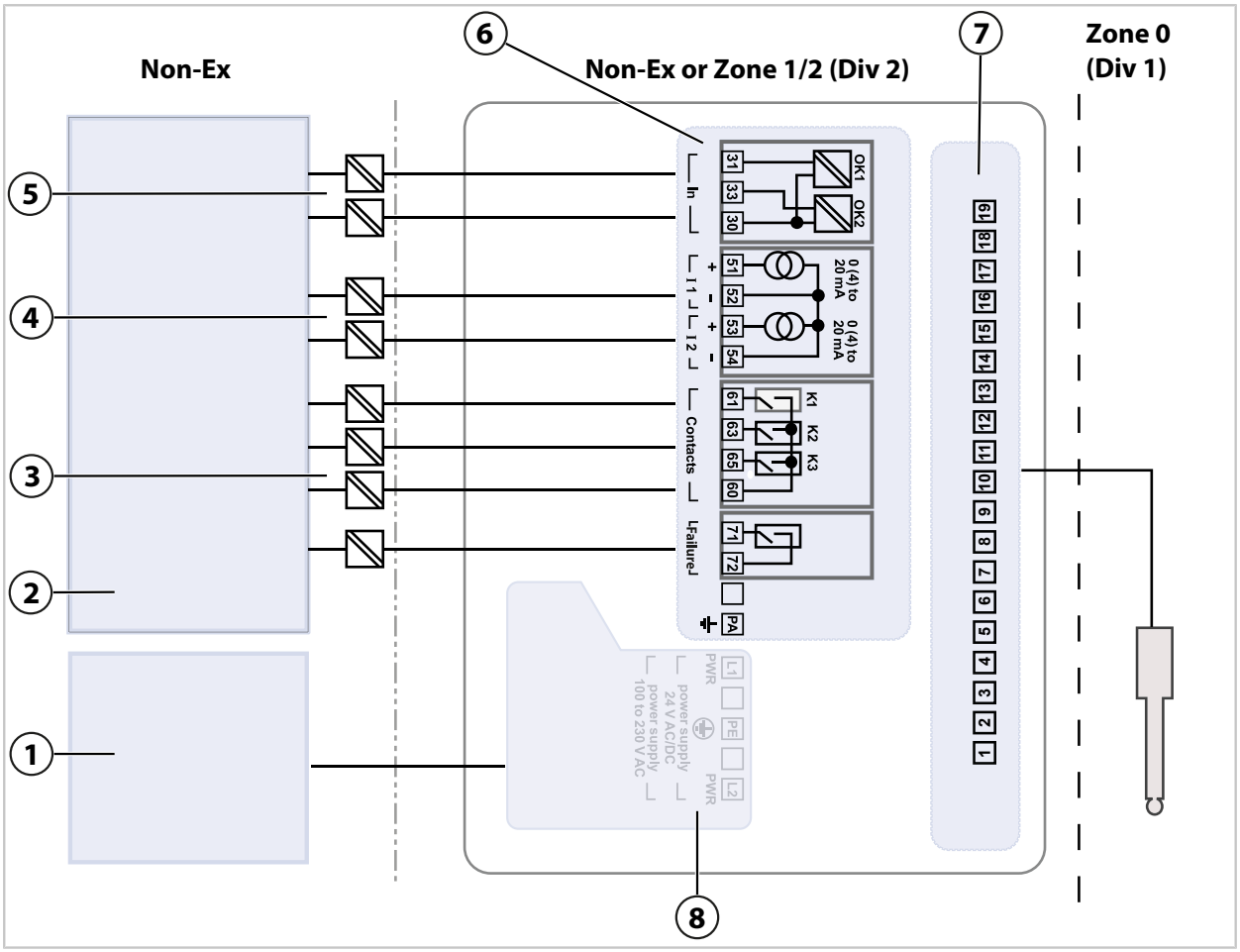
Terminal	Description
31	Optocoupler input
33	
30	
51 +	Current Output 1
52 -	0(4) ... 20 mA
53 +	Current Output 2
54 -	0(4) ... 20 mA
61	Relay contacts, freely assignable
63	
65	
60	
71	Relay contact
72	
PA	Ground (equipotential bonding)
L1	Power supply 24 V AC/DC
PE	Protective ground[1)]
L2	Power supply 24 V AC/DC

[1)] Must be connected with the protective ground conductor in the mains connection cable.

3.3.2 Wiring for Protos II 4400X

With Power Terminal Cover (Package Contents)

The power terminal cover included in the package contents only covers the power terminal blocks **(8)**. All other connections must be intrinsically safe.



1	Power supply (non-Ex)	5	2× valve control module, connection to optocoupler inputs OK1, OK2
2	Programmable logic controller (non-Ex)	6	Signal terminals (intrinsically safe Ex ib)[1)]
3	4× switch amplifier, connection to relay contacts K1 ... K4	7	Module connections (intrinsically safe Ex ib[ia] or Ex ib)[1)]
4	2× supply/input switch amplifier, connection to current outputs I1, I2	8	Power terminal blocks (increased safety Ex eb, U_m = 253 V)

Interface Components for Intrinsically Safe Connection

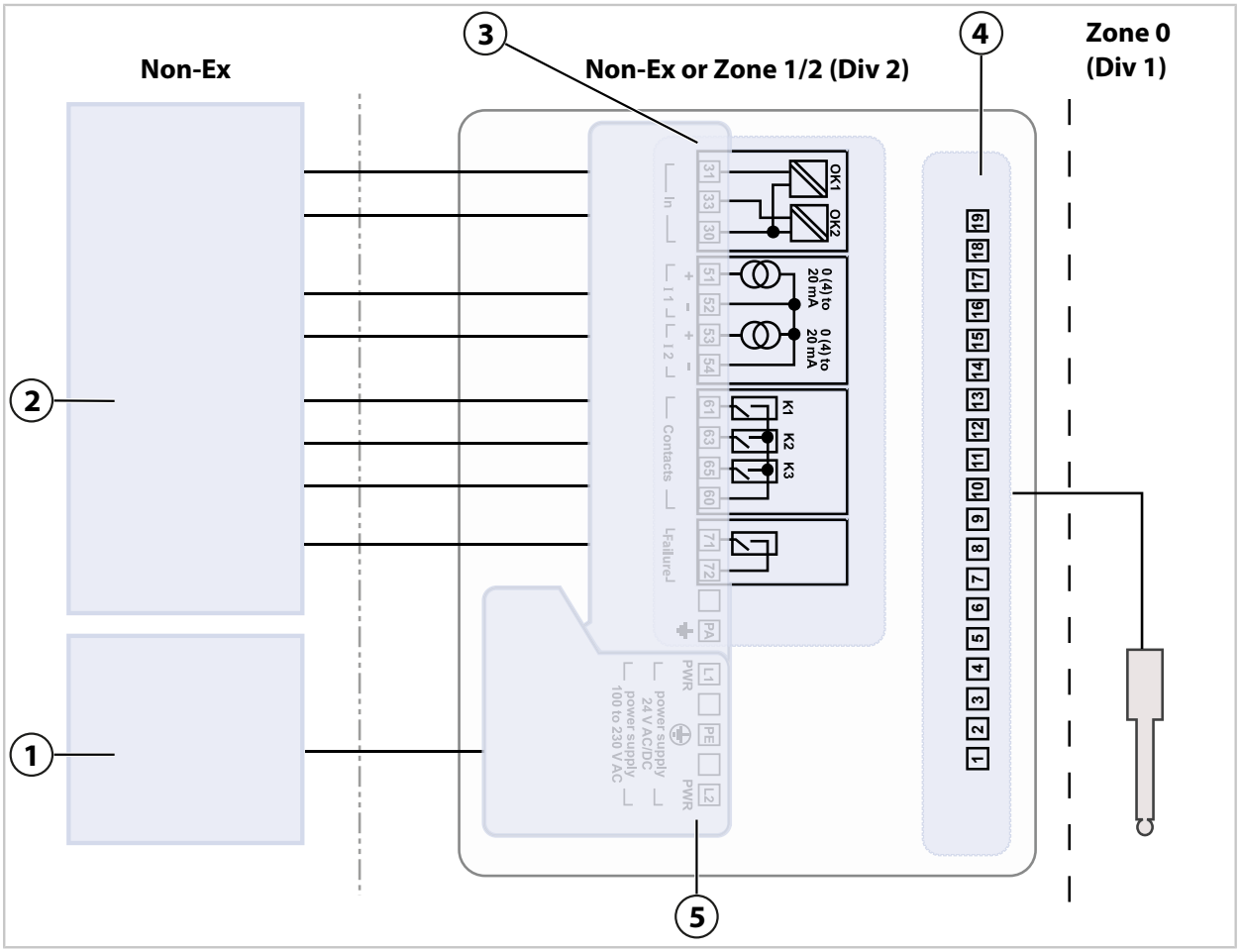
Examples:

	Designation	Type	Manufacturer
(3)	Switch amplifier	KF**-SR2-Ex1.W.**	Pepperl + Fuchs
(4)	Supply/input switch amplifier	MACX MCR-EX-SL-RPSSI-I***	Phoenix Contact
(5)	Valve control module	KFD2-SL2-Ex1.B	Pepperl + Fuchs

[1)] See the appendix to the certificates or Control Drawings for the electrical parameters.

With ZU1042 Terminal Cover (Optional)

The optionally available ZU1042 terminal cover covers not only the power terminal blocks **(5)** but also the signal terminals **(3)**. This eliminates the need for interface components in front of the BASE module inputs/outputs.



1	Power supply (non-Ex)	4	Module connections (intrinsically safe Ex ib[ia] or Ex ib)[1]
2	Programmable logic controller (non-Ex, outputs SELV/PELV)	5	Power terminal blocks (increased safety Ex eb, U_m = 253 V)
3	Signal terminals (increased safety Ex ec, U_m = 60 V)		

[1] See the appendix to the certificates or Control Drawings for the electrical parameters.

3.3.3 Relay Contacts: Protective Wiring

Relay contacts are subject to electrical erosion. With inductive and capacitive loads in particular, this will reduce the service life of the contacts. For suppressing sparks and arcing, use components such as RC combinations, non-linear resistors, series resistors, and diodes.

NOTICE! The permissible load capability of the relay contact must not be exceeded, even during switching operations. → *Specifications, p. 117*

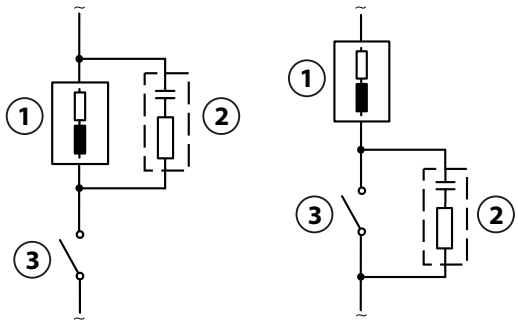
Note on Relay Contacts

As delivered, the relay contacts are suitable for low signal currents (as of approx. 1 mA). If currents above approx. 100 mA are switched, the gold plating is destroyed during the switching process. After that, the contacts will not reliably switch low currents.

Parameter setting for relay contacts → *Relay Contacts, p. 69*

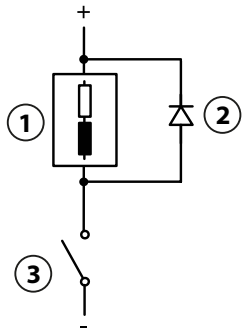
Wiring of relay contacts → *Terminal Assignment, p. 28*

Typical AC Application with Inductive Load



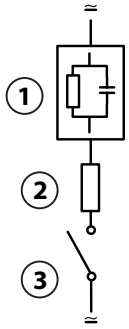
1	Load	3	Contact
2	Typical RC combination, e.g., capacitor 0.1 µF, resistance 100 Ω/1 W		

Typical DC Application with Inductive Load



1	Inductive load	3	Contact
2	Free-wheeling diode, e.g.,1N4007 (note polarity)		

Typical AC/DC Application with Capacitive Load



1	Capacitive load	3	Contact
2	Resistance e.g., 8 Ω/1 W at 24 V/0.3 A		

3.3.4 Sensor Connection

See the user manual of the corresponding module for the description.

4 Commissioning

Note: Upon request, Knick will provide safety briefings and product training during initial commissioning of the product. More information is available from the relevant local contacts.

- Install the enclosure. → *Installation, p. 23*
- Wire the connections. → *Electrical Installation, p. 27*
- Insert the modules and connect the sensor(s); see the module installation guide.
- Set the device parameters. → *Parameter Setting, p. 44*

5 Operation and Use

5.1 Changing the User Interface Language

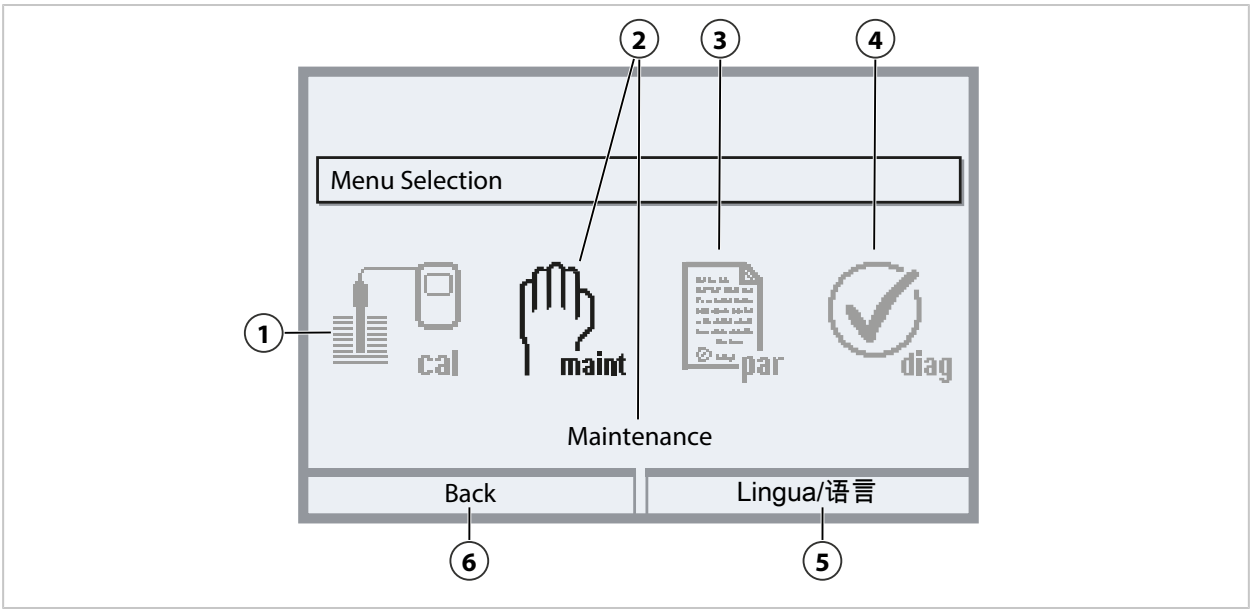
01. Press the ***menu*** key in measuring mode. Menu Selection opens.
02. Press the ***right softkey: Lingua***. Press the right ***arrow key*** and set the language of the user interface.
03. Confirm with ***enter***.
    Note: The user interface language can also be changed in the Parameter Setting menu.

Parameter Setting ▸ FRONT Module ▸ Language → *FRONT Module Parameter Setting, p. 59*

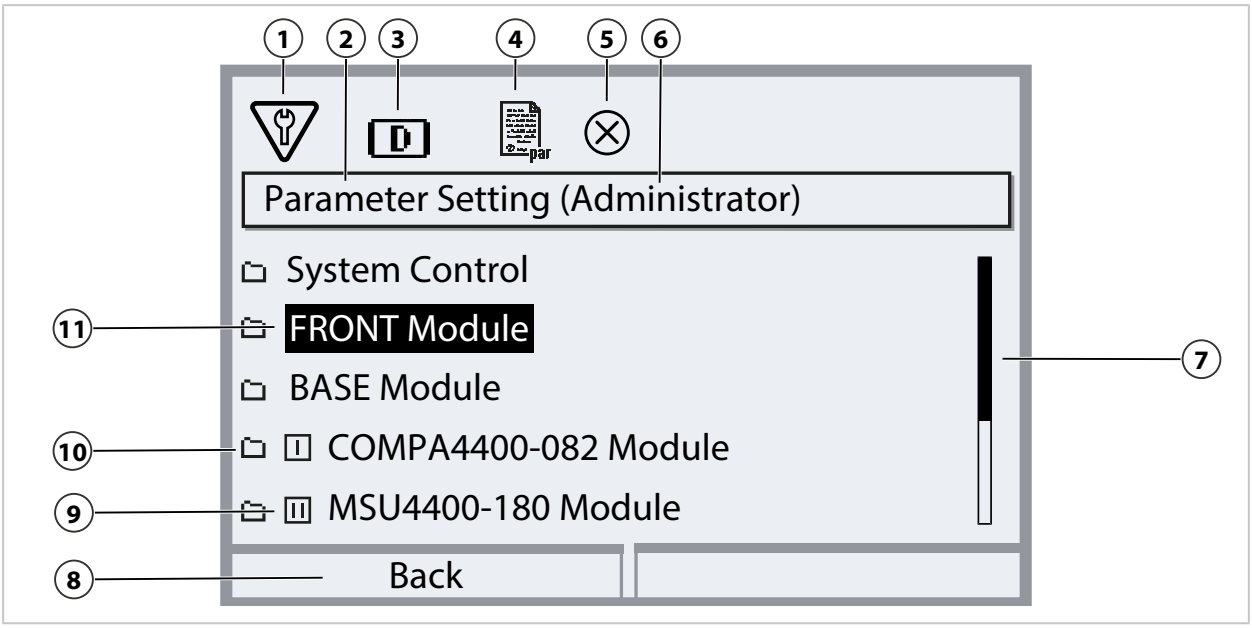
5.2 FRONT Module User Interface

5.2.1 Display

Protos II has a transflective graphic LC display. The device is operated with plain text in different languages. Messages are output as icons and plain text.



1	Calibration	4	Diagnostics
2	Maintenance (selected)	5	Softkey function: Select language
3	Parameter setting	6	Softkey function display

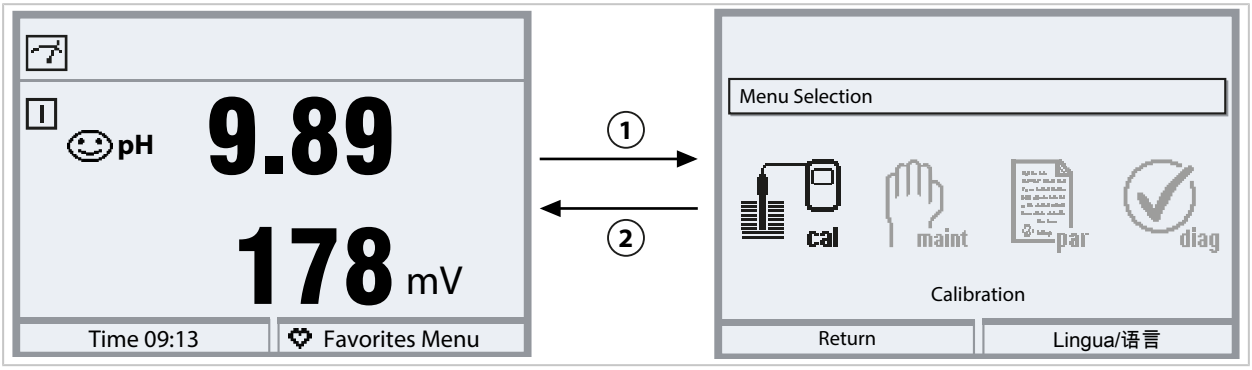


1	HOLD function check	7	Scroll bar
2	Headline of current menu	8	Softkey function display
3	Memory card (Data Card)	9	Measuring channel (module slot)
4	Mode indication (parameter setting)	10	Folder element (submenu)
5	Failure is active.	11	Current selection (highlighted in black)
6	Menu level (administrator level)		

Overview of icons → *Symbols and Markings on the Display, p. 122*

5.2.2 Menu Selection

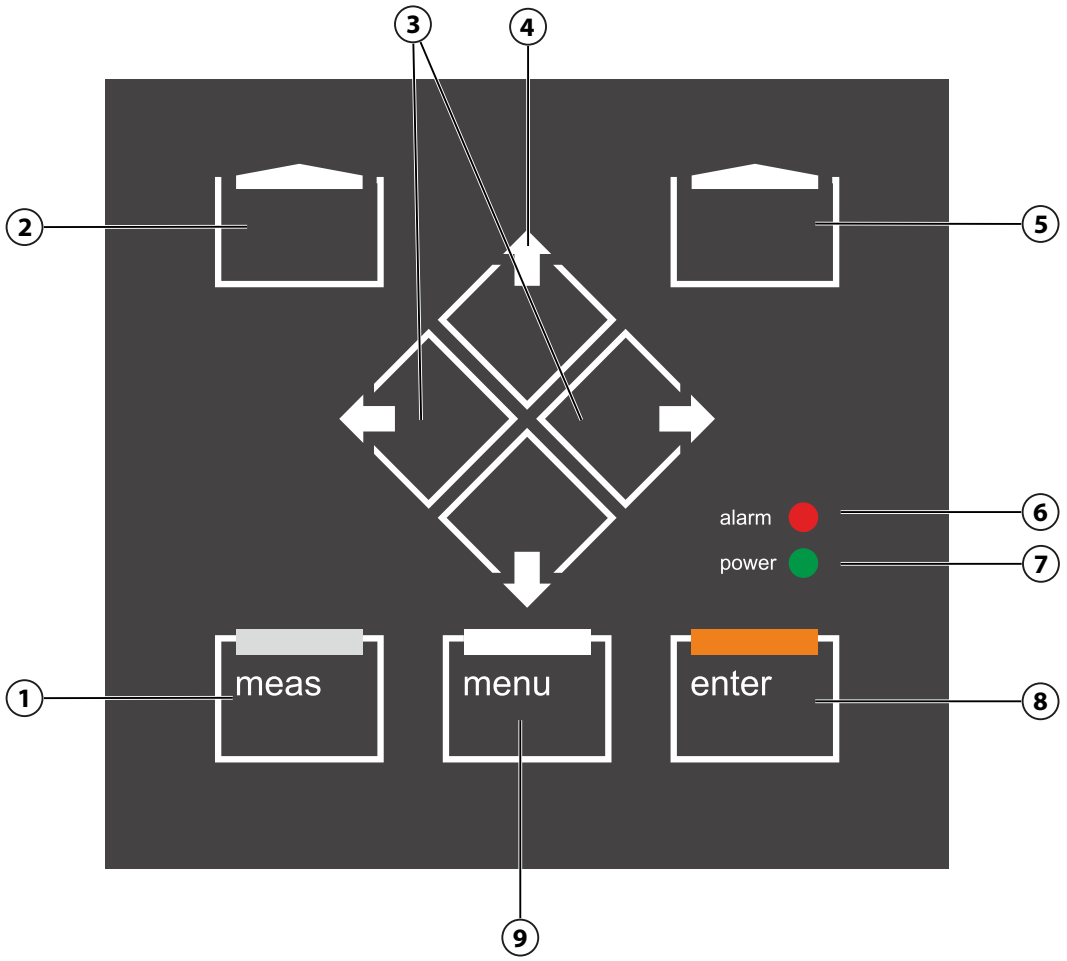
After the device is turned on, it first conducts an internal test routine and automatically determines which modules are plugged in. The device is then in measuring mode.



1	The ***menu*** key opens Menu Selection.	2	The ***meas*** key returns to measuring mode.

Use the ***arrow keys*** and ***enter*** to select the desired menu group.

5.2.3 Keypad



1 ***meas*** key: Switches into measuring mode.	6 Red LED: Indicates a failure (on) or maintenance request/ function check (blinking).
2 ***Left softkey***: Function according to the function display on the left	7 Green LED: Indicates the power supply.
3 ***Left/right arrow keys***: Menu selection: previous/next menu Digit selection: left/right	8 ***enter*** key: Opens the menu, confirms entries.
4 ***Up/down arrow keys***: Line selection Increases/decreases the numerical value	9 ***menu*** key: Opens Menu Selection.
5 ***Right softkey***: Function according to the function display on the right	

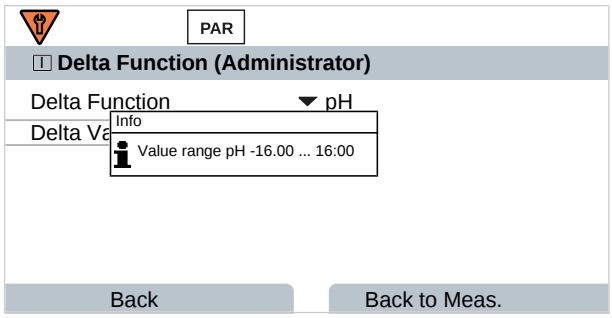
5.2.4 Entering Text and Numbers; Selecting Signs

01. Select a number with the ***left/right arrow keys***.
02. Enter numbers or letters with the ***up/down arrow keys***.

Change sign if required:

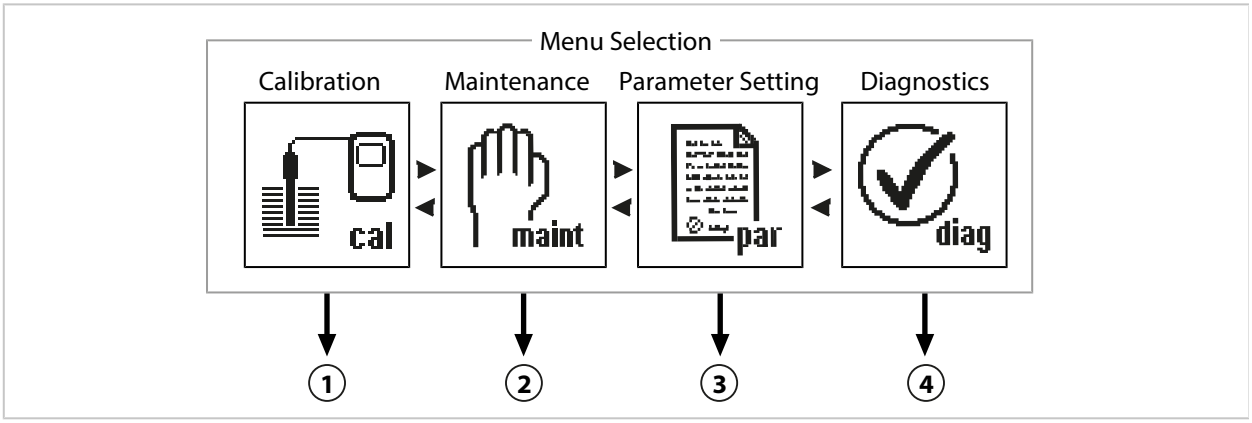
03. Switch to signs with the left ***arrow key***.
04. Set the sign value with the ***up*** or ***down arrow keys***.
05. Confirm with ***enter***.

    Note: If you enter values outside the specified value range, an information window showing the permissible value range is shown.



5.3 Menu Structure Overview

Use the ***menu*** key to access Menu Selection.



Note: The Calibration, Maintenance, and Parameter Setting menus (operating level and administrator level) are protected with passcodes. → *Passcode Entry, p. 58*

1	Calibration		
		[I]/[II]/[III] … Module	Depends on the connected module
			… See the corresponding user manual for a description of the submenus.
2	Maintenance	→ *Maintenance Functions, p. 82*	
		Open/Close Memory Card	Only with an installed Data Card
		BASE … Module	
			… Additional submenus
		[I]/[II]/[III] … Module.	Depends on the connected module
			… See the corresponding user manual for a description of the submenus.
3	Parameter Setting	→ *Parameter Setting, p. 44*	
		Viewing Level (All Data)	
		Operator Level (Operation Data)	
		Administrator Level (All Data)	
		System Control	
			… Additional submenus
		FRONT … Module	
			… Additional submenus
		BASE … Module	
			… Additional submenus
		[I]/[II]/[III] … Module	Depends on the connected module
			… See the corresponding user manual for a description of the submenus.

4	Diagnostics → *Diagnostics Functions, p. 76*		
	Message List		
	Logbook		
	Device Description		
	Meas. Point Description		
	FRONT … Module		
		…	Additional submenus
	BASE … Module		
		…	Additional submenus
	[I]/[II]/[III] … Module.		Depends on the connected module
		…	See the corresponding user manual for a description of the submenus.

5.4 Access Control

Access to the device functions is regulated and limited by individually adjustable passcodes. This prevents the unauthorized modification of device settings or manipulation of the measurement results.

Set passcodes under Parameter Setting ▸ System Control ▸ Passcode Entry → *Passcode Entry, p. 58*

5.5 Operating States

Function Check Mode (HOLD Function)

When you open the Parameter Setting, Calibration or Maintenance menus, Protos II switches to the function check mode (HOLD). The current outputs and relay contacts behave in accordance with the parameter settings. The red "alarm" LED blinks when configured accordingly → *FRONT Module Parameter Setting, p. 59*.

⚠ CAUTION! In function check mode (HOLD), the current outputs may be frozen at the last measured value or set to a fixed value. Measurement operations must not be carried out while the device is in function check mode (HOLD), as the system may behave unexpectedly and put users at risk.

Operating mode	Current outputs	Contacts	Controller (PID module)
Measure			
Diagnostics			
Calibration[1)]			
Maintenance[1)]			
Sensor monitor			
Current source			
Manual controller			
Parameter setting[1)]			
Rinse function[1)]		[2)]	

Active (output functions normally)

Last value or fixed default value

Manual control of the outputs

Depending on parameter setting

1) Function check (HOLD) is active.

2) Rinse contact is active.

5.6 Measurement Display

The following settings are possible:	
2, 4, 6, or 8 values without measuring channel selection	Any display of measured values from the measuring channels and the device possible
2 or 4 values with measuring channel selection	Any display of measured values from the measuring channels

The settings are made in the Measurement Display submenu:

Parameter Setting ▸ FRONT Module ▸ Measurement Display

An overview of the display options can be found in the Parameter Setting chapter.
→ *FRONT Module Parameter Setting, p. 59*

The ***right softkey: Back to Meas.*** returns you to measurements from any menu level. You may have to confirm that the system is ready for measurement.

If required, the display can be configured to switch off after not having been used for a user-defined period of time.

This setting can be changed in the Display submenu:

Parameter Setting ▸ FRONT Module ▸ Display

Display shutdown can be configured as follows:

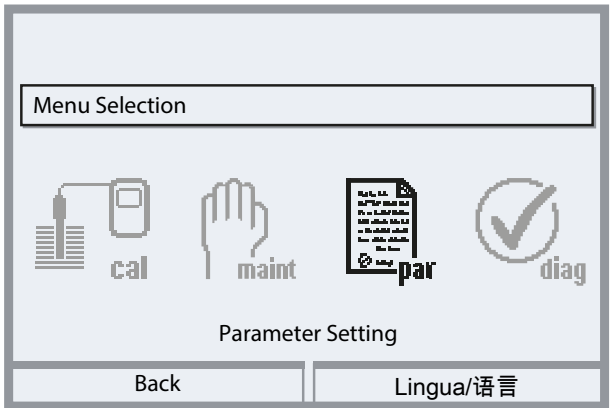
- No shutdown
- After 5 minutes
- After 30 minutes

6 Parameter Setting

⚠ CAUTION! Faulty parameter settings or adjustments can result in faulty outputs. A system specialist must therefore commission Protos II, set all its parameters, make all necessary adjustments, and protect it from unauthorized modifications.

Opening Parameter Setting

01. While in measuring mode, press the ***menu*** key.
    ✓ Menu Selection opens.

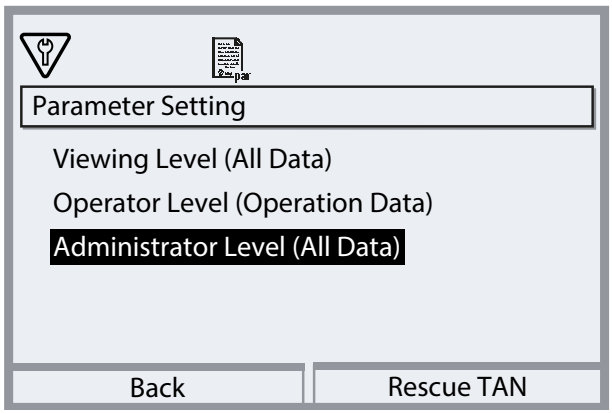


02. Using the right ***arrow key***, select the Parameter Setting menu and confirm with ***enter***.
03. Select the relevant operating level and enter any required passcode. → *Passcode Entry, p. 58*
    Note: Function check (HOLD) is active. The current outputs and relay contacts behave in accordance with the parameter settings. Return to measuring mode to exit the function check, e.g., with the ***meas*** key.

6.1 Operating Levels

There are three access levels in the Parameter Setting menu:

- Viewing Level (All Data)
- Operator Level (Operation Data)
- Administrator Level (All Data)



Viewing Level

- Display of all settings
- Settings cannot be changed on the viewing level.

Operator Level

- Access to all settings that are enabled on the administrator level.
- Locked settings are shown in gray and cannot be edited.

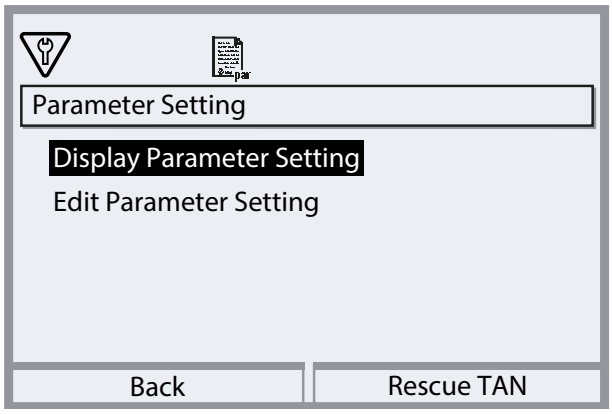
Administrator Level

- Access to all settings, including passcode settings. → *Passcode Entry, p. 58*
- Releasing or locking functions for access from the operator level. Functions that can be locked for the operator level are marked with the "lock" icon. → *Locking a Function, p. 46*

Note: For reasons of clarity, the step to "Select the relevant operating level and enter any required passcode" is omitted in the parameter setting description set out in this document. Parameter setting is generally carried out at Administrator level.

Parameter Setting with Audit Trail Activated (TAN Option FW4400-081)

If Audit Trail has been activated, the start menu of the parameter setting looks as follows:

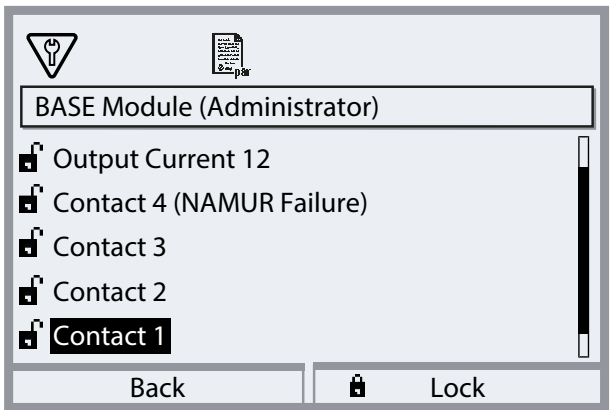


See also
→ *Audit Trail (FW4400-081), p. 114*

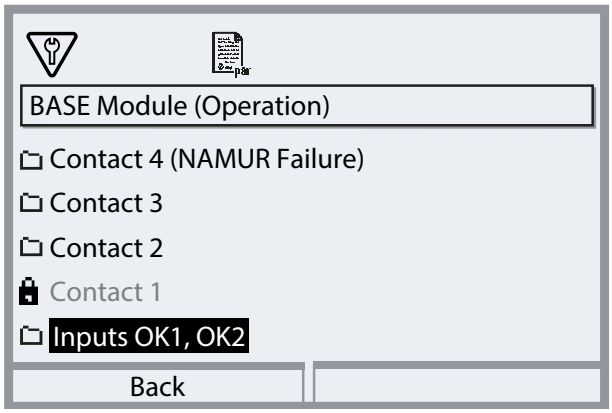
6.2 Locking a Function

Example: Locking access to the setting options for relay contact K1 from the operator level

01. Open Parameter Setting.
02. Select Administrator Level.
03. Enter passcode (factory setting 1989).
04. Select submenu: BASE Module ▸ Contact K1



05. ***Right softkey: Lock***
    ✓ The Contact 1 submenu is marked with the "lock" icon. This function can no longer be accessed from the operator level.
    The ***softkey*** function automatically changes to ***Unlock***.
    ✓ On the operator level, the locked function is shown in gray.



6.3 Parameter Setting Menus

Menu	Description
System Control	→ *System Control, p. 47*
FRONT Module	→ *FRONT Module Parameter Setting, p. 59*
BASE Module	→ *BASE Module Parameter Setting, p. 66*

Additional menus depending on installed modules. See the user manual of the corresponding module for the description.

6.4 System Control

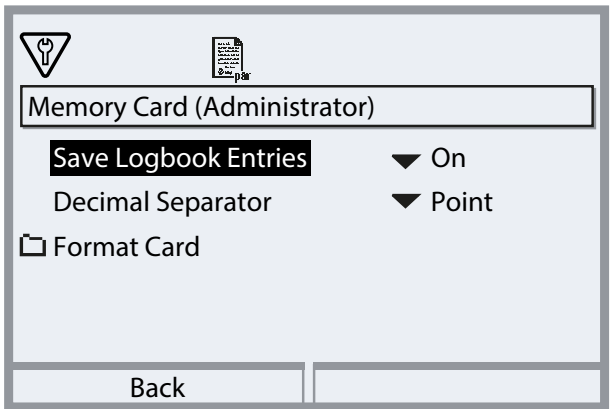
Note: The system control settings can only be changed at the administrator level. The menus are not displayed at the operating level.

Submenu	Description
Memory Card	Enable/disable data recordings. Format the memory card. → *Memory Card, p. 48*
Transfer Configuration	When a Data Card is inserted, the transmitter configuration can be saved and transferred to another transmitter. → *Transfer Configuration, p. 49*
Parameter Sets	Two parameter sets (A, B) are available in the device. When a Data Card is inserted, up to five parameter sets can be saved on or loaded from the Data Card. → *Parameter Sets, p. 50*
Units (Bus)	When using a COMPA4400-082 or PN4400-095 module: Select the units of measurement for the individual parameter
Function Control	Allocate functions for activation via softkey or optocoupler input → *Function Control, p. 50*
Calculation Blocks	Calculate existing process variables to new variables. → *Calculation Blocks, p. 51*
Time/Date	Define date and time format; entry of date, time, and weekday. → *Time/Date, p. 54*
Meas. Point Description	Free entry of a tag number and annotations; can be opened in the Diagnostics menu. → *Measuring Point Description, p. 54*
Firmware Update	This menu item is shown if an FW Update Card is inserted. → *Firmware Update, p. 55*
Option Activation	Activation of add-on functions via TAN. The TAN is only valid for the device with the associated serial number. → *Option Activation, p. 56*
Logbook	Delete the logbook entries. → *Logbook, p. 56*
Audit Trail	TAN option FW4400-081: Assign the communication modules for the Audit Trail functions → *Audit Trail (TAN Option FW4400-081), p. 57*
Buffer Table	TAN option FW4400-002: Specify a custom buffer set, when using a pH module. → *pH Buffer Table: Entry of Individual Buffer Set (FW4400-002), p. 102*
Concentration Table	TAN option FW4400-009: Specify a special concentration solution for conductivity measurement, when using a conductivity measuring module. → *Concentration Determination (FW4400-009), p. 104*
Restore Factory Settings	Reset all parameter settings to factory settings → *Restore Factory Settings, p. 57*
Passcode Entry	Change passcodes → *Passcode Entry, p. 58*

6.4.1 Memory Card

Using the Data Card → *Memory Card, p. 98*

Parameter Setting ▸ System Control ▸ Memory Card



Enable/disable recording of logbook entries on the Data Card.

With activated TAN option FW4400-103 measurement recorder: Enable/disable recording of measurement recorder entries on the Data Card. → *Measurement Recorder (FW4400-103), p. 112*

With activated Unical controller (using module MSU4400(X)-180): Enable/disable recording of the Unical system prognostics.

The decimal separator can be set as a point or comma. This applies to all recordings.

The Data Card can be formatted, in which case all saved entries are deleted.

Recording Logbook Entries

As soon as the Data Card has been activated for saving the logbook data, all existing logbook entries are saved on the Data Card. New entries are added as soon as they appear.

Example of a file generated on a Data Card:
\logbook\L_[serial number].TXT

The individual columns are separated by tabs. This makes the file readable in word processing programs or spreadsheet programs like Microsoft Excel.

A separate file is created for each device. This means that a Data Card can also be used to collect the logbook data of multiple devices.

The entries in the logbook file mean the following:

No.	Message number
Time stamp	Time stamp of the logbook entry
Status	(x) - Message became active. ( ) - Message became inactive.
Message	Text of the message (in the operating language set)

6.4.2 Transfer Configuration

Parameter Setting ▸ System Control ▸ Transfer Configuration

All device settings can be saved on a memory card (ZU1080-P-*-D Data Card): → *Memory Card, p. 98*

Note: The inserted Data Card is shown on the display.

- Select "Configuration": "Save" to write all the device settings (except passcodes) to the Data Card. Backup file generated on the Data Card: param/config.par
- Select "Configuration": "Load" to read all the device settings from the Data Card and apply them to the device.

Transferring all Device Settings from One Device to Other Devices

Requirements

- The devices all feature identical hardware.
- TAN options (add-on functions): All required TAN options must be enabled before they can be transferred.

Steps

01. Parameter Setting ▸ System Control ▸ Transfer Configuration
02. "Configuration" menu item: "Save"
03. Press ***right softkey: Execute*** to start the transmission.
    ✓ The device settings are saved to the Data Card.
04. Open/Close Memory Card submenu
05. Press ***right softkey: Close*** to end the access to the memory card.
06. Remove the Data Card.
    ✓ You can transfer the device settings to other, identically equipped devices.
07. Insert the data card upon which the device settings are saved into the next device to be configured.
08. Parameter Setting ▸ System Control ▸ Transfer Configuration
09. "Configuration" menu item: "Load"
10. Press ***right softkey: Execute*** to start the transmission.
    ✓ The device settings are read from the Data Card and applied.
11. Open/Close Memory Card submenu
12. Press ***right softkey: Close*** to end the access to the memory card.
13. Remove the Data Card.

6.4.3 Parameter Sets

Parameter Setting ▸ System Control ▸ Parameter Sets

Protos II provides two complete selectable parameter sets (A/B) for different measurement tasks. The currently activated parameter set can be signaled by a relay contact. → *Relay Contacts, p. 69*

Parameter set "B" only permits the setting of process-related parameters.

Save Parameter Set

The active parameter set is transferred to the Data Card.

Note: The parameter set saved on the Data Card is overwritten.

Load Parameter Set

A parameter set stored on the Data Card is transferred to the device.

Note: This overwrites the current parameter set in the device.

Up to 5 parameter sets can be stored on the Data Card with TAN option FW4400-102.
→ *Parameter Sets 1-5 (FW4400-102), p. 109*

Select Parameter Set A/B

The control element for switching the parameter sets (optocoupler input or softkey) is selected under:

Parameter Setting ▸ System Control ▸ Function Control

The currently active parameter set is shown in the status line by an icon:

0 ... 2 V AC/DC: Parameter Set A active

10 ... 30 V AC/DC: Parameter Set B active

Note: The selection has no effect when using parameter sets from a memory card. Switching between parameter sets A and B is possible if they are saved in the device.

6.4.4 Function Control

Parameter Setting ▸ System Control ▸ Function Control

The following functions can be activated by softkey or optocoupler input OK2:

OK2 input:

- Off
- Parameter set selection → *Parameter Sets, p. 50*

Left/right softkey:

- Off
- Value rotation
- Parameter set selection
- Favorites menu → *Favorites Menu, p. 76*
- Unical service (with inserted MSU module)

Profibus DO2 (with inserted COMPA module):

- Off
- Parameter set

6.4.5 Calculation Blocks

Calculation blocks convert existing process variables to new variables. A calculation block always has two measuring modules with all their measured values as input values.

The general device status (NAMUR signals) is also taken into account.

The existing process variables are used to calculate:

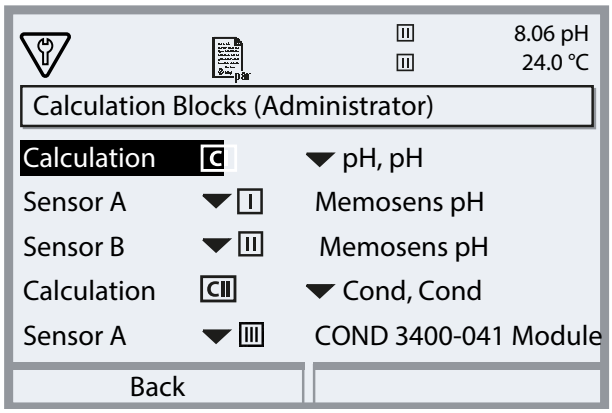
- Measured value difference (selection dependent on sensor)
- Ratio
- Passage
- Rejection
- Deviation
- pH value calculation from dual conductivity measurement (see below)
- User-Spec. (DAC): User specification

Activating and Setting Parameters for Calculation Blocks

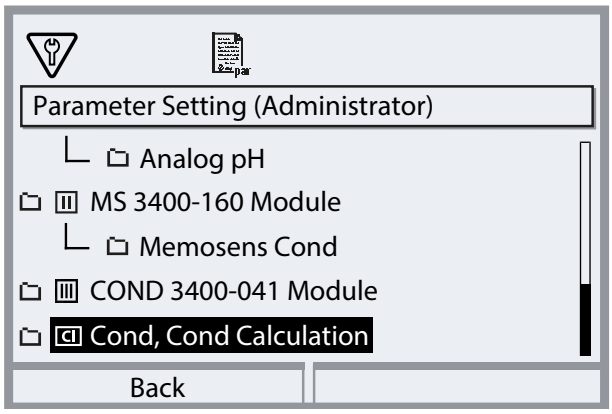
The following combinations are possible as calculation blocks for three measuring modules:
I + II, I + III, II + III

Two calculation blocks can be activated.

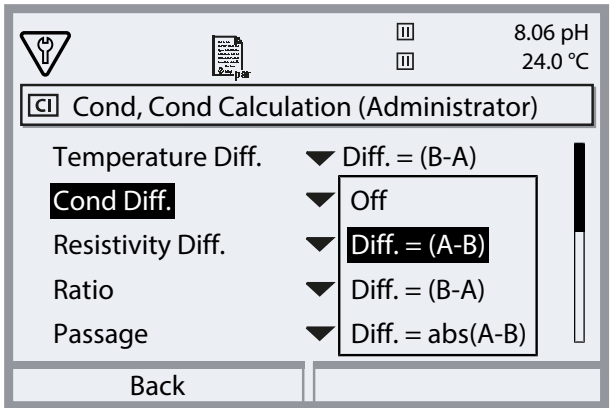
01. Parameter Setting ▸ System Control ▸ Calculation Blocks
02. Select combinations of process variables.



03. 2× ***left softkey: Back***
04. Use the ***arrow keys*** to scroll downwards and select a calculation block.
    Note: Calculation blocks are displayed in the parameter setting like modules and have the extension [CI] or [CII].



05. Parameter setting for calculation block.



Process Variable Combinations in the Calculation Block

Process variable combinations	Calculation block	Variables calculated by the calculation block	
pH + pH	pH/pH	Temperature difference	°C
		pH value difference	pH
		ORP difference	mV
		pH-voltage difference	mV
Cond + Cond CondI + CondI Cond + CondI	Cond/Cond	Temperature difference	°C
		Conductivity difference	S/cm
		Resistivity difference	Ωcm
		Ratio	S/cm [%]
		Passage	S/cm [%]
		Rejection	S/cm [%]
		Deviation	S/cm [%]
		pH Value	pH
Oxy + Oxy	Oxy/Oxy	Sat. %Air Diff.	%Air
		Saturation $\%O_2$ difference	$\%O_2$
		Conc. (Liquid) difference	mg/l
		Conc. (Gas) difference	%Vol
		Temperature difference	°C

Calculation Formulas

Process variable	Calculation formula	Range	Measuring span
Difference (can be selected in the menu)	Diff. = A – B Diff. = B – A Diff. = abs(A – B)	Process variable	Process variable
Ratio (only Cond/Cond)	Cond A/Cond B	0.00 ... 19.99	0.10
Passage (only Cond/Cond)	Cond B/Cond A × 100	0.00 ... 199.9	10 %
Rejection (only Cond/Cond)	(Cond A – Cond B)/Cond A × 100	–199.9 ... 199.9	10 %
Deviation (only Cond/Cond)	(Cond B – Cond A)/Cond A × 100	–199.9 ... 199.9	10 %

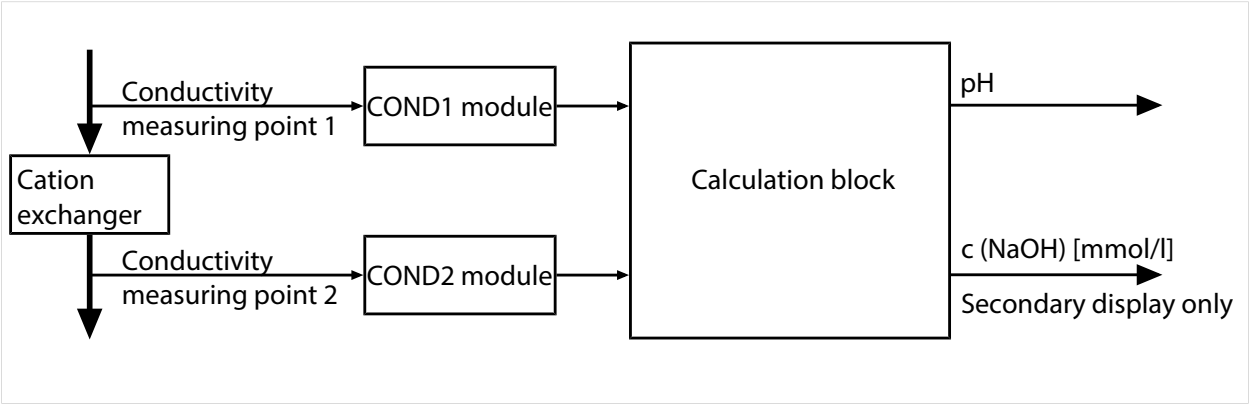
Typical Application

pH Value Measurement of Boiler Feed Water in Power Plant Technology

In the case of monitoring boiler feed water in power plants, a dual conductivity measurement can be used to calculate the pH value under certain conditions. To do so, the conductance of the boiler feed water is measured upstream and downstream of the ion exchanger. This frequently used method of indirect pH value measurement is relatively low-maintenance and has the following advantages:

An unadulterated pH value measurement in ultrapure water is highly critical. Boiler feed water is a low-ion medium. It requires the use of a special electrode that must be continuously calibrated and typically does not have a long useful life.

Two sensors are used for conductivity measurement upstream and downstream of the ion exchanger. The pH value is determined from both of the calculated measured conductivity values.



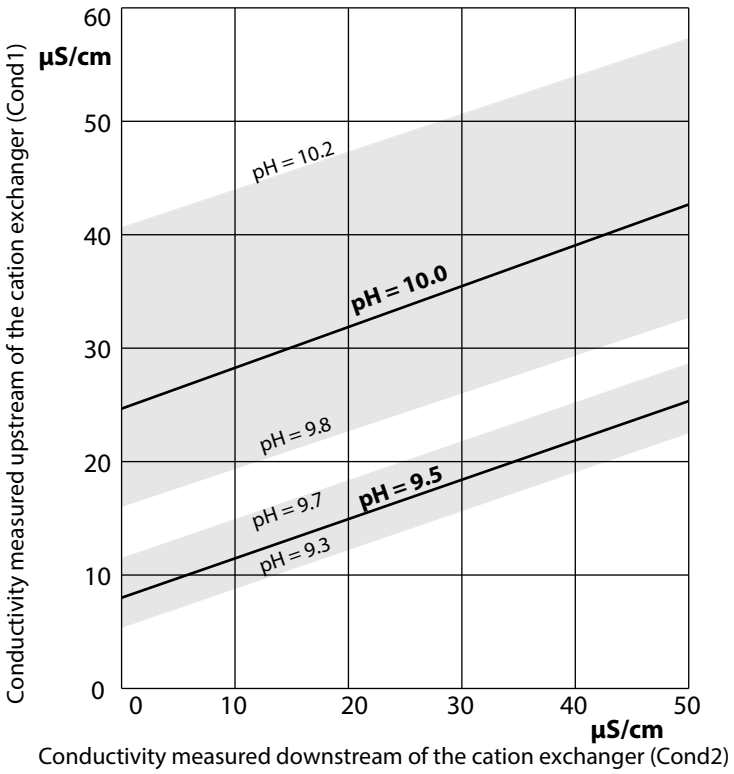
Calculating the Concentration of Caustic Soda Solution/the pH Value:

$c(NaOH) = (Cond1 - {}^{1}/_{3}\ Cond2) / 243$

$pH = 11 + \log[c(NaOH)]$

Recommended pH Ranges:

10 ± 0.2 for < 136 bar operating overpressure or
9.5 ± 0.2 for > 136 bar operating overpressure



Conditioning the boiler water in natural circulation boilers with sodium hydroxide. Relationship between the pH value and the conductivity measured upstream or downstream of the cation exchanger.

Source: Appendix to VGB Guideline for boiler feed water, boiler water and vapor from steam generators above 68 bar permissible operating pressure (VGB-R 450 L, 1988 edition)

6.4.6 Time/Date

Parameter Setting ▸ System Control ▸ Time/Date

The time and date in the installed real-time clock are required for:

- Controlling calibration and cleaning cycles
- Displaying the time on the display
- Assigning times to the calibration data in the sensor head of digital sensors
- The diagnostic functions, e.g., time stamp of logbook entries

Note: No automatic switchover from and to daylight savings time.

6.4.7 Measuring Point Description

Parameter Setting ▸ System Control ▸ Meas. Point Description

You can enter the measuring point and annotations (e.g., date of last maintenance):

- Select corresponding digit: left/right arrow keys
- Select characters A-Z 0-9 _ # * + - / : < = > Space: up/down arrow keys

If Memosens sensors are used, you can also enter one measuring point description per sensor channel. The entries are made in the parameter menu of the corresponding Memosens sensor.

Display of the measuring point description in the Diagnostics menu
→ *Measuring Point Description, p. 80*

6.4.8 Firmware Update

Parameter Setting ▸ System Control ▸ Firmware Update

Note: First check whether a firmware update is relevant for your device.
Query the current firmware version under:
Menu Selection ▸ Diagnostics ▸ Device Description

Note: The TAN option FW4400-106 for a firmware update is no longer necessary from firmware 01.03.00.

A FW Update Card is required for a firmware update. → *Memory Card Types, p. 100*

Note: The menu is only shown if the FW Update Card is inserted.

The device is capable of replacing its own firmware (the operating program) with the supplied FW version on the FW Update Card ("update").

NOTICE! During a firmware update, the device is not operable. The outputs are in an undefined state. The parameter settings must be verified after a firmware update.

Note: Before a firmware update for the standard micro controller, we recommend saving the previous version on the FW Update Card.

Executing a Firmware Update with FW Update Card

Using the FW Update Card → *Memory Card, p. 98*

01. Unscrew the enclosure screws of the front unit and open the device.
02. Insert the FW Update Card into the card slot in the front unit.
    ✓ The FW Update Card icon is shown in the display.
03. Close the device and tighten the enclosure screws in a crosswise pattern. Tightening torque 0.5 ... 2 Nm.
04. Save the firmware (FW) previously installed on the device if required:
    Menu Selection ▸ Parameter Setting ▸ System Control ▸ Firmware Update ▸ Save Firmware
    Start the backup with ***right softkey: Start***.
    ✓ When the firmware update has finished, the device will return to measuring mode.
05. Load the firmware update:
    Menu Selection ▸ Parameter Setting ▸ System Control ▸ Firmware Update ▸ Update Firmware
06. Select the relevant version with the ***arrow keys***.
07. Confirm with ***enter***.
08. Start the firmware update with ***right softkey: Start***.
    ✓ When the firmware update has finished, the device will return to measuring mode.
09. When the updates have finished, open the front unit and remove the FW Update Card.
10. Close the device and tighten the enclosure screws in a crosswise pattern. Tightening torque 0.5 ... 2 Nm.
11. Check parameter settings.

Updating Module Firmware

A firmware update can also be performed for a specific module:

01. Select Update Module.
02. Select the appropriate module.
03. Proceed as described above.

Note: The firmware of some modules consists of two components (APP and COM), both of which must be updated.

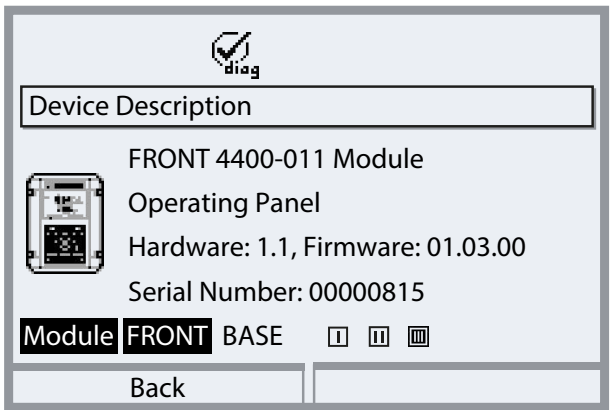
6.4.9 Option Activation

Parameter Setting ▸ System Control ▸ Option Activation

Add-on functions (TAN options) expand the functionality of the device system. TAN options are device-related. Therefore, you must specify the serial number of the device in addition to the relevant order code for this function when ordering a TAN option. The manufacturer then supplies a TAN (transaction number) for activating the add-on function. This TAN is only valid for the device with the associated serial number.

You can find the serial number of your device under:

Diagnostics ▸ Device Description



Note: For Protos, the serial number of the FRONT Module must be specified as this is where the system control is stored.

Overview and description of the individual TAN options → *TAN Options, p. 101*

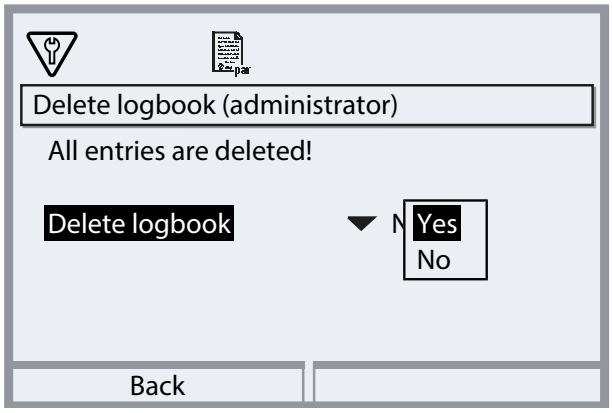
Activate TAN Option

01. Parameter Setting ▸ System Control ▸ Option Activation
02. Select the option to be enabled.
03. Set to "Active" using the ***arrow keys***.
    ✓ Enter the TAN at the prompt. The current serial number is shown.
04. Enter the TAN and confirm with OK.
    ✓ The option is available.
    Note: An activated TAN option can be deactivated and reactivated without having to re-enter the TAN.

6.4.10 Logbook

Parameter Setting ▸ System Control ▸ Logbook

Deleting the logbook entries:



Displaying the logbook entries:

Diagnostics ▸ Logbook → *Logbook, p. 78*

Recording on the Data Card:

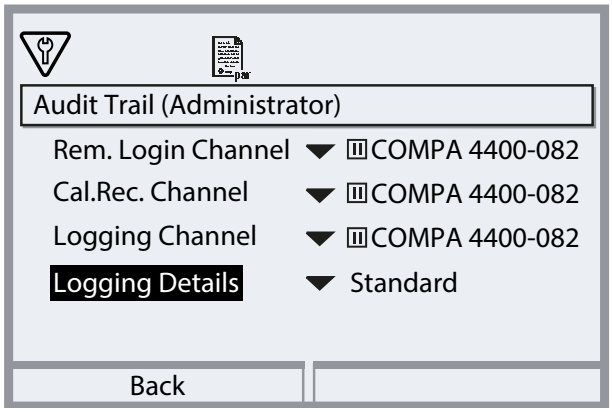
Parameter Setting ▸ System Control ▸ Memory Card → *Memory Card, p. 48*

6.4.11 Audit Trail (TAN Option FW4400-081)

Parameter Setting ▸ System Control ▸ Audit Trail

Note: The menu is only shown if the TAN option is activated.

Assign the communication modules for the Audit Trail functions:



Description of the Audit Trail functions → *Audit Trail (FW4400-081), p. 114*

6.4.12 pH Buffer Table (TAN Option FW4400-002)

Parameter Setting ▸ System Control ▸ Buffer Table

Note: The menu is only shown if the TAN option is activated.

See also

→ *pH Buffer Table: Entry of Individual Buffer Set (FW4400-002), p. 102*

6.4.13 Concentration Table (TAN Option FW4400-009)

Parameter Setting ▸ System Control ▸ Concentration Table

Note: The menu is only shown if the TAN option is activated.

See also

→ *Concentration Determination (FW4400-009), p. 104*

6.4.14 Restore Factory Settings

Allows the parameters to be reset to their factory settings:

Parameter Setting ▸ System Control ▸ Restore Factory Settings

NOTICE! After confirming with "Yes", all individual parameter settings are overwritten with the factory settings.

6.4.15 Passcode Entry

Parameter Setting ▸ Administrator Level ▸ System Control ▸ Passcode Entry

Passcodes (Factory Setting)	
Calibration	1147
Maintenance	2958
Operator level	1246
Administrator level	1989

The passcodes can be changed or disabled.

Note: The passcode for the administrator level cannot be deactivated.

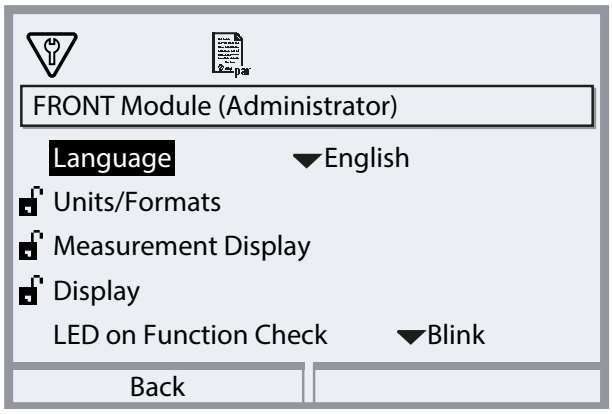
Note: If you lose the passcode for the administrator level, system access is locked! The manufacturer can generate a rescue TAN. If you have any questions, please contact Knick Elektronische Messgeräte GmbH & Co. KG using the information provided on the last page of this document.

6.5 FRONT Module Parameter Setting

Note: Function check (HOLD) is active.

Submenu	Description
Language	User interface language: German (factory setting), English, French, Italian, Spanish, Portuguese, Chinese, Korean, Swedish
Units/Formats	Temperature unit °C (factory setting) or °F. Other units and formats depending on the selected process variable, e.g., pressure in mbar, kPa, psi Display format pH xx.xx or xx.x
Measurement Display	Values to be displayed (up to 8) → *Configuring the Measurement Display, p. 60*
Display	Display color, brightness, and display auto-off (factory setting: none) → *Display, p. 65*
Measurement Recorder	TAN option FW4400-103: Record measured and additional values → *Measurement Recorder (FW4400-103), p. 112*

Whether or not the LED should blink during function check can also be set.

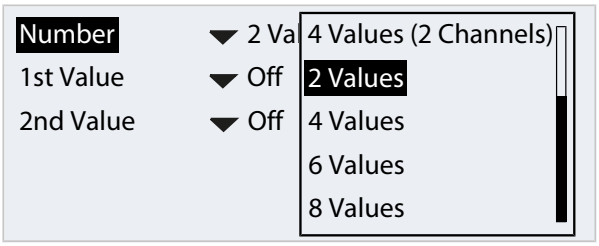
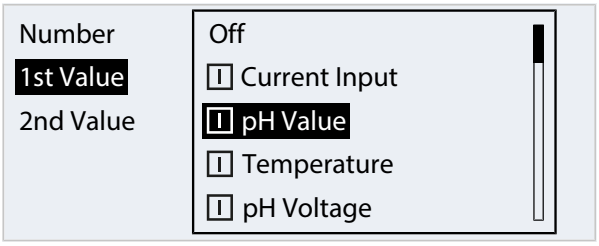
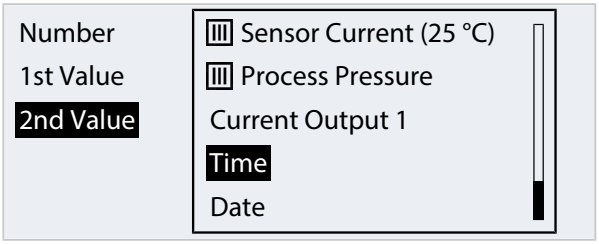
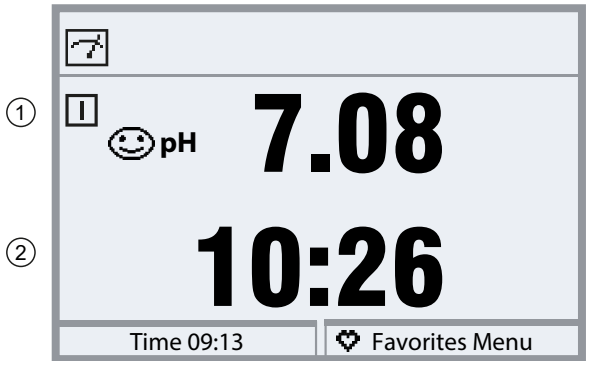


6.5.1 Configuring the Measurement Display

Parameter Setting ▸ FRONT Module ▸ Measurement Display

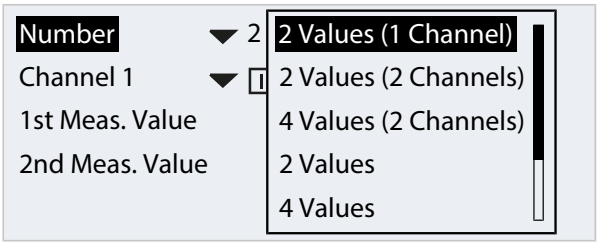
01. Set the number of values to be displayed:
    2 values (1 channel), 2 values (2 channels), 4 values (2 channels),
    2 values, 4 values, 6 values, 8 values
02. As required, assign channels and select variable(s) to be displayed.
03. Confirm with ***enter***.

Measurement Display, Example with 2 Values

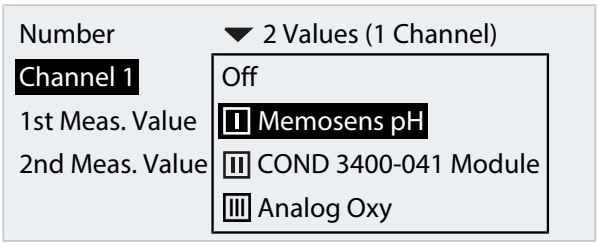
Selection	Result
Select two process variables from the measuring channels and the basic unit	
 Select the number of values. Confirm the selection with ***enter***.	
 Select the first process variable with channel. Confirm the selection with ***enter***.	
 Select the second process variable. Confirm the selection with ***enter***. Continue with ***meas***	 **(1)** First value **(2)** Second value

Measurement Display, Example with 2 Values (1 Channel)

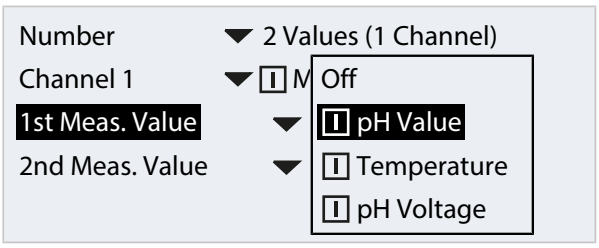
Selection	Result
Select two process variables in one measuring channel:	



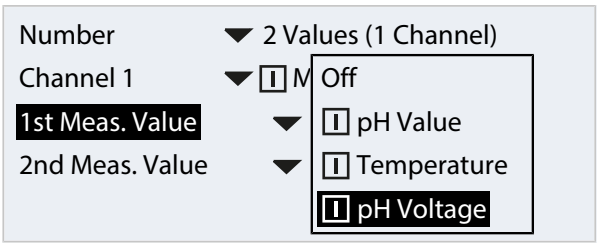
Select the number of values and channels.
Confirm the selection with ***enter***.



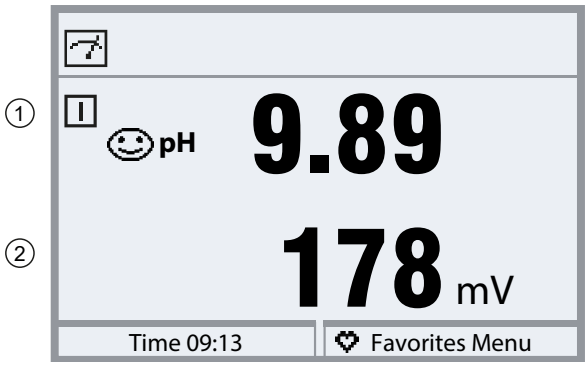
Assign a module to the channel.
Confirm the selection with ***enter***.



Select the first process variable for the module.
Confirm the selection with ***enter***.



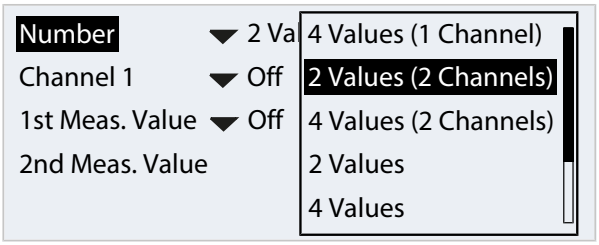
Select the second process variable for the module.
Confirm the selection with ***enter***.
Continue with ***meas***.



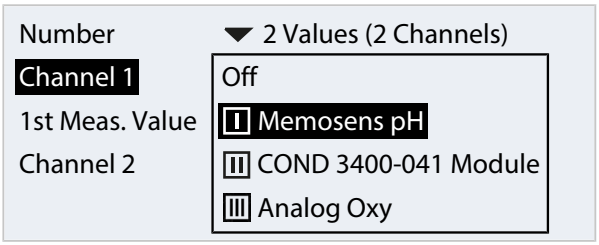
(1) First value in channel I
(2) Second value in channel I

Measurement Display, Example with 2 Values (2 Channels)

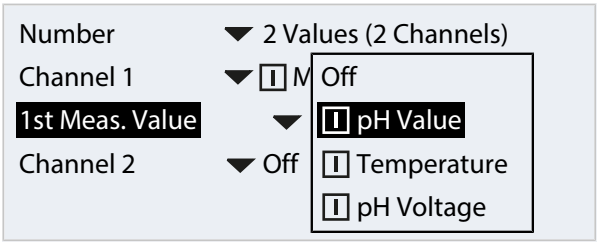
Selection	Result
Select two process variables in two measuring channels:	



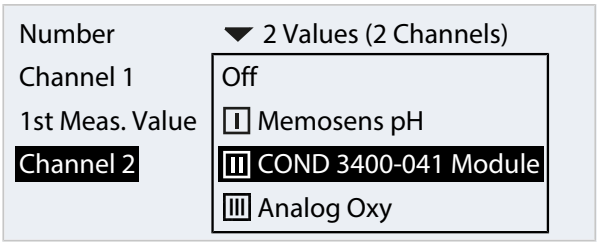
Select the number of values and channels.
Confirm the selection with ***enter***.



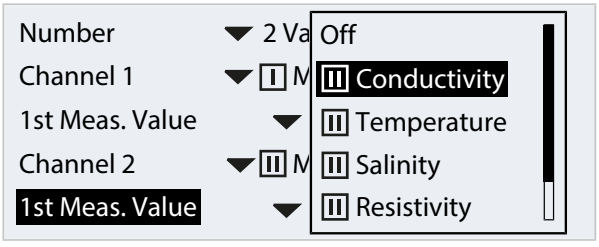
Assign a module to the first channel.
Confirm the selection with ***enter***.



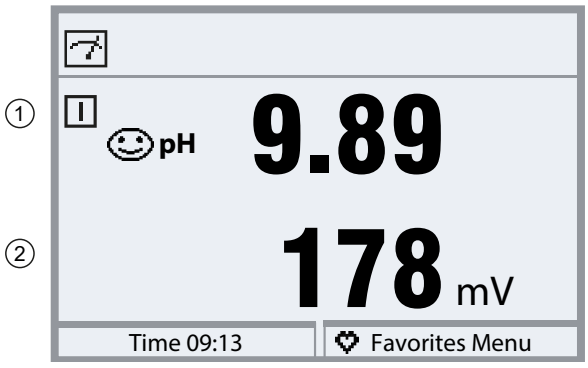
Select the variable for the first channel.
Confirm the selection with ***enter***.



Assign a module to the second channel.
Confirm the selection with ***enter***.



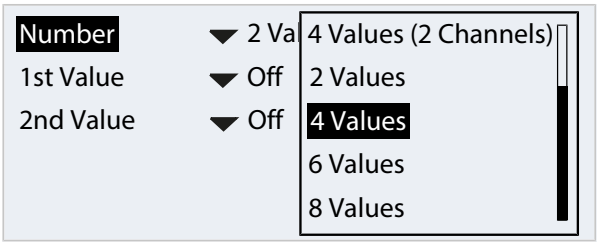
Select the process variable for the second channel.
Confirm the selection with ***enter***.
Continue with ***meas***.



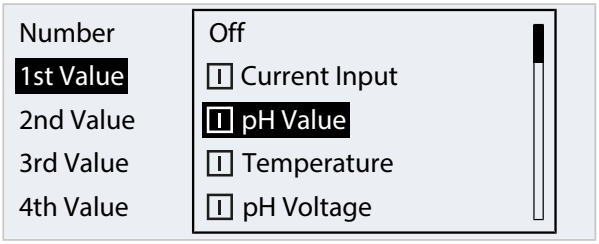
(1) First value in channel I
(2) Second value in channel II

Measurement Display, Example with 4 (6, 8) Values

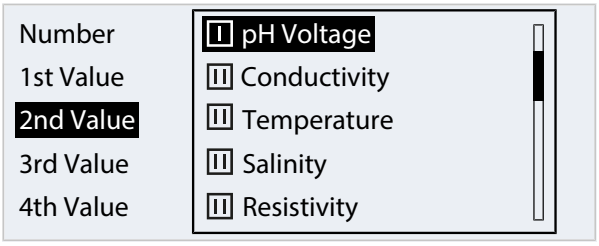
Selection	Result
Select four (six, eight) process variables from any measuring channels and the basic unit	



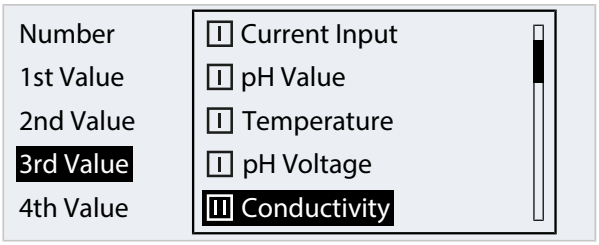
Select the number of values.
Confirm the selection with ***enter***.



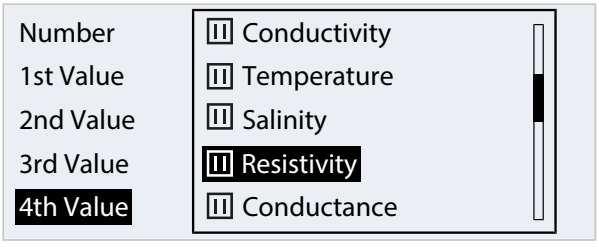
Select the first process variable.
Confirm the selection with ***enter***.



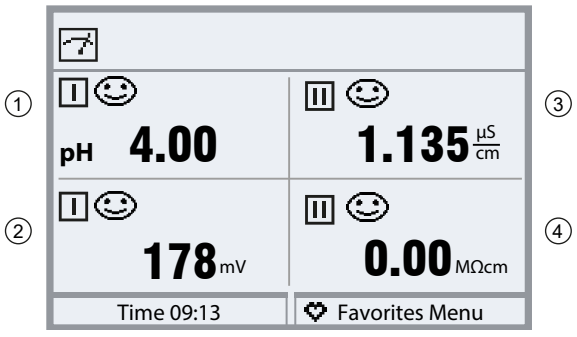
Select the second process variable.
Confirm the selection with ***enter***.



Select the third process variable.
Confirm the selection with ***enter***.

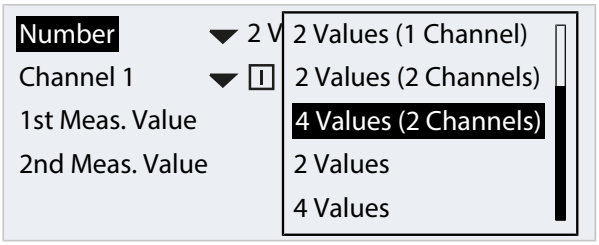
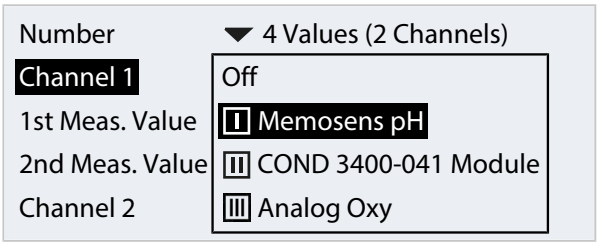
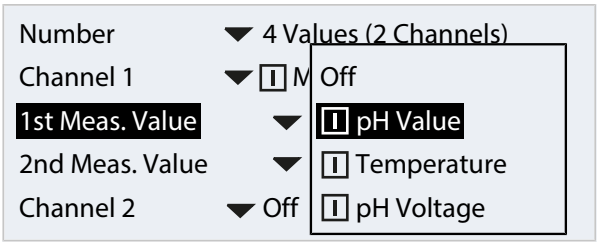
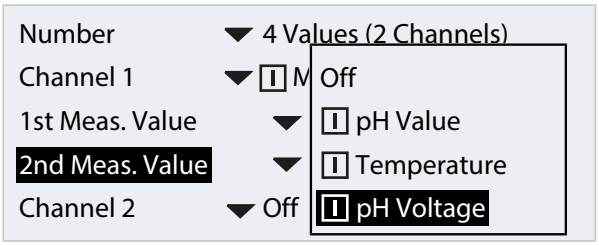
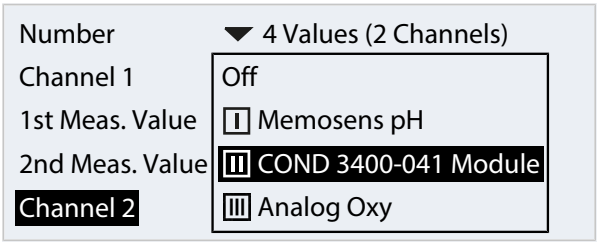


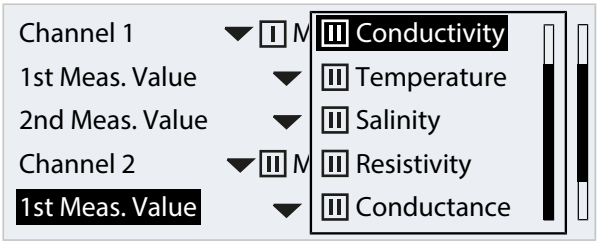
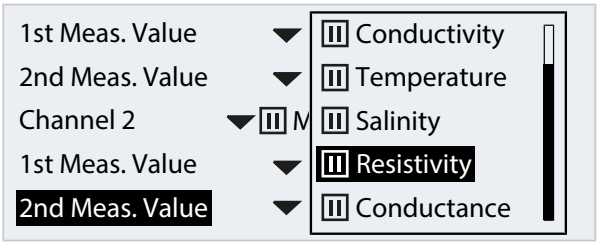
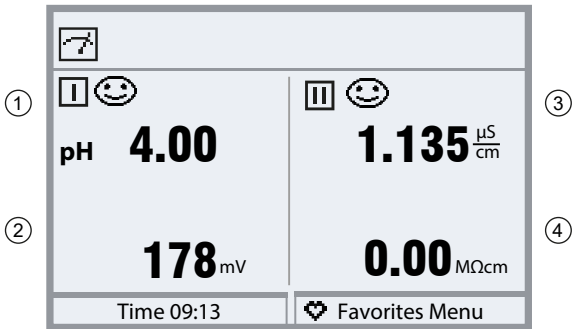
Select the fourth process variable with channel.
Confirm the selection with ***enter***.
Continue with ***meas***.



(1) First value
(2) Second value
(3) Third value
(4) Fourth value

Measurement Display, Example with 4 Values (2 Channels)

Selection	Result
Select four process variables in two measuring channels:	
	
Select the number of values and channels. Confirm the selection with ***enter***.	
	
Assign a module to the first channel. Confirm the selection with ***enter***.	
	
Select the first process variable in Channel 1. Confirm the selection with ***enter***.	
	
Select the second process variable in Channel 1. Confirm the selection with ***enter***.	
	
Assign a module to the second channel. Confirm the selection with ***enter***.	

Selection	Result
 Select the first process variable in Channel 2. Confirm the selection with ***enter***.	
 Select the second process variable in Channel 2. Confirm the selection with ***enter***. Continue with ***meas***.	 **(1)** First value in Channel I **(2)** Second value in Channel I **(3)** First value in Channel II **(4)** Second value in Channel II

6.5.2 Display

Parameter Setting ▸ FRONT Module ▸ Display

It is possible to change the brightness and contrast of the display. The following settings are possible:

Menu item	Description
Brightness	Factory setting: 70 %
Contrast	Factory setting: 0 %
Shutdown	None (factory setting), after 5 min, after 30 min

Note on Display Auto-off

Depending on the parameter setting, the display turns off completely 5 or 30 minutes after the last keystroke. Press any key to switch the display back on.

6.5.3 Measurement Recorder (TAN Option FW4400-103)

Parameter Setting ▸ FRONT Module ▸ Measurement Recorder

The measurement recorder logs measured values and additional values depending on its parameter setting. The last 100 entries are graphically presented on the display of the Protos II.

The menu is only shown if the TAN option is activated.

See also
→ *Measurement Recorder (FW4400-103), p. 112*

6.6 BASE Module Parameter Setting

The following inputs and outputs are available:

- Two current outputs 0/4 ... 20 mA for the transmission of, e.g., measured value and temperature, configurable as active or passive → *Current Outputs, p. 66*
- Four freely configurable, floating switch outputs → *Relay Contacts, p. 69*
- Two digital control inputs, OK1 and OK2 → *Control Inputs, p. 74*

6.6.1 Current Outputs

Parameter Setting ▸ Base Module ▸ Current Output I…

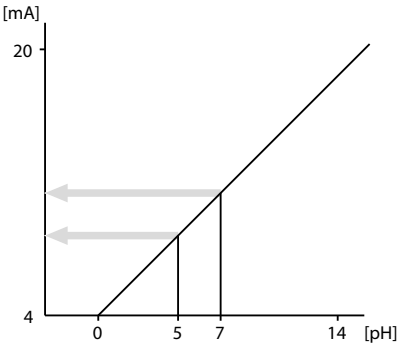
The current outputs are deactivated ex works. The BASE Module provides 2 current outputs.
The OUT module can be used to expand the system by an additional 2 current outputs.

Adjustable parameters for the current outputs:

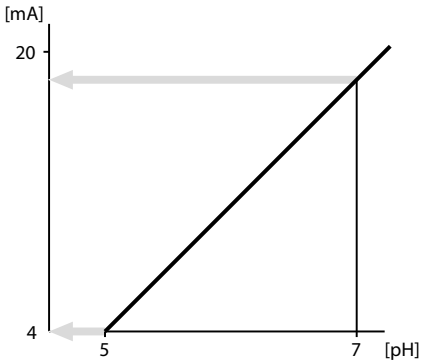
Parameters	Factory setting	Description
Usage	Off	Enable/disable current output.
Process variable		Depends on module assembly
Characteristic → *Characteristic Curves, p. 68*	Linear	Linear Trilinear (entry of additional vertex points required) Function (entry of a 50 % point required) Logarithmic Table (with TAN option FW4400-006 “Current characteristic”) → *Current Characteristic (FW4400-006), p. 103*
Output	4 ... 20 mA	Output current range 4 ... 20 mA or 0 ... 20 mA
Start 0(4) mA		Start of the measuring span (factory setting depending on the selected variable)
End 20 mA		End of the measuring span (factory setting depending on the selected variable)
Output Filter	0 s	Input of a filter time constant → *Output Filter, p. 69*
Function Check	Last Usable Value	Current output behavior in Function Check mode: Current measured value, last usable value, fixed value → *Current During Function Check (HOLD), p. 69*
Behavior during Messages	Off	Current output behavior in case of failure message: Off, 3.6 mA, 22 mA Input of a delay of 0 ... 600 s in the event of a failure message

Setting the Measuring Span

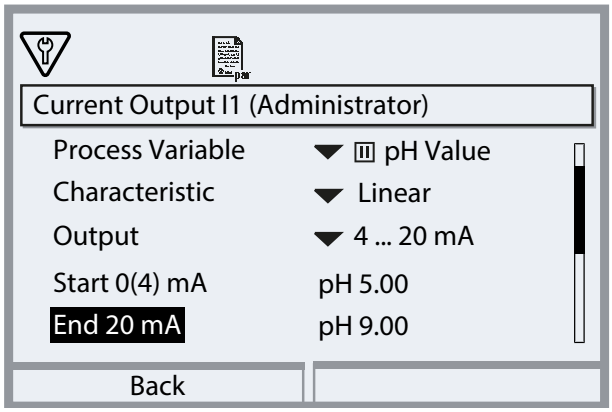
Example 1: Measuring span pH 0 ... 14



Example 2: Measuring span pH 5 ... 7
Advantage: Higher resolution in the range of interest



Parameter setting for Example 2:

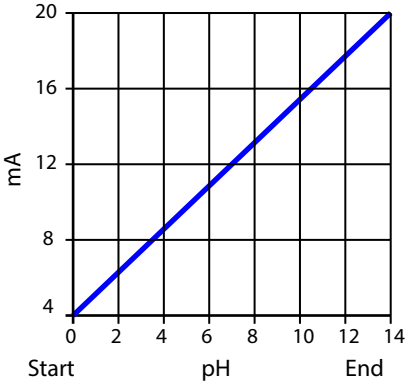


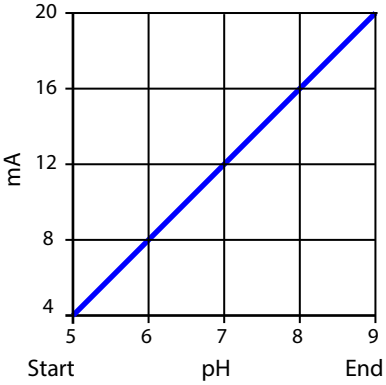
Characteristic Curves

Linear Characteristic

The process variable is represented by a linear output current curve.

Output 4 ... 20 mA, span pH 0 ... 14	Output 4 ... 20 mA, span pH 5 ... 9

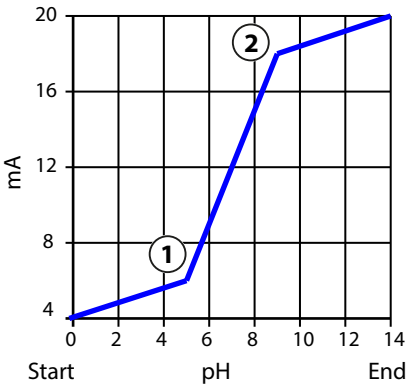


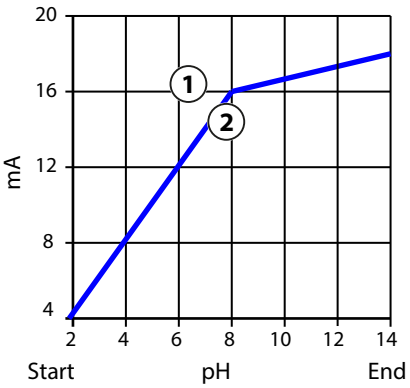


Trilinear/Bilinear Characteristic

Requires two additional vertex points to be entered.

Trilinear: Vertex points **(1)** and **(2)** are different values.	Bilinear: Vertex points **(1)** and **(2)** are the same values.
Output 4 ... 20 mA, span pH 0 ... 14	Output 4 ... 20 mA, span pH 5 ... 9

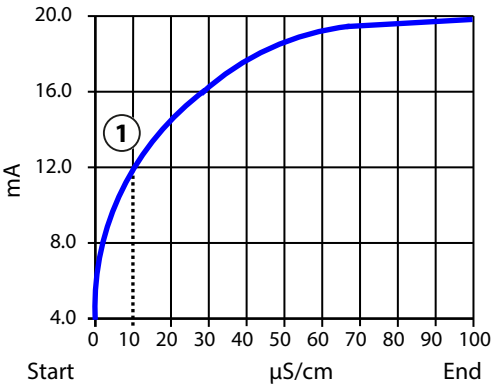


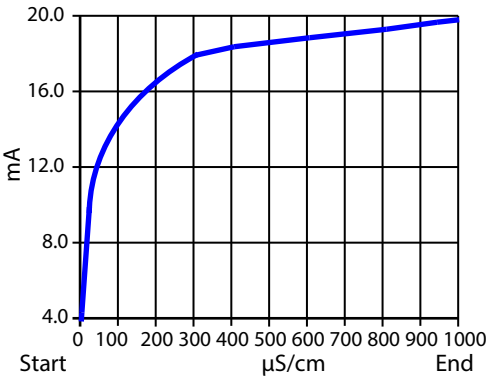


Function/Logarithmic Characteristic

Non-linear curve of the output current, enables measurement across multiple decades, e.g., the measurement of very small measured values with high resolution and measurement of large measured values (low resolution). Requires entry of value for 50% output current.

Characteristic: Function with input of 50 % value **(1)**	Characteristic: Logarithmic
Output 4 ... 20 mA, span 1 ... 100 µS/cm	Output 4 ... 20 mA, span 1 ... 1000 µS/cm

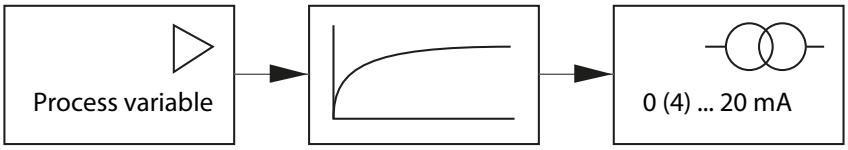




Output Filter

To smooth the current output, a low-pass filter with adjustable time interval can be switched on. When there is a jump at the input (100 %), the output level is at 63 % after the time interval has been reached. The time interval can be set in the 0 ... 120 s range. If the time interval is set to 0 s, the current output follows the input variable.

Note: The filter only acts on the current output, not on the display, the limit values, or the controller!



Time constant 0 ... 120 s

Current During Function Check (HOLD)

Depending on the parameter setting, the current outputs switch to one of the following states:

- Currently measured value: The current measured value is provided at the current output.
- Last usable value (factory setting): The last measured value is held at the current output.
- Fixed value: The current output supplies a fixed value of 0 ... 22 mA.

6.6.2 Relay Contacts

Parameter Setting ▸ BASE Module ▸ Contact K…

The BASE Module has 4 relay contacts (max. load capability AC/DC 30 V/3 A each). Contacts K1 ... K3 are adjustable. The contact K4 is intended for failure messages.

The OUT module can be used to expand the system by an additional 4 relay contacts.

The contact parameters can be set as normally open or normally closed contact independently of each other.

Menu item	Selection	Description
Contact Type	Normally Open N/O	The relay contact closes when it is activated.
	Normally Closed N/C	The relay contact opens when it is activated.

The additional setting options depend on the selected usage.

Notes on wiring → *Relay Contacts: Protective Wiring, p. 33*

Usage of Relay Contacts

The following usages are possible:

- Off
- Failure
- Maintenance request
- Out of specification
- Function check
- Limit value
- Rinse contact
- Rinse contact (channel) (if using two channels)
- Parameter Set B active
- USP output (with conductivity module)
- Sensoface
- Sensoface (channel) (if using two channels)
- Unical (with MSU4400-180 module)

Usage: Failure

01. BASE Module ▸ Contact K…
02. Specify Usage: Failure
03. Set the contact parameters.

Failure is active:

- If a user-defined value has exceeded or fallen below "Failure Hi" or "Failure Lo"
- If the measuring range limits of the device were exceeded
- For other failure messages

This means that the measuring equipment no longer operates properly or that process parameters have reached a critical value.

The relay contact is not activated for "Function Check" (HOLD).

Usage: Maintenance Request

01. BASE Module ▸ Contact K…
02. Specify Usage: Maintenance Request
03. Set the contact parameters.

Maintenance Request is active:

- If messages that require maintenance appear

This means that the equipment is still operating properly but should be serviced, or that process parameters have reached a value requiring intervention. Typical example: The transmitter detected a worn sensor.

The relay contact is not activated for "Function Check" (HOLD).

Usage: Out of Specification

01. BASE Module ▸ Contact K…
02. Specify Usage: Out of specification
03. Set the contact parameters.

Out of specification is active:

- If a user-defined value has exceeded or fallen below "Out of Spec. HI" or "Out of Spec. LO"
- If the device has detected deviations from the permitted ambient conditions or process conditions
- If faults indicating that the measurement uncertainty is probably greater than to be expected under normal operating conditions are present

The relay contact is not activated for "Function Check" (HOLD).

Usage: Function Check

01. BASE Module ▸ Contact K…
02. Specify Usage: Function Check
03. Set the contact parameters.

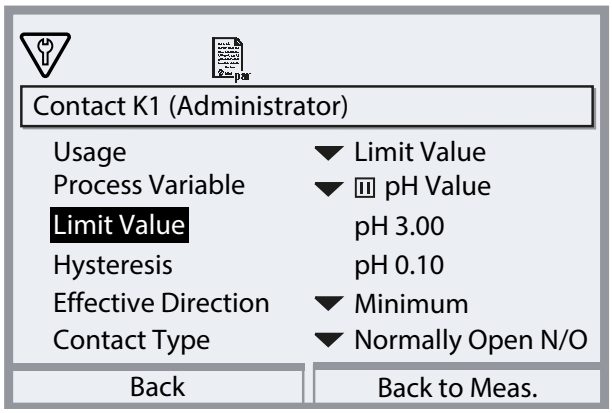
Function Check (HOLD) is active:

- For calibration (only the relevant channel)
- For maintenance (current source, relay test)
- For parameter setting on the operator level and the administrator level
- During an automated rinse cycle

The current outputs respond as configured:
Parameter Setting ▸ BASE Module ▸ Current Output ▸ Function Check

Usage: Limit

01. BASE Module ▸ Contact K…
02. Specify Usage: Limit Value
03. Set the contact parameters.

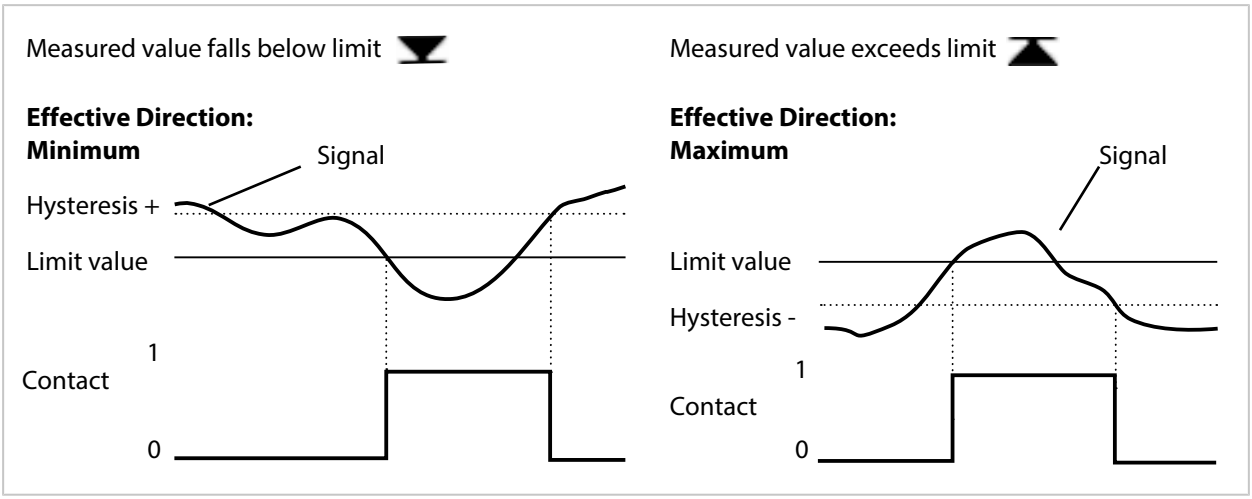


Hysteresis

Hysteresis prevents small fluctuations in the measured value around the limit from constantly triggering a switching operation.

Hysteresis is adjustable and can be activated with an ON/OFF delay time.

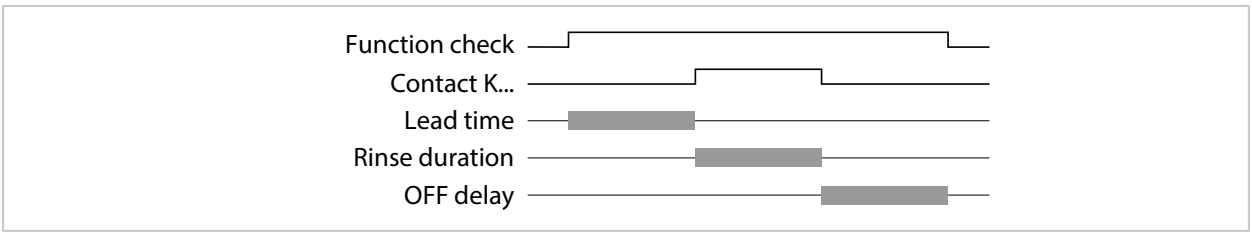
In the measurement display, an icon is used to indicate if the limit has been exceeded or fallen below.



Usage: Rinse Contact

Relay contacts can be used to signal a rinse process.

Time Response



Note: Function Check (HOLD) is activated from the start of the lead time until the end of the OFF delay. The current outputs and remaining relay contacts behave in accordance with the parameter settings.

Configuring the Rinse Contact

01. BASE Module ▸ Contact K…
02. Usage "Rinse Contact"
03. If Usage : "Rinse Contact (Channel)" is selected:
    Select the channel.
04. Select Contact Type (e.g., "Normally Open N/O").
05. Enter the Rinsing Interval .
06. Enter the Rinse Lead Time .
07. Enter the Rinse Duration .
08. Enter the Meas. Lead Time .
09. Logbook Entry "Off/On"

Notes for Configuration of the "Rinse Contact" Function

- Up to 3 rinse functions (contacts K1 ... K3) can be configured independently of each other.
- Multiple rinse functions are not synchronized with each other.
- The "Function Check" (HOLD) operating state (e.g., during parameter setting) delays the execution of the "Rinse Contact" function.

If Usage "Rinse Contact (Channel)" is selected, the contact is assigned to a sensor channel.
Advantage: The activated "Function Check" (HOLD) operating state only applies to the respective sensor channel.

Usage: USP Output

Can be activated by using a conductivity module and the USP function

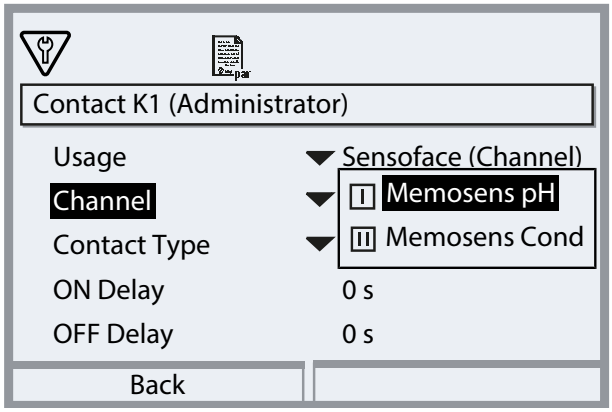
01. BASE Module ▸ Contact K…
02. Specify Usage: USP Output
03. Assign USP channel.
04. Set the contact parameters.

Usage: Sensoface

Sensoface messages can be output via a relay contact.

If using two sensors, the corresponding Sensoface messages can be assigned to different contacts:

01. BASE Module ▸ Contact K…
02. Specify Usage: "Sensoface (Channel)"
03. Select Channel.

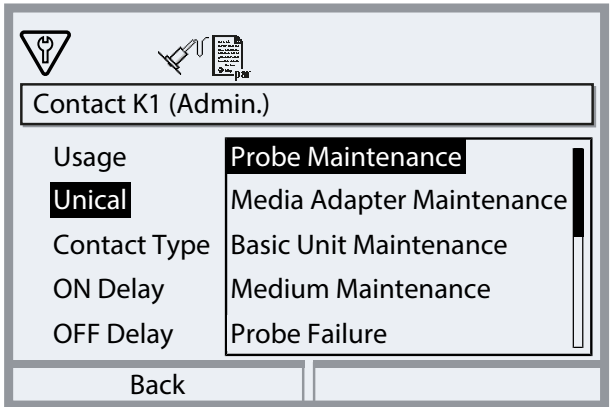


04. Set the contact parameters.

Specify Usage: Unical

Can be activated by using a MSU4400-180 module and connecting a Unical 9000 electro-pneumatic controller

01. BASE Module ▸ Contact K…
02. Specify Usage: Unical
03. Select the message to be signaled.
04. Set the contact parameters.



See the Unical 9000/Protos II 4400 user manual for a description.

6.6.3 Control Inputs

The BASE Module has 2 digital optocoupler inputs (OK1, OK2).

The following functions (depending on the parameter setting) can be triggered via the control signals:

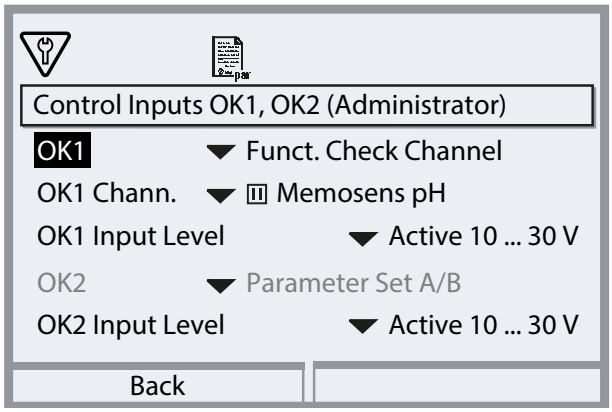
- OK1 Input: Off, function check total, or function check channel
- OK2 Input: Off, Parameter Set A/B

The function of optocoupler input OK2 is defined in the System Control:
Parameter Setting ▸ System Control ▸ Function Control → *Function Control, p. 50*

The switching level for the control signal must be configured:
Input Level: Active 10 ... 30 V or active < 2 V

The settings are made in the Control Inputs OK1/OK2 submenu:

Parameter Setting ▸ BASE … Module ▸ Control Inputs OK1/OK2

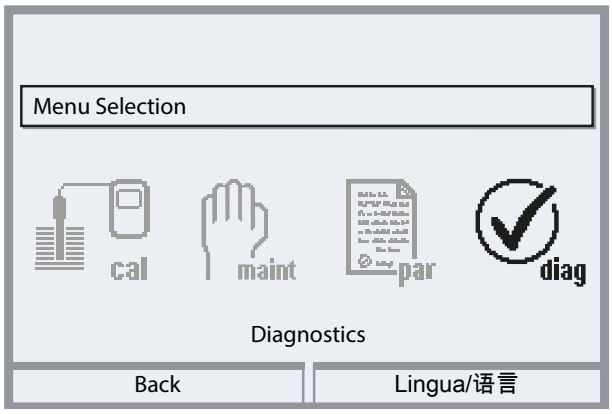


7 Calibration/Adjustment

See the user manual of the corresponding module for the description.

8 Diagnostics

8.1 Diagnostics Functions



The diagnostic functions are based on NAMUR Recommendation NE 107.

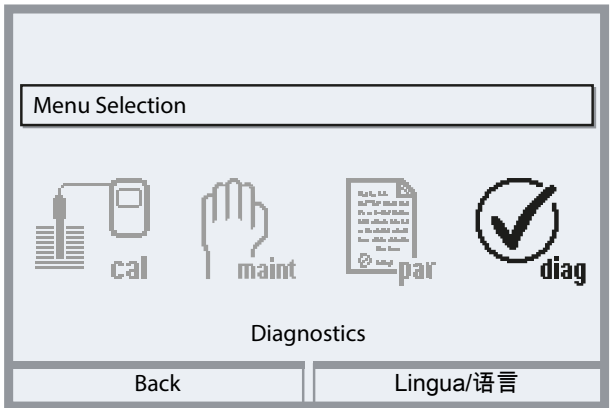
8.1.1 Favorites Menu

Diagnostic functions can be directly opened from the measuring mode with a ***softkey***. To do this, the Favorites Menu function must be assigned to the ***softkey***:
Parameter Setting ▸ System Control ▸ Function Control → *Function Control, p. 50*

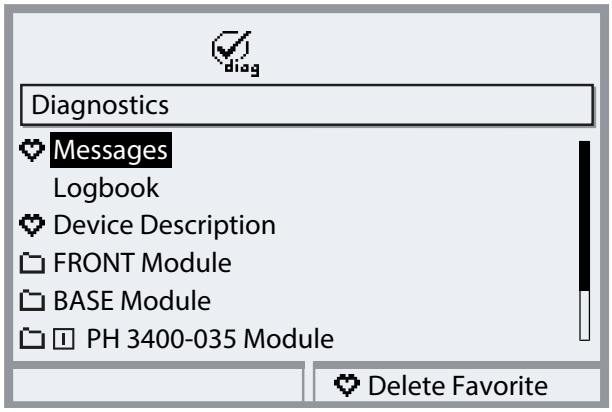
"Favorites" are defined in the Diagnostics menu.

Set Favorite

01. While in measuring mode, press the ***menu*** key.
02. Using the right ***arrow key***, select the Diagnostics menu and confirm with ***enter***.

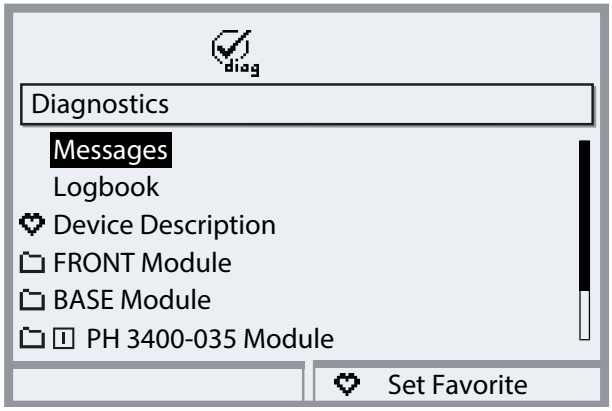


03. Select the desired submenu.
04. ***Right softkey: Set Favorite***
    ✓ A heart icon appears at the front of the menu line. The softkey function changes to ***Delete Favorite***.



Delete Favorite

01. Open the Diagnostics menu and select Favorites Menu.
02. ***Right softkey: Delete Favorite***
    ✓ The heart icon disappears from in front of the menu line. The softkey function changes to ***Set Favorite***.



8.1.2 Overview of Diagnostic Functions

In diagnostics mode, you can open the following submenus without interrupting the measurement process:

Submenus	Description
Message List	Display active messages → *Message List, p. 78*
Logbook	Display the last 100 events with date and time, e.g., calibrations, warning and failure messages, power failure, etc. → *Logbook, p. 78*
Device Description	Provide information about all completed modules: Module type and function, serial number, hardware version, firmware version, and device options → *Device Description, p. 80*
Meas. Point Description	Display measuring point description and annotation → *Measuring Point Description, p. 80*
Audit Trail	TAN option FW4400-081: Display user information → *Audit Trail (FW4400-081), p. 114*
FRONT Module	
Module Diagnostics FRONT	Display the results of the device self-test for the FRONT Module
Display Test	Perform a display test
Keypad Test	Perform a keypad test
BASE Module	
Module Diagnostics BASE	Display the results of the device self-test for the BASE Module
Input/Output Status	Mode indication of the input/outputs

Additional menu items depending on the configuration. See the user manual of the corresponding module for the description.

8.1.3 Message List

All values determined by the measuring module or sensor can generate messages.

Displaying Messages

Diagnostics ▸ Message List

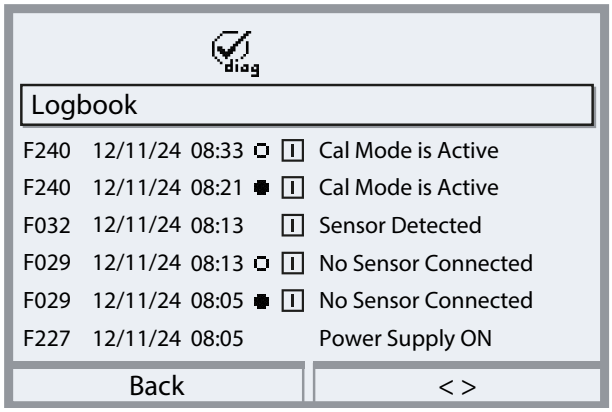
All active error messages are displayed in the Message List menu item with the following information: Message number, message type (NAMUR icon), channel, message text.

An overview of the message texts with notes on troubleshooting can be found in the Troubleshooting chapter. → *Troubleshooting, p. 86*

8.1.4 Logbook

The logbook displays the last 100 events with the message number, date, and time directly on the device: e.g., calibrations, NAMUR messages, voltage failure. Messages generated during function check mode (HOLD) are not saved.

Open under: Diagnostics ▸ Logbook



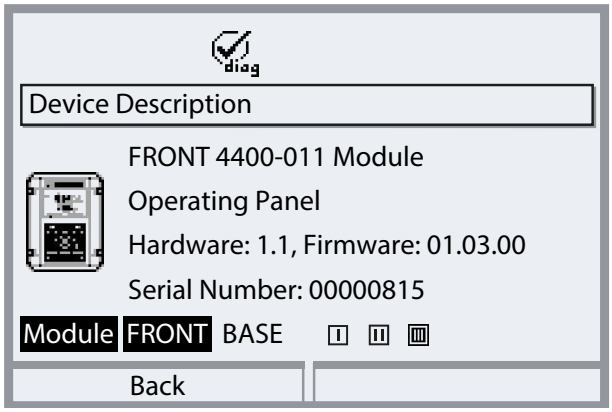
You can scroll forward and backward in the logbook with the ***up/down arrow keys***. The message number can be displayed using the ***right softkey***.

Logbook entries can be deleted in the system control.

Parameter Setting ▸ System Control ▸ Logbook → *Logbook, p. 56*

When a Data Card is used, 20,000 entries or more can be recorded on the Data Card, depending on its memory capacity. → *Memory Card, p. 48*

8.1.5 Device Description



The following device information is displayed for the basic unit (FRONT Module, BASE Module) and the connected modules:

- Device type and function
- Hardware versions
- Firmware versions
- Serial number

Open under: Diagnostics ▸ Device Description

Use the ***left/right arrow keys*** to select the individual modules.

Information on the firmware history (ChangeLog) → *knick-international.com*

8.1.6 Measuring Point Description

Diagnostics ▸ Meas. Point Description

Display the tag number and annotation.

Entry in the menu Parameter Setting ▸ System Control ▸ Meas. Point Description
→ *Measuring Point Description, p. 54*

8.1.7 FRONT Module Diagnostic Functions

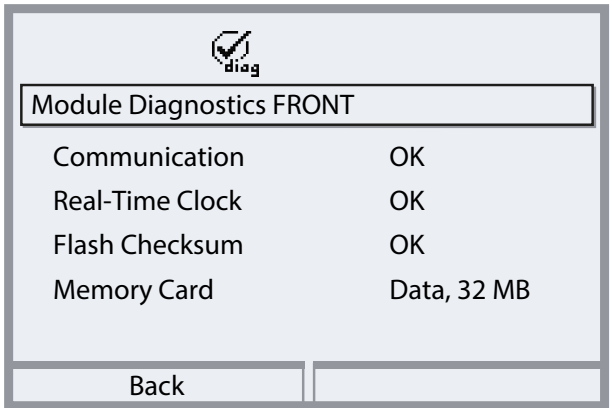
Module Diagnostics

Protos II periodically performs a self-test in the background.

Display the results for the FRONT Module at
Diagnostics ▸ FRONT 4400 Module ▸ Module Diagnostics FRONT

The following is checked:

- Internal communication
- Real-time clock
- Flash checksum
- If a memory card is inserted: Card type and available memory



Display Test

If you select Diagnostics ▸ FRONT … Module ▸ Display Test, the device performs a display test.

Keypad Test

You can test the device keypad by selecting Diagnostics ▸ FRONT … Module ▸ Keypad Test.

01. Press all keys one after the other.
    ✓ A green checkmark shows that a key functions properly.
02. To exit, press the ***left softkey: Back*** twice.

8.1.8 BASE Module Diagnostic Functions

Module Diagnostics

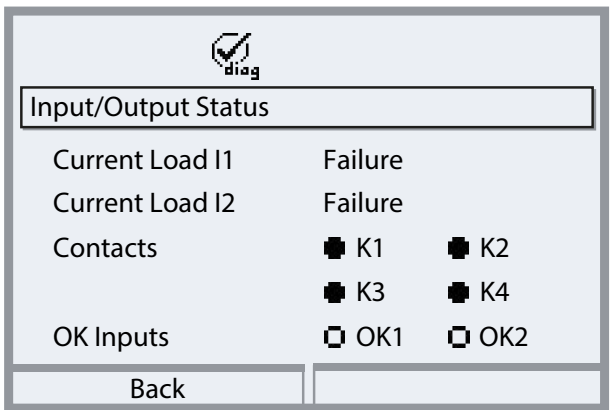
Protos II periodically performs a self-test in the background.

Display the results for the BASE Module at Diagnostics ▸ BASE 4400 Module ▸ Module Diagnostics BASE

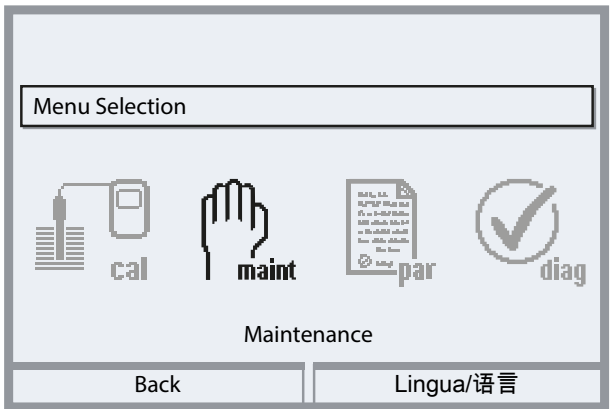
The following is checked:

- Communication
- Flash checksum

Input/Output Status



9 Maintenance Functions



Note: Function check (HOLD) is active. The current outputs and relay contacts behave in accordance with the parameter settings. Return to measuring mode to exit the function check, e.g., with the ***meas*** key.

The maintenance menu provides different functions for checking the device function.

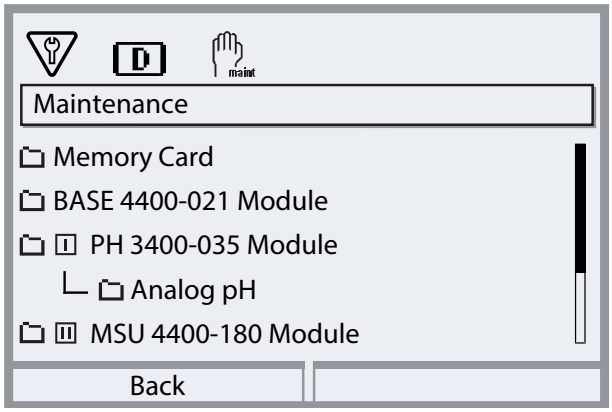
Assigning passcodes helps to ensure that only qualified personnel with access rights are allowed to perform maintenance functions.

The passcodes can be changed or disabled:

Parameter Setting ▸ System Control ▸ Passcode Entry → *Passcode Entry, p. 58*

See the Unical user manual for a description of the maintenance functions when using a Unical electro-pneumatic controller.

9.1 Overview of Maintenance Functions



Submenus	Description
Memory Card	Only with connected Data Card: Open/close memory card. → *Memory Card, p. 98*
BASE4400 Module	
Current Source	Function test: manual control of current outputs in the complete area → *Current Source, p. 83*
Relay Test	Function test of relay contacts → *Relay Test, p. 83*
Adjust Current Output	Adjust the current outputs → *Adjust Current Output, p. 83*

Additional menu items depending on the configuration. See the user manual of the corresponding module for the description.

9.2 Current Source

The output current can be manually specified for the function test (range 0 ... 22 mA):

01. Maintenance ▸ BASE Module ▸ Current Source
02. Select the current output.
03. Use the ***arrow keys*** to enter a valid current value for the corresponding output.
04. Confirm with ***enter***.
    ✓ The actual output current is displayed on the bottom right line for checking.

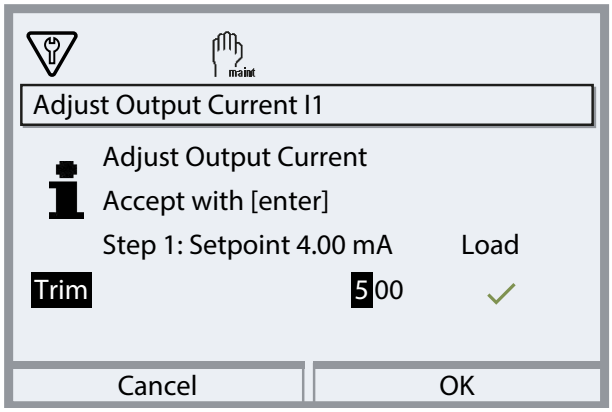
9.3 Relay Test

Maintenance ▸ BASE Module ▸ Relay Test

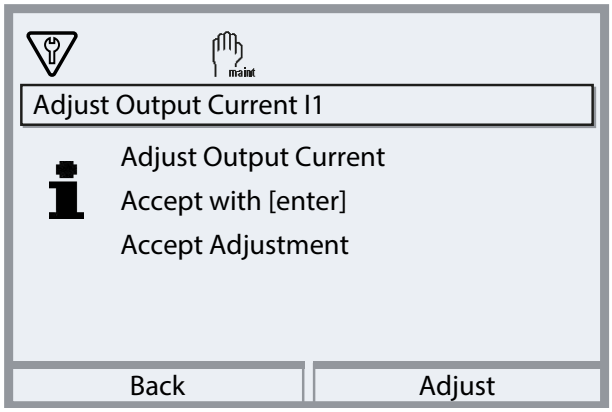
When the menu is opened, the function of the relay contacts (relays) is checked. To check the wiring, the relays can be manually switched.

9.4 Adjust Current Output

01. Open the menu: Maintenance ▸ BASE Module ▸ Adjust Current Output
02. Enter passcode "2014".
03. Select the output current to be adjusted and open the submenu.



04. Step 1: Set the output current for setpoint 4 mA:
    The adjustment range is limited to approximately ± 0.5 mA (0 ... 999 counts).
05. Use the ***right softkey: OK*** to save the value for 4 mA.
06. Step 2: Set the output current for setpoint 20 mA:
    The adjustment range is limited to approximately ± 0.5 mA (0 ... 999 counts).
07. Use the ***right softkey: OK*** to save the value for 20 mA.



08. Step 3: Use the ***right softkey: Adjust*** to adjust the output current with the two stored values.
09. Use the ***right softkey: Yes*** to confirm the confirmation prompt.
    Note: If the function is opened again, it starts with the default values for adjustment. The adjustment must then be performed again.

10 Maintenance

Maintenance

Protos II does not require maintenance.

If maintenance is required at the measuring point (e.g., sensor replacement), function check mode (HOLD) must be activated in the device's Maintenance menu. This can also be done in the Parameter Settings menu (Operator or Administrator level).

Repair

Users cannot repair Protos II 4400(X) and the measuring modules. Please direct your repair requests to Knick Elektronische Messgeräte GmbH & Co. KG at www.knick-international.com.

11 Troubleshooting

11.1 Malfunction States

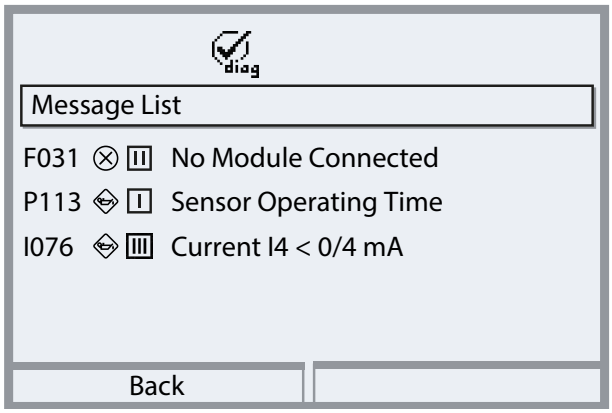
Messages and errors are displayed with the corresponding NAMUR icon.

The message is recorded in the logbook with the date and time. → *Logbook, p. 78*

If messages are wired to current outputs or relay contacts, they are activated after the set delay time has elapsed.

Displaying Messages

01. If the "Failure" ⊗, "Maintenance Request" ◈, or "Out of Specification" ⚠ icons blink on the display, open the Diagnostics menu:
    Menu Selection ▸ Diagnostics ▸ Message List
    ✓ All active messages are displayed in the Message List menu item with the following information: Error number, type (failure, maintenance request, out of specification), channel, message text.



02. Scroll forward and backward with the ***up/down arrow keys***.

Note: The message is deleted from the message list around 2 s after troubleshooting.

General Errors

Error	Possible Cause	Remedy
Display is blank	No power supply	Check the power supply or provide a suitable power supply for the device.
	Display auto-off activated.	Press any key to wake the display following a possible auto-off.
	With BASE4400-029 Module: Input fuse tripped.	Replace fuse (500 mA T). → *View of the Opened Device, p. 16*
No measured value, no error message	Sensor or module incorrectly connected.	Check the sensor connection/install the module properly.
	Measurement display not configured.	Set the measurement display parameters: Parameter Setting ▸ FRONT Module ▸ Measurement Display

11.2 Messages

Message type	NAMUR icon
Maintenance request	
Out of specification	
Failure	
Function check	
Info	Info text; it is displayed directly in the relevant menu.
par	Message type is adjustable: Failure or maintenance request

Signaling via relay contacts → *Relay Contacts, p. 69*

FRONT Module

No.	Type	Message Text	Possible Cause	Remedy
F001	⊗	Module Data Loss	Data error in the parameter settings of a module	Reset to factory settings and set completely new parameters.
F008	⊗	Adjustment Data	Error in the adjustment data	Disable device (approx. 10 s).
				If the message persists, send in the device.
F009	⊗	Firmware Error	Error in the firmware	Disable device (approx. 10 s).
				Re-load the firmware. → *Firmware Update, p. 55*
				If the message persists, send in the device.
F010	⊗	Failed to Restore Factory Settings	An error occurred while resetting to factory settings.	Send in the device.
F029	⊗	No Sensor Connected	The sensor is not identified.	Check connections.
				Check cable, replace as required.
				Check sensor, replace as required.
F030	⊗	Wrong Sensor Connected	The connected digital sensor does not match the parameter settings.	Connect the right sensor.
				Adjust the process variable.
F031	⊗	No Module Connected	No module is identified.	
			No module or wrong module is connected.	Properly install the module and select it in the parameter settings.
			Defective module.	Replace module.
F032	Info	Sensor Identified	A Memosens sensor was connected.	
F033	Info	Sensor Disconnected	Sensor is no longer found.	
			Sensor was removed.	Connect the right sensor and adjust the parameter settings if required.
			Defective connections/cables.	Check connections/cables, replace if required.
F034	Info	Module Identified	A new module was inserted.	

No.	Type	Message Text	Possible Cause	Remedy
F035	Info	Module Disconnected	Module is no longer found.	
			Module was removed.	Insert the right module and adjust the parameter settings if required.
			Defective connections/cables.	Check connections/cables, replace if required.
F036	⊗	Sensor Devaluated	Digital sensor devaluated.	Replace sensor.
F037	◈	Firmware Update Required	Firmware is obsolete.	Update firmware. → *Firmware Update, p. 55*
F038	⊗	Sensor Defective	Sensor defective.	Replace sensor.
F040	◈	Firmware Update (COM) Required	Firmware is obsolete.	Update firmware. → *Firmware Update, p. 55*
F200	⊗	Configuration Data Loss	Data error in the parameter settings	Reset to factory settings and set completely new parameters.
F201	⊗	KBUS Error	Internal communication error	Disable device (approx. 10 s).
				If the message persists, send in the device.
F202	⊗	System Failure	Internal system error	Disable device (approx. 10 s).
				If the message persists, send in the device.
F203	⊗	Inconsistent Parameter Setting	The parameter settings of the measuring channel operating mode are inconsistent.	Check and correct the parameter settings.
F207	⊗	Message List Full	Too many messages on the message list	Open message list and remedy error states displayed.
F208	⊗	Too Many Sensors Configured	Parameters were set for more sensors than are connected.	Either change parameter settings or connect relevant sensors.
F212	⊗	Time/Date	The time and date not set yet.	Set the time and date: Parameter Setting ▸ System Control ▸ Time/Date
F215	◈	Memory Card Full	The memory card is full.	Replace memory card or delete data.
F227	Info	Power Supply ON	Device was connected to the power supply or power supply was restored after a power failure (logbook entry).	
F228	Info	Firmware Update	A firmware update was performed (logbook entry).	
F229	Info	Wrong Passcode	An incorrect passcode was entered.	Enter the correct passcode. → *Passcode Entry, p. 58*
F230	Info	Factory Setting	The device was reset to factory settings (logbook entry).	
F232	⊗	Ex/Non-Ex Modules	Ex and non-Ex modules are used.	Equip uniformly (either only Ex or only non-Ex).
F234	Info	Key Lock Active	A key lock was set.	Deactivate key lock via PCS: Slot 1, Subslot 1, Index 1
F235	Info	Combination of Ex and Non-Ex Components	Ex and non-Ex modules are used.	Equip uniformly (either only Ex or only non-Ex).

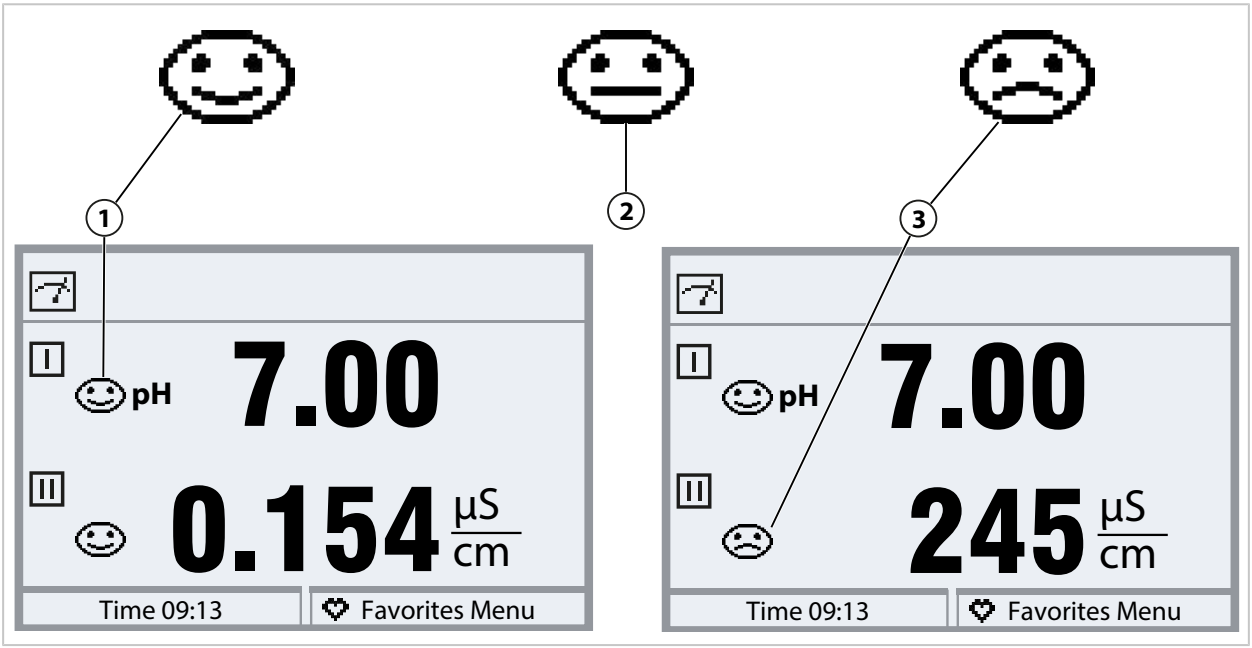
No.	Type	Message Text	Possible Cause	Remedy
F236		HART not Available, Current too Low	Output current I1 < 4 mA.	Set current output I1 to 4 ... 20 mA. Parameter Setting ▸ Inputs/Outputs ▸ Current Outputs ▸ Current Output I1 ▸ Output
F240	Info	Calibration Active	A calibration has been started.	
F246	Info	Calibration Successful	A calibration has been performed successfully (logbook entry).	
F247	Info	Adjustment Successful	An adjustment has been performed successfully (logbook entry).	
F248	Info	Calibration Failed	A calibration was not successful (logbook entry).	

BASE Module

No.	Type	Message Text	Possible Cause	Remedy
B070		Current I1 Span	Current output 1: The measuring span is too small/too big:	Parameter Setting ▸ BASE Module ▸ Current Output I1 Verify start/end.
B071		Current I1 < 0/4 mA	Output current I1 is below the permitted limit.	Set current output I1 to 4 ... 20 mA. Parameter Setting ▸ BASE Module ▸ Current Output I1
B072		Current I1 > 20 mA	Output current I1 is above the permitted limit.	Set current output I1 to 4 ... 20 mA. Parameter Setting ▸ BASE Module ▸ Current Output I1
B073		Current I1 Load Error	Current output 1: The current loop is interrupted (cable breakage) or the load is too high.	Check current loop. Deactivate or short-circuit unused current outputs.
B074		Current I1 Parameter	Faulty parameter setting for current output I1	Check parameter settings: Parameter Setting ▸ BASE Module ▸ Current Output I1
B075		Current I2 Span	Current output 2: The selected span is too small/too big.	Parameter Setting ▸ BASE Module ▸ Current Output I2 Verify start/end.
B076		Current I2 < 0/4 mA	Output current I2 is below the permitted limit.	Set current output I2 to 4 ... 20 mA. Parameter Setting ▸ BASE Module ▸ Current Output I2
B078		Current I2 Load Error	Current output 2: The current loop is interrupted (cable breakage) or the load is too high.	Check current loop. Deactivate or short-circuit unused current outputs.
B079		Current I2 Parameter	Faulty parameter setting for current output I2	Check parameter settings: Parameter Setting ▸ BASE Module ▸ Current Output I2
B100	Info	Current: Manual Control	Function test of current outputs	
B101	Info	Relay: Manual Control	Function test of relay contacts	

No.	Type	Message Text	Possible Cause	Remedy
B103	Info	Analog Controller: Man. Control	Function test of the analog controller	
B200		Rinse Contact Active		
B201		Function Check via Input	Function Check was activated via OK1 Input.	

11.3 Sensoface and Sensocheck



1 Happy Sensoface
2 Neutral Sensoface
3 Sad Sensoface

The Sensoface icons provide users with diagnostic information on the wear and required maintenance of the sensor. In measuring mode, an icon (happy, neutral, or sad smiley) is shown on the display to reflect the continuous monitoring of the sensor parameters.

You can configure the current output parameters such that a Sensoface message generates a 22 mA error signal:

Parameter Setting ▸ BASE Module ▸ Current Output I… ▸ Behavior during Messages

Sensoface messages can also be output via a relay contact:

Parameter Setting ▸ BASE Module ▸ Contact K… : "Usage: Sensoface"

Enabling/Disabling Sensoface

Sensoface is enabled and disabled in the Sensor Data submenu of the corresponding measuring module.

See the user manual of the corresponding module for the description.

Sensoface Criteria

pH

Sensoface		Slope	Zero Point[1)]
☺	Happy	53.3 ... 61 mV/pH	pH 6 ... 8
☹	Sad	< 53.3 mV/pH or > 61 mV/pH	< pH 6 or > pH 8

Conductivity (Contacting)

Sensoface		Cell Constant	
		Analog Sensors	Memosens
☺	Happy	0.005 cm^{-1} ... 19.9999 cm^{-1}	0.5x nom. cell constant ... 2x nom. cell constant
☹	Sad	< 0.005 cm^{-1} or > 19.9999 cm^{-1}	< 0.5x nom. cell constant or > 2x nom. cell constant

Conductivity (Inductive)

Sensoface		Cell Factor		Zero Point
		Analog Sensors	Memosens	
☺	Happy	0.1 cm^{-1} ... 19.9999 cm^{-1}	0.5x nom. cell factor ... 2x nom. cell factor	-0.25 mS ... 0.25 mS
☹	Sad	< 0.1 cm^{-1} or > 19.9999 cm^{-1}	< 0.5x nom. cell factor or 2x nom. cell factor	< -0.25 mS or > 0.25 mS

Oxygen

Sensoface		Slope		
		Standard Sensor (SE7*6)	Trace Sensor 01 (SE7*7 ...)	Trace Sensor 001
☺	Happy	-110 nA ... -30 nA	-525 nA ... -225 nA	-8000 nA ... -2500 nA
☹	Sad	< -110 nA or > -30 nA	< -525 nA or > -225 nA	< -8000 nA or > -2500 nA
Sensoface		**Zero Point**		
		Standard Sensor (SE7*6)	**Trace Sensor 01 (SE7*7 ...)**	**Trace Sensor 001**
☺	Happy	-1 nA ... 1 nA	-1 nA ... 1 nA	-3 nA ... 3 nA
☹	Sad	< -1 nA or > 1 nA	< -1 nA or > 1 nA	< -3 nA or > 3 nA

Note: The worsening of a Sensoface criterion leads to the devaluation of the Sensoface display (Smiley gets "sad"). An improvement of the Sensoface display can only take place after calibration or removal of the sensor defect.

[1)] Applies to standard sensors with zero point pH 7

Sensocheck

Note: Function is active for digital sensors and analog pH, ORP, and oxygen sensors.

Process Variable	Sensocheck Function
pH:	Automated monitoring of glass and reference electrodes
Oxygen:	Monitoring of membrane/electrolyte
Conductivity:	Notes on sensor state

Enable/Disable Sensocheck

Sensocheck is enabled and disabled in the Sensor Monitoring menu of the corresponding measuring module.

See the user manual of the corresponding module for the description.

12 Decommissioning

12.1 Disposal

To dispose of the product properly, follow the local regulations and laws.

Customers can return their electrical and electronic waste devices.

For details on how to return and dispose of electrical and electronic devices in an environmentally friendly manner, please refer to the manufacturer's declaration on our website. If you have any queries, suggestions, or questions about how Knick recycles electrical and electronic waste devices, please send us an email: → *support@knick.de*

12.2 Return Delivery

If a product must be returned, send it to the responsible local representative in a clean condition and securely packaged. → *knick-international.com*

13 Accessories

Accessories	Order No.
Pipe-mount kit → *ZU0544 Pipe-Mount Kit, p. 95*	ZU0544
Panel-mount kit → *ZU0545 Panel-Mount Kit, p. 96*	ZU0545
Protective hood → *ZU0548/ZU1178 Protective Hood, p. 97*	ZU0548
VP8 connector	ZU0721
M12 socket, 8-pin	ZU0860
Terminal cover for Protos II 4400X → *Wiring for Protos II 4400X, p. 31*	ZU1042

Memory Cards

Memory Cards, non-Ex	Order No.
Data Card	ZU1080-P-N-D
FW Update Card	ZU1080-P-N-U
FW Repair Card	ZU1080-P-N-R
Custom FW Update Card	ZU1080-P-N-S-***[1)]
Custom FW Repair Card	ZU1080-P-N-V-***[1)]

Memory Cards, Ex	Order No.
Data Card	ZU1080-P-X-D
FW Update Card	ZU1080-P-X-U
FW Repair Card	ZU1080-P-X-R
Custom FW Update Card	ZU1080-P-X-S-***[1)]
Custom FW Repair Card	ZU1080-P-X-V-***[1)]

Description of the memory cards → *Memory Card, p. 98*

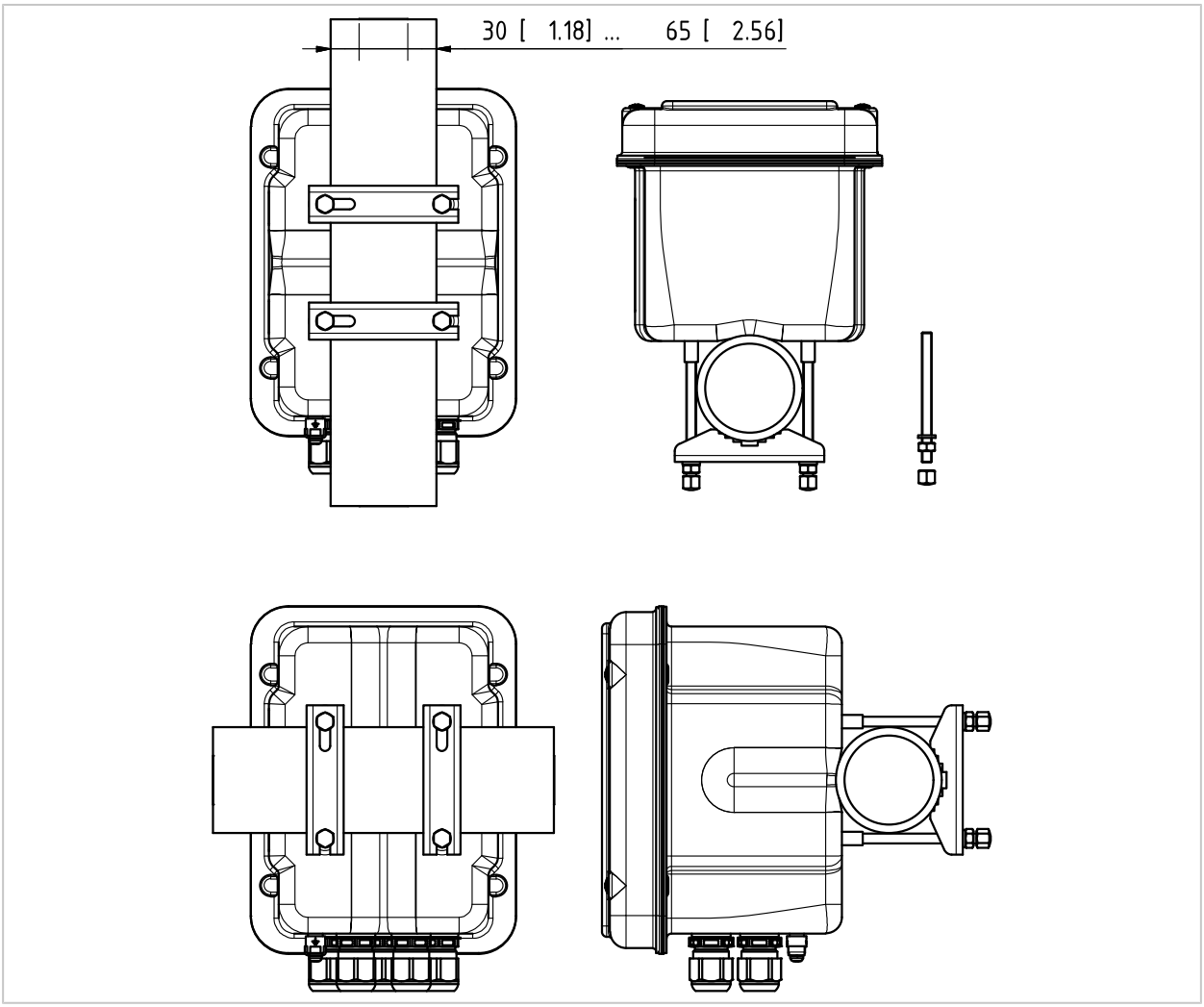
1) *** = device firmware

13.1 ZU0544 Pipe-Mount Kit

Package Contents

- 2× pipe clip (stainless steel A4)
- 4× threaded rod (M6×80, stainless steel A4)
- 4× each: washer, hexagon nut, cap nut (M6, stainless steel A4)

Note: All dimensions are listed in millimeters [inches].



Note: The ZU0544 pipe-mount kit is suitable for a pipe diameter of 30 ... 65 mm (1.18 ... 2.56″) or an edge length of 30 ... 45 mm (1.18 ... 1.77″).

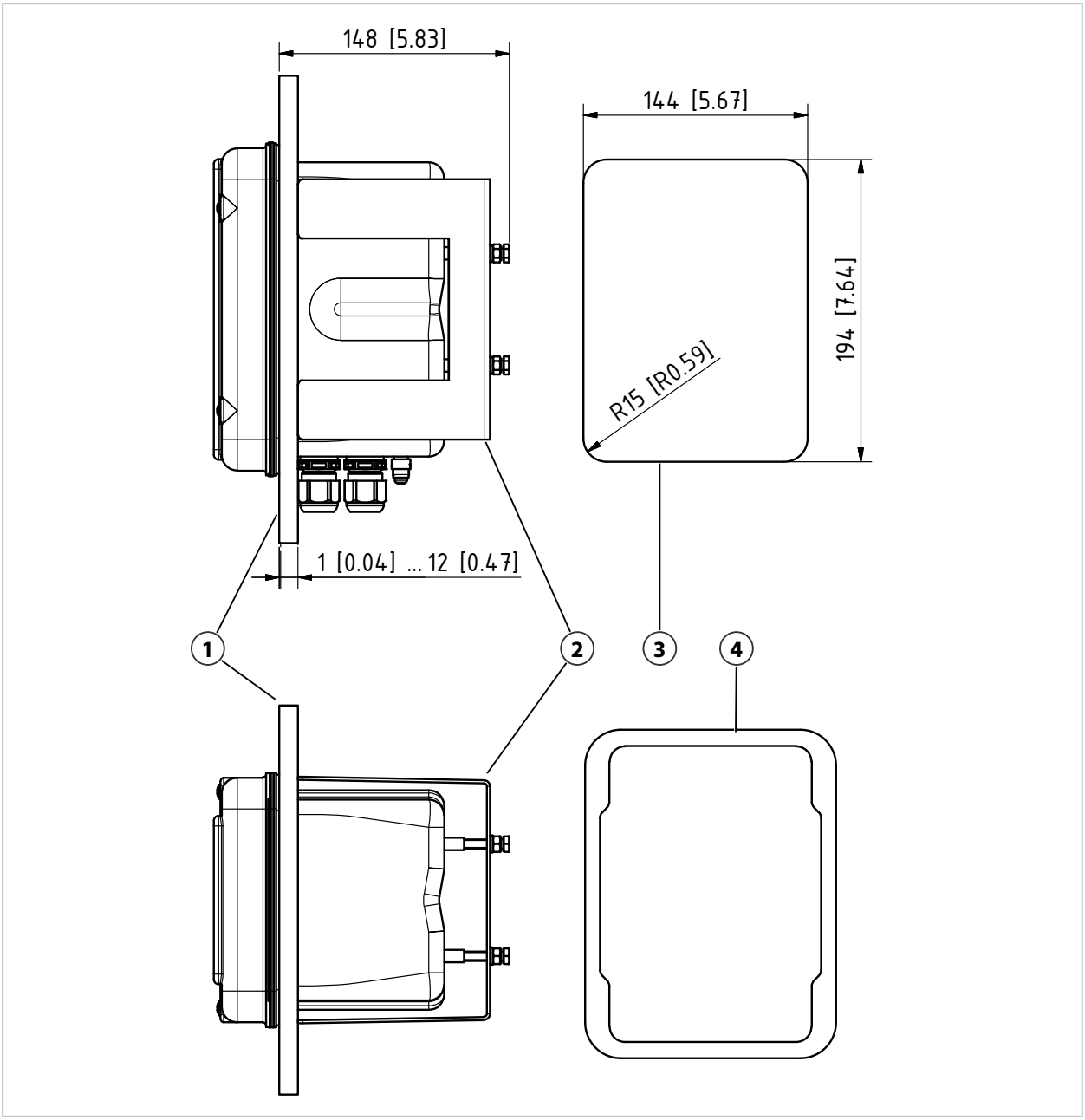
01. Check the Protos II 4400(X) for damage.
02. Prepare the pipe-mount kit: Guide the threaded rod through the pipe clip and slide on the hexagon nut and washer.
03. Position the pipe-mount kit and Protos II 4400(X) on the pipe and screw it tight.
04. Secure the threaded rod with cap nuts.
05. Check that it is securely fastened.

13.2 ZU0545 Panel-Mount Kit

Package Contents

- 1× mounting bracket
- 1× control panel seal
- 4× hexagon bolt M6 × 30
- 4× washer M6
- 4× hexagon nut M6

Note: All dimensions are listed in millimeters [inches].



1	Control panel	3	Panel cutout
2	Mounting bracket	4	Control panel seal

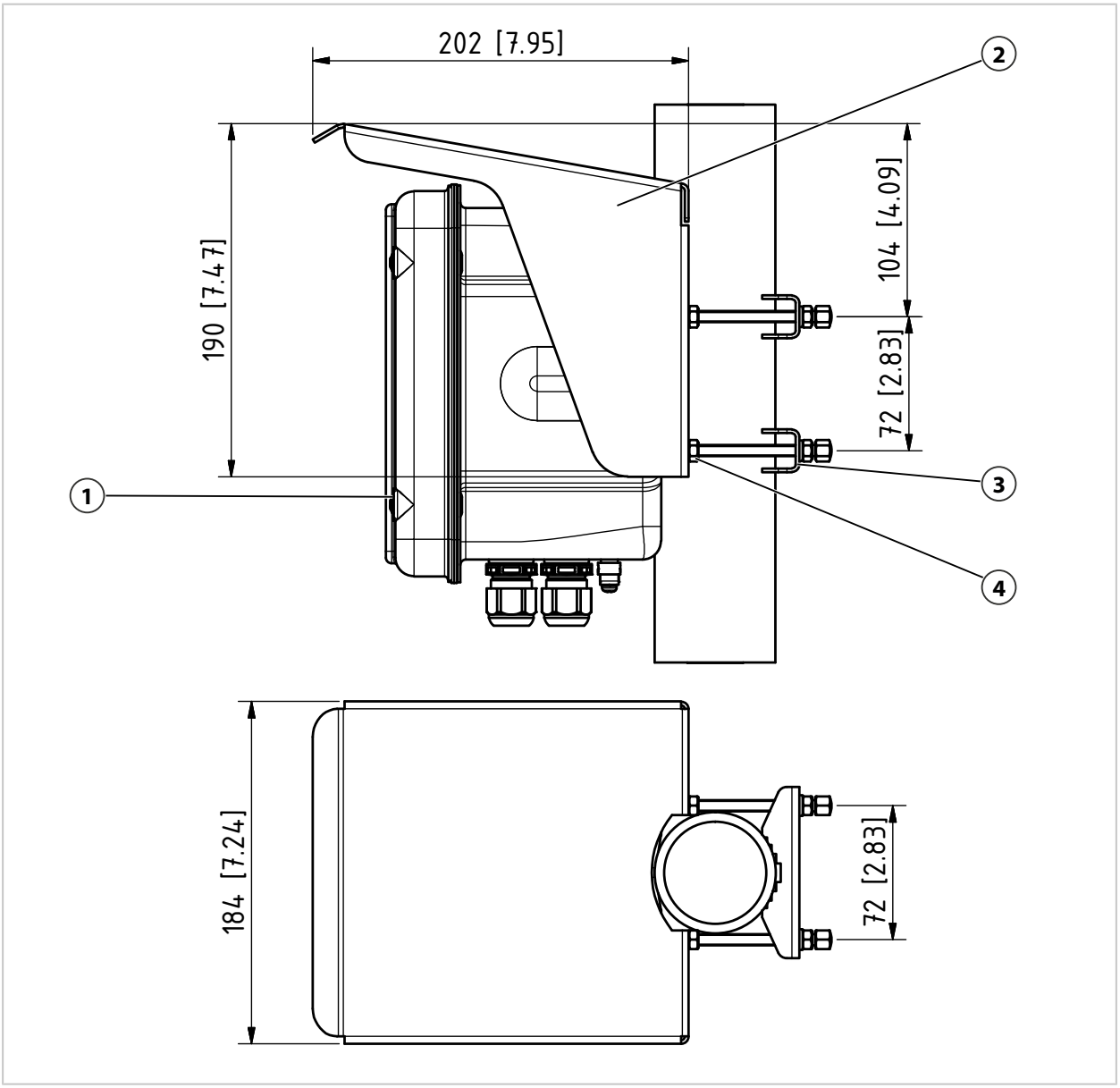
13.3 ZU0548/ZU1178 Protective Hood

Package Contents

- 1× protective hood (ZU0548: stainless steel A2, ZU1178: stainless steel 1.4401)
- 4× nut M6 (stainless steel 1.4401) to attach the protective hood on the threaded rod of the ZU0544 pipe-mount kit

Note: The protective hood can only be used with pipe mounting.

Note: All dimensions are listed in millimeters [inches].



1	Protos	3	ZU0544 Pipe-Mount Kit
2	Protective hood	4	Union nut M6

13.4 Memory Card

Safety

All memory cards are available as both non-Ex and Ex versions. Ex and non-Ex components must not be mixed.

Memory cards identified with an **N** in the product name must not be used in potentially explosive atmospheres.

When working in hazardous locations, the regulations and standards applicable at the installation site for the construction and operation of electrical installations in potentially explosive atmospheres must be observed. Refer to the information in the Safety Guide of the Protos II 4400X.

Intended Use

Memory cards are used to save data or make firmware changes in conjunction with the Protos II 4400(X). The device's measurement data, configuration data, and firmware can be saved.

The corresponding settings are made in System Control:

Menu Selection ▸ Parameter Setting ▸ System Control ▸ Memory Card

Package Contents

- Memory card
- Installation guide
- Declaration of Compliance with the Order 2.1 in accordance with EN 10204
- USB cable, 1.5 m (4.92 ft), USB A/Micro-USB connection
- EU Declaration of Conformity (only for ZU1080-P-X-*)

Inserting/Removing the Memory Card

⚠ **WARNING! Voltages dangerous to touch.** When opening the device, there may be dangerous touch voltages in the terminal compartment. Do not touch the terminal compartment when changing the memory card.

01. If necessary, deactivate any Data Card currently in use, see below.
02. Unscrew the enclosure screws of the front unit and open the device.
03. Insert the memory card into the card slot in the front unit.

04. Close the device and tighten the enclosure screws in a crosswise pattern. Tightening torque 0.5 … 2 Nm.
    ✓ The display shows an icon indicating the memory card type.

Note: When using a Data Card: Before disconnecting the supply voltage and before removing, the memory card must be deactivated to prevent possible data loss:
Menu Selection ▸ Maintenance ▸ Open/Close Memory Card

Deactivating the Data Card

01. Open the Maintenance menu.
02. Open/Close Memory Card :
03. Use the ***right softkey: Close*** to end the access to the memory card.
    ✓ The Data Card icon on the display is marked with an [x].

04. Remove the memory card, see above.

Reactivating the Data Card

If the Data Card is not removed after being deactivated, the Data Card icon on the display continues to be marked with an [x]. The Data Card must be reactivated for further use:

01. Open the Maintenance menu.
02. Open/Close Memory Card :
03. Use the ***right softkey: Open*** to reactivate the memory card.
    ✓ The Data Card icon reappears on the display and the memory card can be used again.
    Note: If using a different memory card, e.g., an FW Update Card, these steps can be omitted.

Connection to PC

Connect the memory card to the PC's USB port using the supplied USB cable.

1 Micro USB port
2 System connection Protos II

Note: The Ex memory card may be connected to a standard PC in the non-Ex location.

Memory Card Types

Icon	Card type (original accessory)	Purpose
	Data Card Non-Ex: ZU1080-P-N-D Ex: ZU1080-P-X-D	Data recording (e.g., configuration, parameter sets, logbook, measurement recorder data). When data is being transmitted, the icon blinks. The Data Card can be used in conjunction with the following TAN options: FW4400-102 Parameter Sets 1-5 FW4400-103 Measurement Recorder
	FW Update Card Non-Ex: ZU1080-P-N-U Ex: ZU1080-P-X-U	Firmware update for enhanced functionality. The previous firmware is replaced by the current version. General data cannot be stored on this memory card.
	FW Repair Card Non-Ex: ZU1080-P-N-R Ex: ZU1080-P-X-R	Firmware repair in case of device malfunctions free of charge. General data cannot be stored on this memory card.
	Custom FW Update Card Non-Ex: ZU1080-P-N-S Ex: ZU1080-P-X-S	Customer-specific FW versions Firmware update for enhanced functionality. Older firmware versions can be stored on a custom FW Update Card. General data cannot be stored on this memory card.
	Custom FW Repair Card Non-Ex: ZU1080-P-N-V Ex: ZU1080-P-X-V	Customer-specific FW repair versions For custom cards, the firmware version can be chosen as required, e.g., to set the firmware of all existing devices to a uniform version proven in operation.

Firmware Update with FW Update Card

→ *Firmware Update, p. 55*

Firmware Repair with FW Repair Card

01. Unscrew the enclosure screws of the front unit and open the device.
02. Insert the FW Repair Card into the card slot in the front unit.
03. Close the device and tighten the enclosure screws in a crosswise pattern. Tightening torque 0.5 … 2 Nm.
04. The automatic update process starts and runs automatically.

Specifications

Memory card	Accessory for additional functions (firmware update, measurement recorder, logbook)
Storage capacity	32 MB
Logbook	In the case of exclusive use: up to 400,000 entries
Measurement recorder	In the case of exclusive use: up to 200,000 entries
Unical system prognostics	In the case of exclusive use: up to 600,000 entries
Connection to PC	Micro USB
Connection to device	Plug-in connection
Communication	USB 2.0, high-speed, 12 Mbit/s Data Card, MSD (mass storage device) FW Update Card, FW Repair Card: HID (human interface device)
Dimensions	L 32 mm × W 12 mm × H 30 mm

14 TAN Options

The functions described in the following are available after the corresponding TAN option is activated.
→ *Option Activation, p. 56*

Note: The TAN option FW4400-106 for a firmware update is no longer necessary from firmware 01.03.00.

Description of the firmware update → *Firmware Update, p. 55*

Add-On Function (TAN Option)	Order No.
pH buffer table: Entry of individual buffer set → *pH Buffer Table: Entry of Individual Buffer Set (FW4400-002), p. 102*	FW4400-002
Current characteristic → *Current Characteristic (FW4400-006), p. 103*	FW4400-006
Ultrapure water: Temperature compensation for conductivity → *Ultrapure Water: Temperature Compensation for Conductivity (FW4400-008), p. 103*	FW4400-008
Concentration determination for use with conductivity sensors → *Concentration Determination (FW4400-009), p. 104*	FW4400-009
Sensor channel B for 2nd Memosens sensor on the MSU4400(X)-180 module	FW4400-014
Oxygen measurement in the saturation range and low oxygen concentration for the MS4400(X)-160/MSU4400(X)-180 module	FW4400-015
Sensor channel B+C for the 2nd + 3rd Memosens sensor on the MSU4400(X)-180 module	FW4400-018
Audit Trail → *Audit Trail (FW4400-081), p. 114*	FW4400-081
5 parameter sets → *Parameter Sets 1-5 (FW4400-102), p. 109*	FW4400-102
Measurement recorder → *Measurement Recorder (FW4400-103), p. 112*	FW4400-103

14.1 pH Buffer Table: Entry of Individual Buffer Set (FW4400-002)

For the buffer table that can be entered, the FW440-002 add-on function must be activated in the device with a TAN. → *Option Activation, p. 56*

An individual buffer set with 3 buffer solutions can be entered. To do so, the nominal, temperature-corrected buffer values for the temperature range 0 … 95 °C (32 … 203 °F) are entered in increments of 5 °C (9 °F). This buffer set is available in addition to the default standard buffer solutions under the name "Table".

Conditions for the Specifiable Buffer Set:

- This should be in the pH 0 … pH 14 range.
- The difference between two adjacent pH values (distance 5 °C) of the same buffer solution may be no more than 0.25 pH units.
- The values of buffer solution 1 must be smaller than those of buffer solution 2.
- The distance of values with the same temperature to both buffer solutions must be larger than 2 pH units. If the entry is faulty, an error message will be output.

The pH value at 25 °C (77 °F) is always used for buffer display during calibration.

The settings are made in the Buffer Table submenu:

Parameter Setting ▸ System Control ▸ Buffer Table

01. Select the buffer to be entered. In ascending order (e.g., pH 4, 7, 10), 3 complete buffer solutions must be entered. Minimum distance between buffers: 2 pH units.
02. Enter nominal buffer values and all buffer values as temperature-corrected values and confirm with ***enter***.

The individual buffer sets are selected in the menu:

Parameter Setting ▸ Module ▸ Cal Presettings

Calibration Mode : Calimatic

Buffer Set : Table

14.2 Current Characteristic (FW4400-006)

For the current characteristic that can be entered, the FW4400-006 add-on function must be activated in the device via TAN. → *Option Activation, p. 56*

Assignment of the output current to the process variable in increments of 1 mA.

The settings for current outputs I1 and I2 are made under:

Parameter Setting ▸ BASE … Module

01. Open the Current Output I1 or Current Output I2 submenu.
02. Specify Usage: On
03. Specify a Process Variable.
04. Characteristic: Table
    ✓ The Table submenu is displayed.
05. Open the Table submenu.
06. Enter the values for the process variable.

The process variable must always be assigned ascending or descending.

An OUT module is required for additional current outputs:

Parameter Setting ▸ OUT… Module

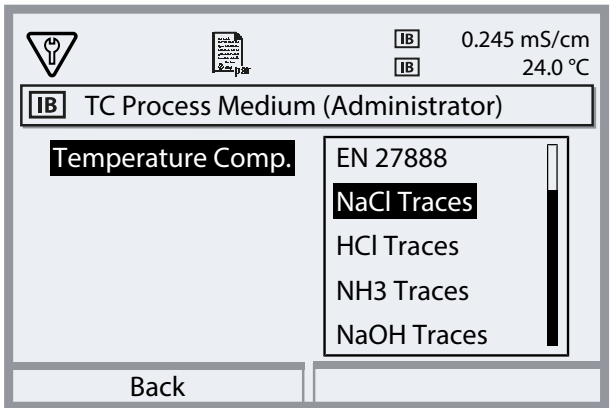
14.3 Ultrapure Water: Temperature Compensation for Conductivity (FW4400-008)

For the temperature compensation for ultrapure water with traces of impurity, the add-on function FW4400-008 must be activated in the device via TAN.

Trace Impurities in Ultrapure Water	
NaCl	Neutral ultrapure water, for conductivity measurement in water treatment downstream of mixed bed filter
HCl	Acidic ultrapure water, for conductivity measurement downstream of cation filter
NH_3	Ammoniacal ultrapure water
NaOH	Alkaline ultrapure water

The settings are made in the TC Process Medium submenu:

Parameter Setting ▸ Cond(I) … Module ▸ TC Process Medium



14.4 Concentration Determination (FW4400-009)

For concentration determination, the FW4400-009 add-on function must be activated in the device via TAN. → *Option Activation, p. 56*

The measured conductivity and temperature values are used to determine the substance concentration in percent by weight (wt%) for H_2SO_4, HNO_3, HCl, NaOH, NaCl, and oleum.

Prerequisites for Concentration Determination

On the following pages, the conductivity curve depending on substance concentration and media temperature is presented.

For reliable concentration determination, the following boundary conditions must be adhered to:

- The concentration calculation is based on the presence of a pure binary mixture (e.g., water-hydrochloric acid). If other dissolved substances like salts are present, the resulting concentration values are falsified.
- In areas of small curve gradients (e.g., at area boundaries), small changes in the conductivity value can correspond to large changes in concentration. This can potentially lead to an unsteady display of the concentration value.
- Because the concentration value is calculated from the measured conductivity and temperature values, precise temperature measurement is very important. For this reason, thermal equilibrium between the conductivity sensor and measured medium must be maintained.

The settings are made in the Concentration submenu:

Parameter Setting ▸ … Module ▸ Concentration

01. Concentration: On
02. Select the Medium:
    NaCl (0 … 28 %), HCl (0 … 18 %), NaOH (0 … 24 %), H_2SO_4 (0 … 37 %), HNO_3 (0 … 30 %), H_2SO_4 (89 … 99 %), HCl (22 … 39 %), HNO_3 (35 … 96 %), H_2SO_4 (28 … 88 %), NaOH (15 … 50 %), Oleum (12 … 45 %), Oleum (60 … 72 %), Table

You can set parameters for concentration value limits for warning and failure messages:

Parameter Setting ▸ System Control ▸ … Module ▸ Measured Value Monitoring

Specifying a Special Concentration Solution for Conductivity Measurement

For a customer-specific solution, 5 concentration values A … E can be entered in a matrix with 5 default temperature values 1 … 5. First enter the 5 temperature values, and then the associated conductivity values for each of the concentrations A … E.

These solutions are available in addition to the default standard solutions under the name "Table".

The settings are made under System Control in the Concentration Table submenu:

Parameter Setting ▸ System Control ▸ Concentration Table

01. Enter temperature 1 … 5.
02. Enter temperature-corrected values for concentration A … E.
    Note: The temperature values must be rising (Temp. 1 is the lowest, Temp. 5 the highest temperature).
    The concentration values must be rising (Conc. A is the lowest, conc. E the highest concentration).
    The table values A1 … E1, A2 … E2, etc. must all be rising within the table or all falling. Points of inflection are not allowed.
    Incorrect table entries are indicated by an exclamation point in a red triangle.

The table used is a 5×5 matrix:

	Conc. A	Conc. B	Conc. C	Conc. D	Conc. E
Temp. 1	A1	B1	C1	D1	E1
Temp. 2	A2	B2	C2	D2	E2
Temp. 3	A3	B3	C3	D3	E3
Temp. 4	A4	B4	C4	D4	E4
Temp. 5	A5	B5	C5	D5	E5

The concentration table is selected in the menu:

Parameter Setting ▸ … Module ▸ Cal Presettings

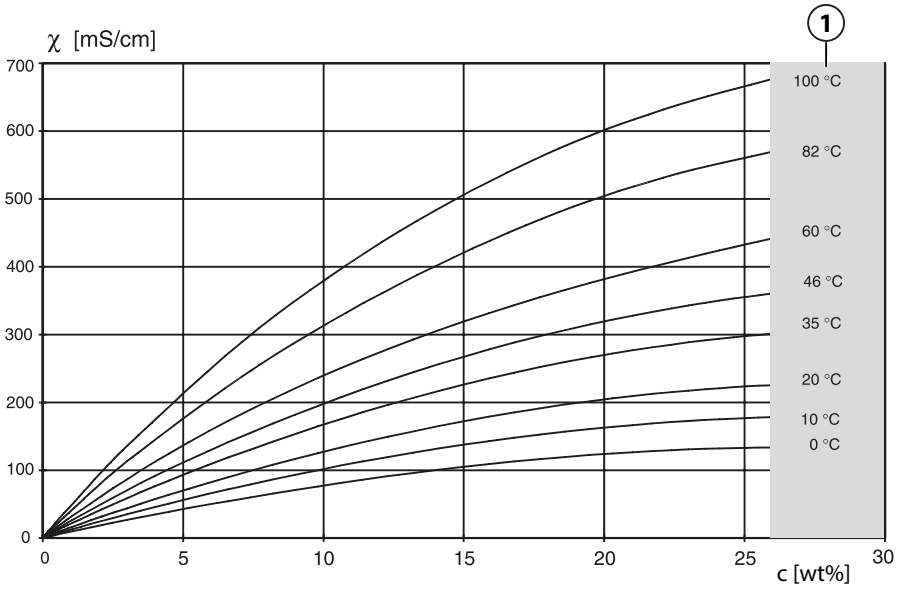
Calibration Mode : Automatic

Cal Solution : Table

Concentration Curves

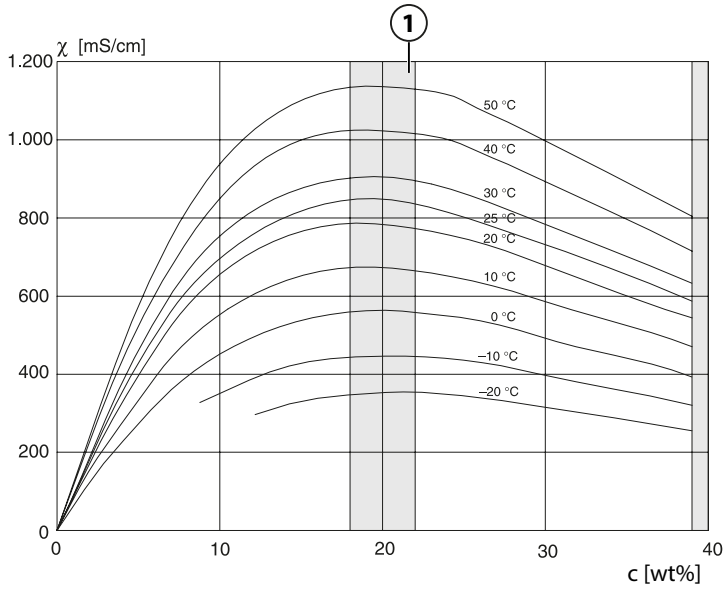
Conductivity [mS/cm] versus substance concentration [wt%] and media temperature [°C]

Sodium Chloride Solution NaCl



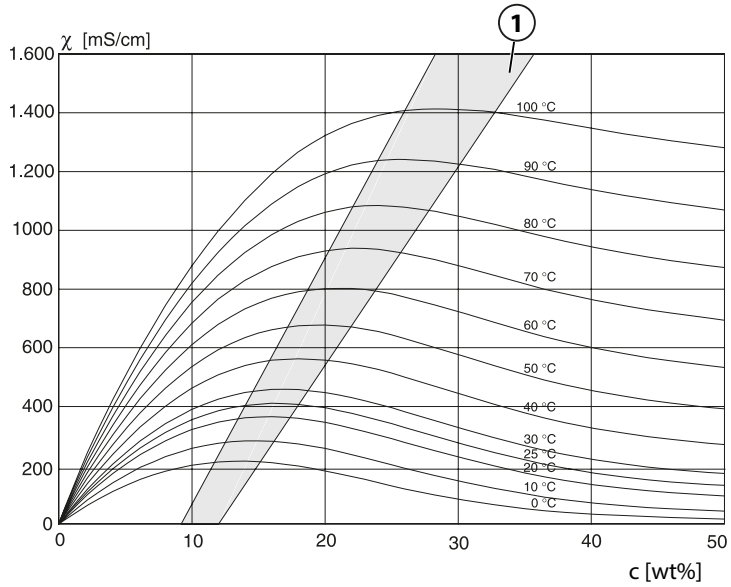
1 Range within which concentration determination is not possible.

Hydrochloric Acid HCl



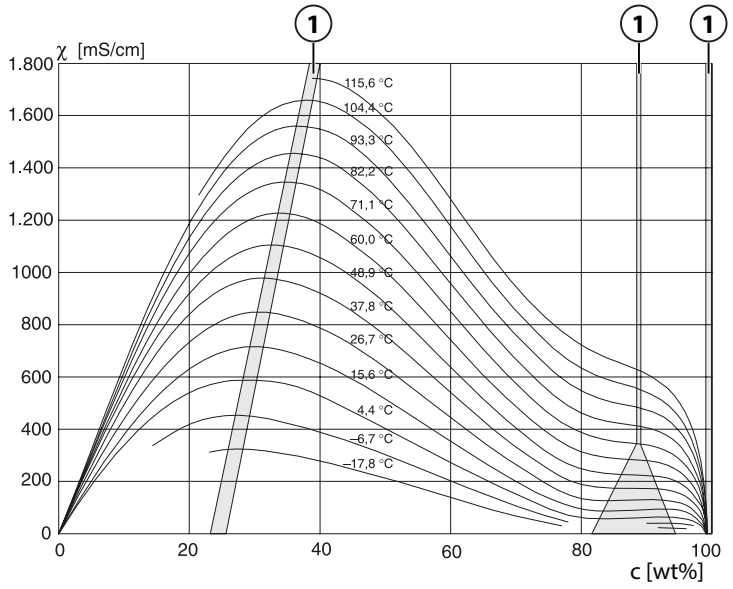
1 Range within which concentration determination is not possible.

Caustic Soda Solution NaOH



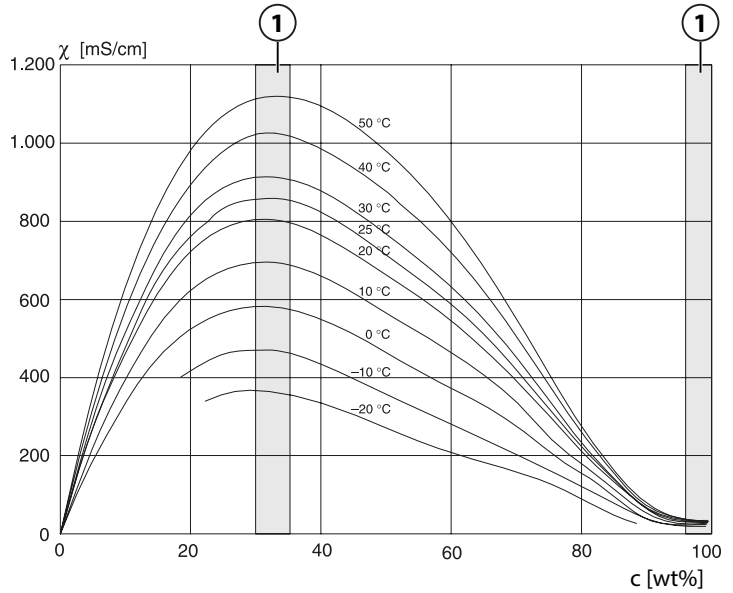
1 Range within which concentration determination is not possible.

Sulfuric Acid H_2SO_4



1 Range within which concentration determination is not possible.

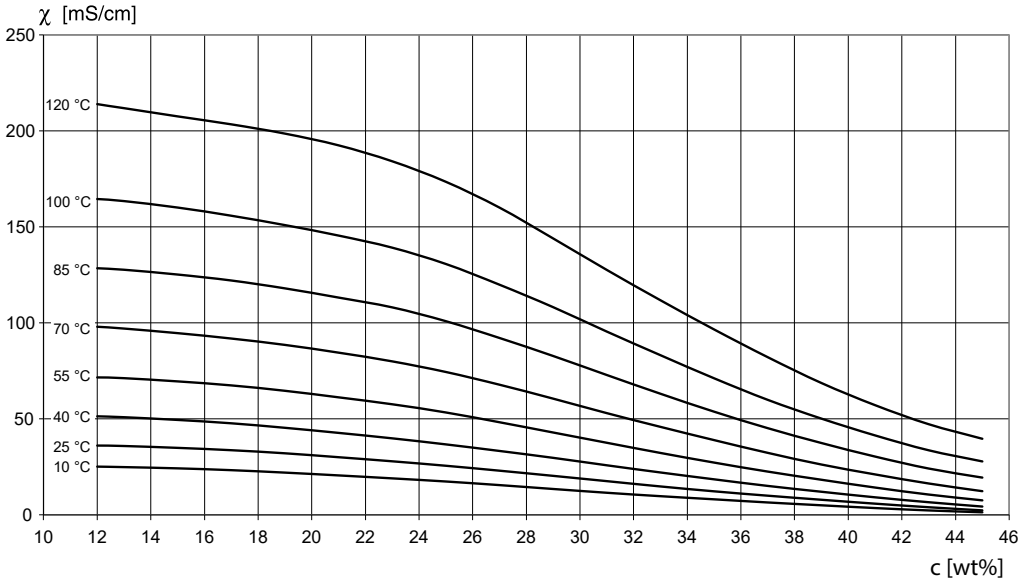
Nitric Acid HNO_3



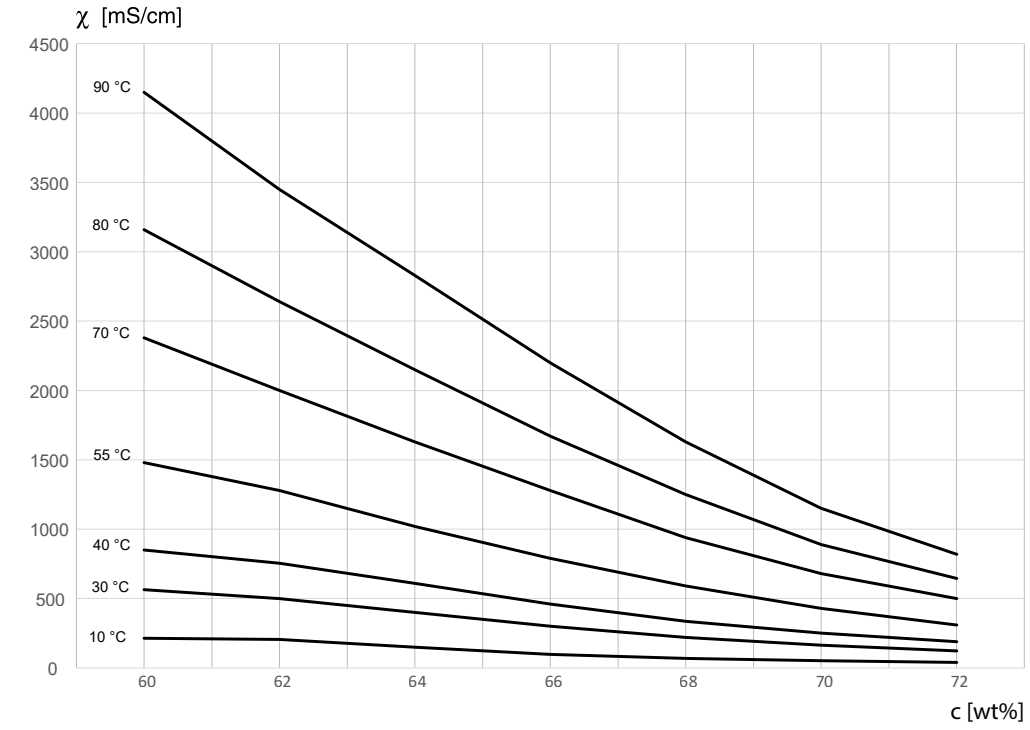
1 Range within which concentration determination is not possible.

Oleum $H_2SO_4 \cdot SO_3$

12 ... 45 %:



60 ... 72 %:



14.5 Parameter Sets 1-5 (FW4400-102)

To use parameter sets 1-5, the add-on function FW4400-102 must be activated in the device via TAN.
→ *Option Activation, p. 56*

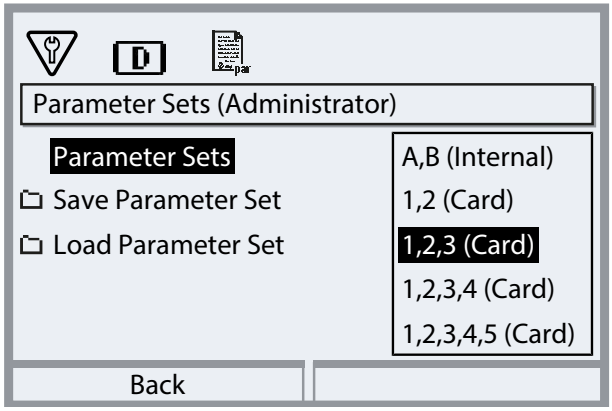
Using the Data Card → *Memory Card, p. 98*

Note: To make operation easier, the Open/Close Memory Card submenu is accessible directly from the Parameter Sets menu. The menu item is displayed as soon as Parameter Sets is selected on the Data Card.

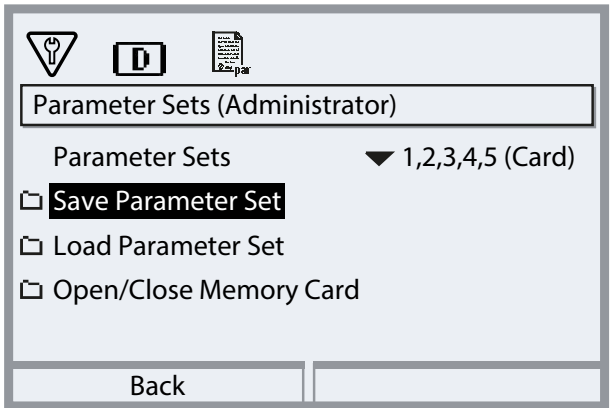
Saving a Parameter Set on the Data Card

Two parameter sets (A, B) are present in the device. Parameter Set A can be saved on a Data Card.
Up to 5 different parameter sets, e.g., from different device, can be saved on the Data Card.

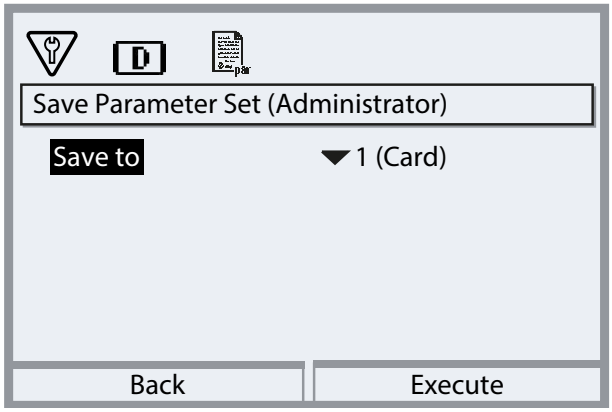
01. Parameter Setting ▸ System Control ▸ Parameter Sets
02. Select the number of parameter sets.



Note: As soon as parameter sets are selected on the Data Card, OK2 “Parameter Set Selection“ is set to “Off”.

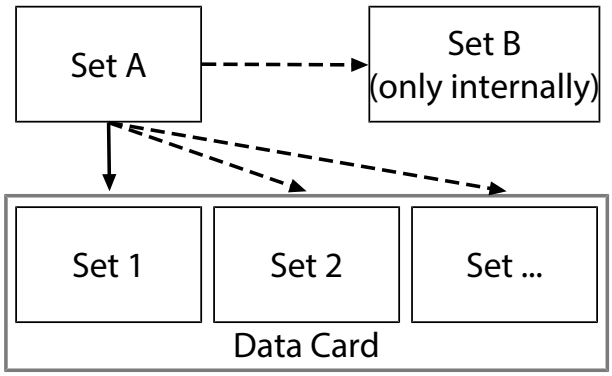


03. Save Parameter Set ▸ Save to : Select the parameter set to overwrite.



04. ***Right softkey: Execute***

✓ The parameter set is saved as a file on the Data Card.

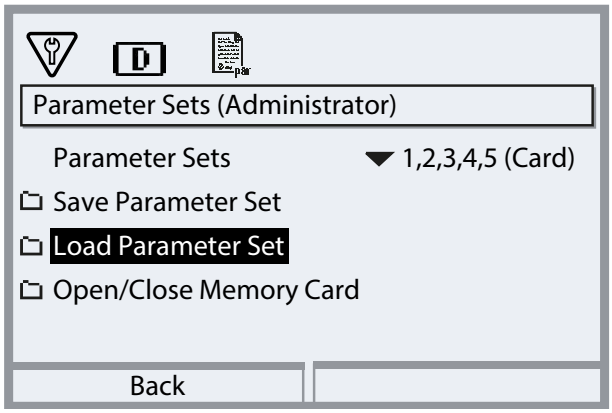


Loading a Parameter Set from the Data Card

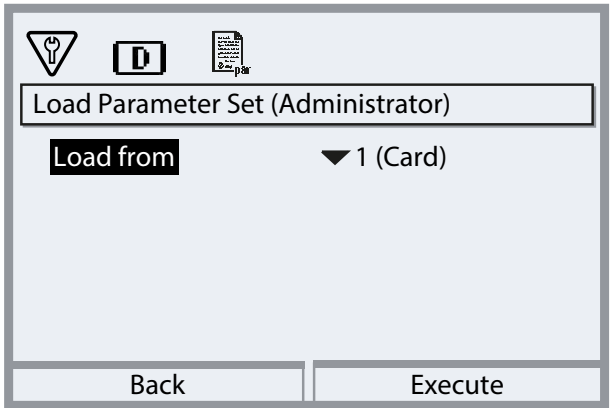
A parameter set saved on the Data Card (1, 2, 3, 4, or 5) can be loaded to the device-internal Parameter Set A.

01. Parameter Setting ▸ System Control ▸ Parameter Sets

02. Select the number of parameter sets.
Note: As soon as parameter sets are selected on the Data Card, OK2 "Parameter Set Selection" is set to "Off".

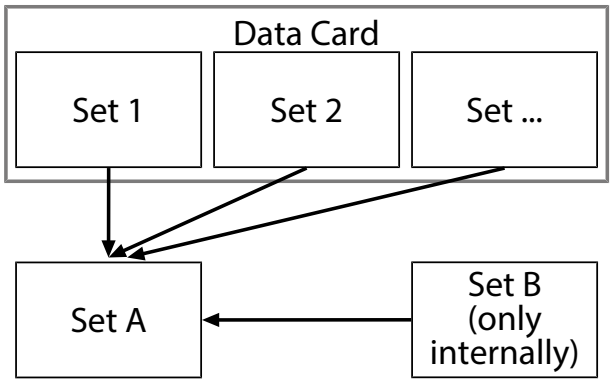


03. Load Parameter Set ▸ Load from : Select the parameter set to load.



04. ***Right softkey: Execute***

✓ The parameter set is saved as Parameter Set A in the device.



14.6 Measurement Recorder (FW4400-103)

To use the measurement recorder, the add-on function FW4400-103 must be activated in the device via TAN. → *Option Activation, p. 56*

The measurement recorder logs measured values and additional values depending on its parameter setting.

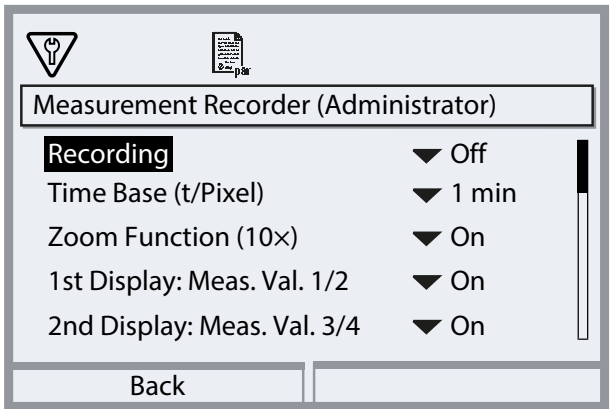
The following are adjustable:

- Process variables to be displayed
- Start and end values for the process variable to be recorded
- Time base (recording interval, selectable from 10 s to 10 h)

In addition, the time axis can be stretched by a factor of 10 with the "zoom function".

Setting the Measurement Recorder Parameters

Parameter Setting ▸ FRONT Module ▸ Measurement Recorder



Note: Recording should not be enabled until all parameters are set.

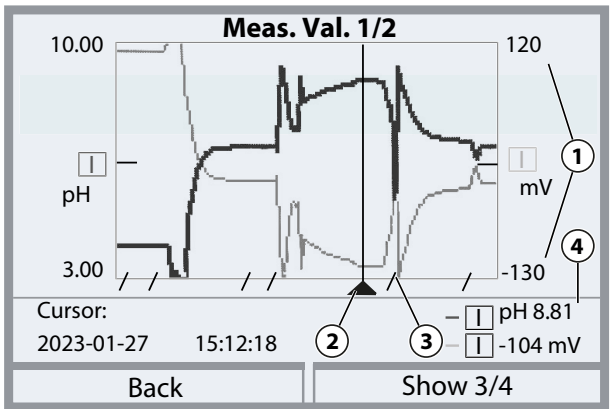
Displaying Measurement Recorder Data

Press the ***meas*** key in measuring mode.

The measurement recorder saves all the entries in a file. The last 100 entries are graphically presented on the display of the device.

Up to 4 process variable are displayed. The 4 process variable are distributed to 2 measurement recorders. Use the ***right softkey*** to toggle between the measurement recorders.

For fast changes, the zoom function is automatically switched on. It begins several pixels before the event. This makes process variable fluctuations traceable in detail.



1	Displayed range Start and end value of the process variable	3	Areas of fast process variable changes (automatic zoom function) are marked by lines.
2	Cursor (shift with arrow keys)	4	Current measured values at cursor position

Deleting Measurement Recorder Data

01. Parameter Setting ▸ FRONT Module ▸ Measurement Recorder
02. Clear measurement recorder: Select "Yes".
03. Confirm with ***right softkey: OK***.

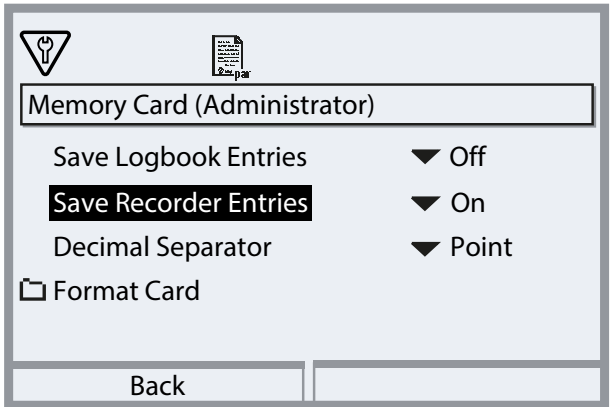
Saving on the Data Card

Note: The device-internal memory has a limited memory capacity and continuously overwrites the oldest data sets after reaching maximum memory capacity. For recordings that take a long time, a Data Card is absolutely necessary. The data saved on the Data Card can be read out and evaluated with a computer.

Using the Data Card → *Memory Card, p. 98*

Activate the Data Card to save the recorder data:

Parameter Setting ▸ System Control ▸ Memory Card



A separate file is created for each device. This means that a Data Card can also be used to collect the measurement recorder data of multiple devices.

Example of a file generated on a Data Card:
\recorder\R_[serial number].TXT

The individual columns are separated by tabs. This makes the file readable in word processing programs or spreadsheet programs like Microsoft Excel.

The entries in the recorder file have the following meaning:

TIME STAMP	Time stamp of the recorder entry
CH1/2/3/4	1st/2nd/3rd/4th recorder channel with measured value and unit of measurement
Z1/2	1st/2nd additional value and unit of measurement
MAINT	"Maintenance Request" NAMUR signal
HOLD	"Function Check/HOLD" NAMUR signal
FAIL	"Failure" NAMUR signal

14.7 Audit Trail (FW4400-081)

To use the Audit Trail function, the FW4400-081 add-on function must be activated in the device via TAN. → *Option Activation, p. 56*

The U.S. Food and Drug Administration (FDA) regulates the creation and processing of electronic documents in pharmaceutical development and production, as outlined in "Title 21 Code of Federal Regulations, 21 CFR Part 11, Electronic Records; Electronic Signatures." Requirements for transmitters that are used in these areas can be derived from this. Thanks to the FW4400-081 add-on function, Protos II 4400(X) fulfills the requirements in accordance with FDA 21 CFR Part 11.

Refer to the Supplementary Datasheet for further information → *support@knick.de*

Prerequisites

- Protos II 4400(X) basic unit from FRONT FW Version 01.04.xx
- One of the following communication modules
  - COMPA4400(X)-082: Communication unit for PROFIBUS PA
  - PN4400-095: Communication unit for PROFINET from FW Version 01.01.xx

The communication modules are selected in Protos II 4400(X):

Parameter Setting ▸ System Control ▸ Audit Trail → *Audit Trail (TAN Option FW4400-081), p. 57*

Functionality

- Access control for remote login
- Audit Trail logging
- Calibration record

Access Control for Remote Login

The user identifies themselves in the production plant system, e.g., PCS operator terminal, using company-specific access data.

Possibility of two-factor authentication:

- 1st factor: Login with user name, password, and reason for login if necessary
- 2nd factor: 4-digit access key that has to be entered at the device (optional)

Login:

- The customer's existing authentication system can be used via the PROFIBUS PA or PROFINET fieldbus interface.
- Username, access key, and access rights are maintained in the customer's database system.
- During login, the user can enter a reason for logging in (up to 160 characters) in the designated field.
- Each login generates an Audit Trail Record in the system Audit Trail.
- The customer can assign predefined access rights to individual users.

Auto Logout

A timeout value for automatic logout can be set via the fieldbus interface.

Conditions for auto logout:

- No key on the device is pressed.
- No process (e.g., calibration) is running on the device.
- The preset timeout has expired.
- The function check is not active (measured value mode, diagnostic mode, menu selection).

Note: If an action (e.g., calibration or parameter setting) has been started, auto logout will not be triggered. This prevents interrupting safety-relevant operations.

As soon as a key is pressed, the auto logout timeout is paused.

Audit Trail Logging

All events generated by the individual system components are recorded as Audit Trail Records and stored in the system Audit Trail Logbook of the customer database.

Events are recorded from the following system components:

- Protos basic unit and installed modules
- Connected sensors
- Connected Unical 9000 controller with retractable fitting

The following events are recorded:

- Login, logout, auto logout
- Changes to the device configuration
- Activation/deactivation of TAN options
- Activation/deactivation of function check
- Setting of date or time
- Activation/deactivation of Audit Trail functions, e.g., logging
- Transfer of device configurations to or from a Data Card
- Calibrations/adjustments including time, success status, calibration mode, and type of calibration (e.g., two-point calibration)
- Firmware updates (basic unit and module)
- Unical program starts and program steps
- Service states of the retractable fitting
- Sensor replacement with sensor data (digital sensors)
- Messages

Audit Trail Records

- Audit Trail Records are made available in Protos for retrieval via the fieldbus interface.
- The language of each Audit Trail Record corresponds to the language set for the Protos user interface.
- Each Audit Trail Record is provided directly as readable text.
- Each line represents a single Audit Trail Record with a unique running number and time stamp.
- Up to 512 Audit Trail Records are stored in a buffer in the Protos II 4400(X) until they are retrieved via the fieldbus.
- The storage duration of Audit Trail Records is unlimited.

Calibration Record

- After each calibration and adjustment of the sensor, a complete calibration record is made available for retrieval.
- The calibration record is transmitted directly to the customer database via the fieldbus interface.
- The calibration record includes data such as:
  - Time stamp
  - User login data
  - Calibration mode
  - Sensor name
  - Zero point
  - Slope
  - Limit values

15 Specifications

15.1 Power Supply

BASE4400-029 Module	
Power supply (terminals 18/19)	24 (– 15 %) ... 230 (+ 10 %) V AC/DC, approx. 18 VA/10 W, AC: 48 ... 62 Hz
BASE4400X-025/VPW Module	
Power supply (terminals N/L/PE)	100 (– 15 %) ... 230 (+ 10 %) V AC < 15 VA, 48 ... 62 Hz
BASE4400X-026/24V Module	
Power supply (terminals L1/L2/PE)	AC 24 V (- 15 %, + 10 %) < 15 VA, 48 ... 62 Hz DC 24 V (- 15 %, + 20 %) < 10 W
Overvoltage category	II
Protection class	I

15.2 Connections

Input OK 1	
Description	Optocoupler input Ui ≤ 30 V, floating, galvanically isolated up to 60 V
Connection	Non-Ex: Terminals 11/13 Ex: Terminals 30/31
Function	Activation of the function check mode (HOLD)
Switching voltage	0 ... 2 V AC/DC inactive 10 ... 30 V AC/DC active (invertible) Control current 5 mA
Input OK 2	
Description	Optocoupler input Ui ≤ 30 V, floating, galvanically isolated up to 60 V
Connection	Non-Ex: Terminals 12/13 Ex: Terminals 30/33
Function	Switch to second parameter set
Switching voltage	0 ... 2 V AC/DC inactive 10 ... 30 V AC/DC active (invertible) Control current 5 mA
Current Output I1	
Description	0/4 ... 20 mA (22 mA), max. 10 V, galvanically isolated up to 60 V (galvanically connected to output I2)
Connection	Non-Ex: Terminals 7/8 Ex: Terminals 51/52
Load monitoring	Error message while load limit is exceeded
Failure message	3.6 mA (at 4 ... 20 mA) or 22 mA, adjustable
Measurement error[1)]	< 0.2% of current value + 0.02 mA
Current source	0.00 ... 22.00 mA

[1)] At rated operating conditions

Current Output I2		
Description	0/4 ... 20 mA (22 mA), max. 10 V, galvanically isolated up to 60 V (galvanically connected to output I1)	
Connection	Non-Ex: Terminals 9/10 Ex: Terminals 53/54	
Load monitoring	Error message while load limit is exceeded	
Failure message	3.6 mA (at 4 ... 20 mA) or 22 mA, adjustable	
Measurement error[1)]	< 0.2% of current value + 0.02 mA	
Current source	0.00 ... 22.00 mA	
Relay Contacts		
Description	4 relay contacts K1 ... K4, floating, galvanically isolated up to 60 V K1, K2, K3 connected on one side	
Connection	Non-Ex: Terminals 1/2/3/4/5/6 Ex: Terminals 61/63/65/60/71/72	
Contact rating for ohmic load	Non-Ex:	AC: < 30 V/< 3 A, < 90 VA DC: < 30 V/< 3 A, < 90 W
	Ex:	DC: < 30 V/< 500 mA, < 10 W

15.3 Device

Product name	Non-Ex: Protos II 4400 Ex: Protos II 4400X
Explosion protection (Protos II 4400X)	See the appendix to the certificates or Control Drawings for the entity parameters
Module slots	3
Display	
Type	Graphic LC display, white backlighting
Resolution	240 x 160 pixels
Language	German, English, French, Italian, Spanish, Portuguese, Chinese, Korean, Swedish
Keypad	NAMUR keypad, single keys, no dual assignment [meas] [menu] [cursor keys] [enter] [softkey 1] [softkey 2], NAMUR LED: red and green.
Enclosure	
Material	Protos II 4400(X) C: steel, coated Protos II 4400(X) S: polished stainless steel, 1.4305
Dimensions	→ *Dimension Drawing, p. 121*
Protection rating	IP65/NEMA 4X
Weight	Non-Ex: approx. 3.2 kg (7.05 lb) plus approx. 160 g (0.35 lb) per module Ex: approx. 3.9 kg (8.6 lb) plus approx. 160 g (0.35 lb) per module
Mounting	Wall, pipe, control panel mounting
Tightening torque	Connection thread: 2.3 Nm Cap nut: 1.5 Nm

1) At rated operating conditions

Cable glands	5 cable glands M20 x 1.5, A/F 24 Non-Ex: WISKA type ESKV M20 Ex: WISKA type ESKE/1 M20
Terminal clamping ranges	Standard sealing insert, non-Ex: 6 ... 13 mm Standard sealing insert, Ex: 7 ... 13 mm Reduction sealing insert: 4 ... 8 mm Multiple sealing insert, non-Ex: 5 ... 6.5 mm Multiple sealing insert, Ex: 5.85 ... 6.5 mm
Tensile strain	Not permitted, only suitable for a "fixed installation"
Equipotential bonding clamp	Cross-section > 4 mm^2
Tightening torque	1 Nm
Internal terminals	
Screw terminals	For single wires and stranded wires 0.2 ... 2.5 mm^2
Tightening torque	0.5 ... 0.6 Nm
Wiring	
Stripping length	Max. 7 mm
Ferrules	0.25 ... 2.5 mm^2
Temperature resistance	> 75 °C (167 °F)
Real-time clock	Different time and date formats selectable, power reserve approx. 1 day
Data retention in the event of power failure	
Parameters and adjustment data	> 10 years (EEPROM)
Logbook, statistics, records, optional: Measurement recorder, memory card	> 10 years (Flash)
Parameter sets	Parameter sets A and B Toggle manually or via digital control input OK1

15.4 Ambient Conditions

(with installed module)

Climatic class	3K5 in accordance with EN 60721-3-3
Location class	C1 in accordance with EN 60654-1
Ambient temperature, operation	Non-Ex: –20 ... 55 °C (–4 ... 131 °F) Ex: –20 ... 50 °C (–4 ... 122 °F)
Ambient temperature, transport/storage	-20 ... 70 °C (-4 ... 158 °F)
Relative humidity	5 ... 95%
Pollution degree	2

15.5 Compliance

(with installed module)

EMC	EN 61326-1, EN 61326-2-3, NAMUR NE 21
Emitted interference	Industrial applications[1] (EN 55011, Group 1, Class A)
Immunity to interference	Industrial applications
Lightning protection	EN 61000-4-5, installation class 2
RoHS compliance	EU Directive 2011/65/EU
Electrical safety	Protective conductor terminal in accordance with EN 61010-1, protection against electric shock Non-Ex: Terminal 17 Ex: Terminal PE

15.6 Diagnostics and Statistics

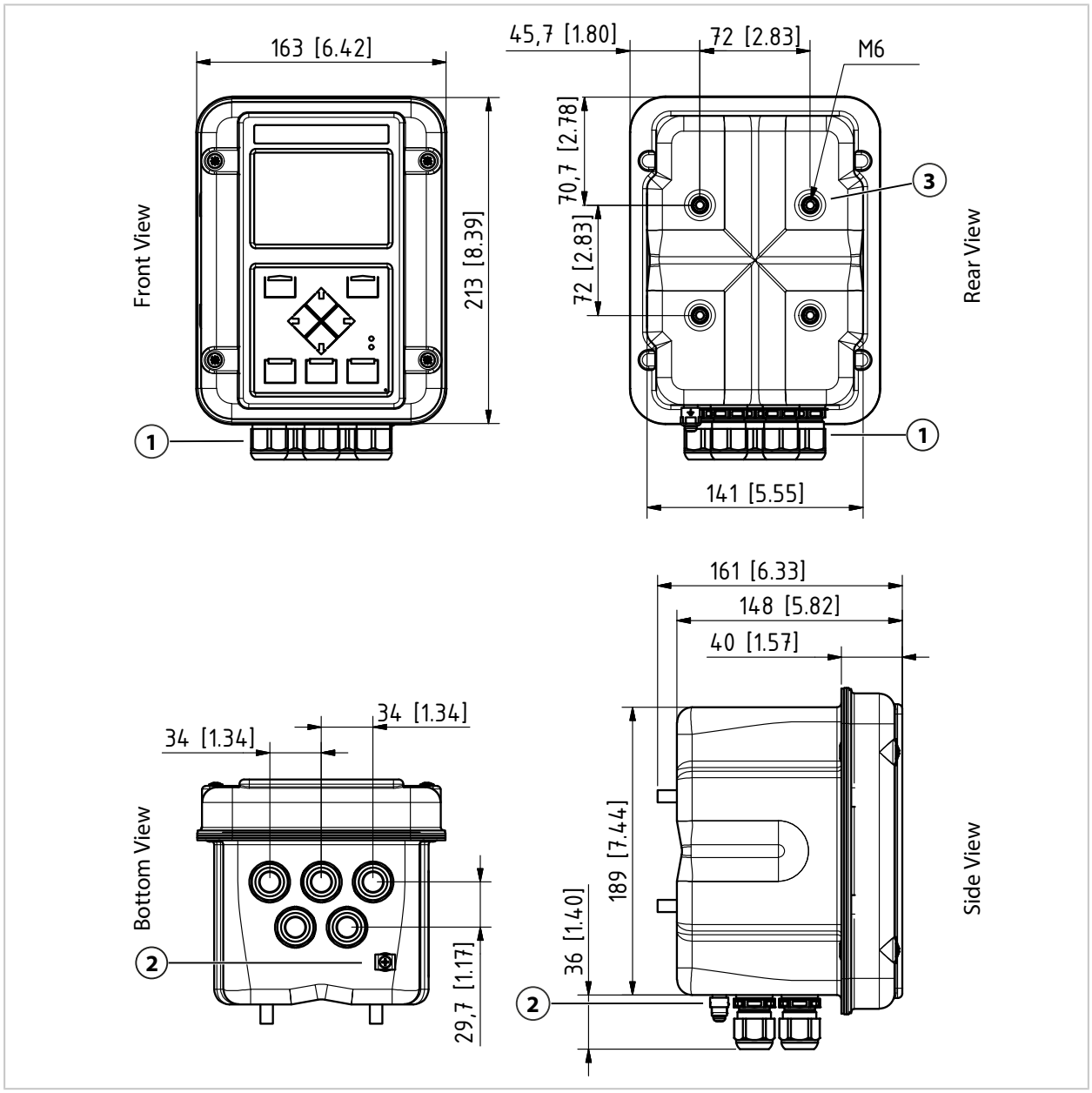
Device self-test	RAM, FLASH, EEPROM, display, and keypad test
Logbook	Recording of functions opened, warning messages and failure messages upon occurrence and elimination with date and time, 100 entries with date and time in device memory, up to 400,000 entries in conjunction with Data Card
Measurement recorder (TAN option FW4400-103)	4-channel measured value recorder with events marking (failure, maintenance request, function check, limit values)
Storage capacity	100 entries in device memory, up to 200,000 entries in conjunction with Data Card
Recording	Process variables and span freely selectable
Type of recording	Current value
Time base	10 s ... 10 h

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

16 Appendix

16.1 Dimension Drawing

Note: All dimensions are listed in millimeters [inches].



1 Cable glands M20 x 1.5 (A/F 24)	3 Holes for wall mounting, female thread M6
2 Equipotential bonding clamp	

16.2 Symbols and Markings on the Display

	Function check in accordance with NAMUR NE 107 *Wrench symbol in upside-down triangle* The NAMUR "HOLD" contact is active. Current outputs as configured: Currently measured value: The currently measured value appears at the current output. Last measured value: The last measured value is held at the current output. Fixed value: The current output supplies a fixed value.
	Out of specification in accordance with NAMUR NE 107 *Black question mark in triangle* The NAMUR "Out of Specification" contact is active. Error message: Diagnostics ▸ Message List
	Failure in accordance with NAMUR NE 107 *Blinking black cross icon in circle* The NAMUR "Failure" contact is active. Error message: Diagnostics ▸ Message List
	Maintenance request in accordance with NAMUR NE 107 *Oil can icon in square* The NAMUR "Maintenance Request" contact is active. Error message: Diagnostics ▸ Message List
	The device is in calibration mode. Function check (HOLD) is active for the calibrated module.
	The device is in maintenance mode. Function check (HOLD) is active.
	The device is in parameter mode. Function check (HOLD) is active.
	The device is in diagnostics mode.
	The device is in measuring mode.
	Indicates the active parameter set. (The device provides two parameter sets A and B. Up to 5 sets can be added using add-on functions and memory card)
	When in measuring mode, Sensoface smileys indicate the quality of the sensor data: Happy
	Neutral
	Sad
	A "closed" Data Card (memory card) is located in the device. The memory card can be removed. If you want to continue using the card, select "Open Memory Card" in the Maintenance menu.
	There is an enabled Data Card (memory card) in the device. **Note:** Select "Close Memory Card" in the Maintenance menu before removing the memory card.
	There is an FW Update Card (memory card) in the device. You can save the current device firmware or perform a firmware update from the memory card.

	There is an FW Repair Card (memory card) in the device. General data cannot be stored on this memory card.
	Designates the module port (1, 2, or 3) with indication of the channel number for multi-channel modules, allowing the clear assignment of measured value/parameter displays in the case of identical module types.
	
	To the left of a menu line that contains a further menu level. Pressing ***enter*** opens the submenu.
	To the left of a menu line that, at administrator level, can be blocked from access at operator level.
	To the left of a menu line that, at administrator level, was blocked from access at operator level.
	To the left of a Diagnostics menu item set as a “Favorite”.
	Delta function is active (output value = measured value - delta value)
	Hourglass indicates that a waiting time is running.
	Limit indication: Lower/upper range limit exceeded.
	
	Calibration: Step 1 of product calibration has been executed. The device is waiting for the sample values.
TC	Calibration: The temperature compensation for the measured medium is active
	Sensocheck
	COMFF module: Control via FOUNDATION Fieldbus
	COMPA module: Control via PROFIBUS-PA
	PN module: PROFINET control
	Context menu: Open with ***right softkey***.
	MSU module: Metering pump for port I, II, or III
	MSU module: Valve for rinse medium

	MSU module: Valve for additional medium Aux 1 or Aux 2
	Retractable fitting is in process position (probe in PROCESS).
	Retractable fitting is in service position (probe in SERVICE).
	Probe moving.
	Service mode is active. (Example: Probe in SERVICE))
	No Unical connected or no connection to Unical.
	Display in status line: Unical is Active.

17 Abbreviations

A/F	Width across flats
ATEX	Atmosphères Explosibles (explosive atmospheres)
CE	Conformité Européenne (European conformity)
EEPROM	Electrically Erasable Programmable Read-only Memory
EMC	Electromagnetic compatibility
EN	European standard
ESD	Electrostatic discharge
Ex	Explosion protected
FM	Factory mutual
FW	Firmware
IEC	International Electrotechnical Commission
IECEx	IEC System for Certification to Standards relating to equipment for use in Explosive Atmospheres
IP	International Protection/Ingress Protection
KEMA	Keuring van Elektrotechnische Materialen te Arnhem (certification body for electrotechnical equipment)
NAMUR	User Association of Automation Technology in Process Industries
NE 107	NAMUR recommendation 107: "Monitoring and Diagnosis of Field Devices"
PELV	Protective extra low voltage
PID	Proportional-integral-differential
RAM	Random-access memory
SELV	Safety extra low voltage
TAN	Transaction number

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Translation of the original instructions

Version 3 • This document was published on November 10, 2025.
The latest documents are available for download on our
website under the corresponding product description.

TA-201.515-KNEN03

104819