Knick

User Manual

Protos II 4400(X)
Process Analysis System

Basic Unit: FRONT and BASE Modules
Modular measuring system for liquid analysis and equipment with up to 3 modules

Read before installation.
Keep for future use.

www.knick.de

Returns

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

Disposal

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

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Package Contents

- Protos II 4400(X) basic device (FRONT and BASE modules)
- Wall-mount kit (2x wall-mount bracket, 4x hex bolt M6x10)
- Bag containing small accessory parts (2x reduction sealing insert, 2x blanking plug, 1x multiple sealing insert)
- Test Report acc. to EN 10204
- Installation Guide
- Safety Guide

For Ex version Protos II 4400X:

- Attachment to certificates (KEMA 03ATEX2530, IECEx DEK 11.0054)
- EU Declaration of Conformity
- Control Drawing
- JPEx Certificates DEK23.0087 and DEK23.0088

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

Measuring and communication modules are not included in the basic device's package contents.

Safety

The following safety instructions contain the necessary information for the safe use of the product. For any questions relating to safety, please contact Knick Elektronische Messgeräte GmbH & Co. KG using the contact details provided.

Intended Use

The Protos II 4400(X) is a process analysis system for recording and processing electrochemical quantities in liquids and gases.
The Protos II 4400(X) has a modular design and consists of the following components:

- BASE module
- FRONT module
- Measuring and communication modules

The defined rated operating conditions must be observed when using this product. These conditions are set out in full in the Specifications chapter of this user manual as well as in parts in the installation guide for the Protos II 4400(X).

Using the product improperly or for any purpose other than the product's intended purpose is not permitted and may result in injury to persons or damage to objects or the environment.

Applications

The Protos II 4400(X) has been developed for use in industrial applications.
The Protos II 4400(X) is available in a polished or coated stainless steel housing suitable for a wide variety of applications.
Up to three measuring and communication modules can be installed in the slots provided.
The process variables are determined by the measuring modules used.

Symbols and Markings

	Special conditions and danger points! Observe the safety instructions and information on the safe use of the product as outlined in the product documentation.
	Refer to the product documentation.
	European Union ATEX marking for operation in explosive atmospheres (only applicable to Protos II 4400X).
IECEx	International IECEx marking for operation in explosive atmospheres (only applicable to Protos II 4400X).
	CE marking with identification number of the notified body involved in the production control. Manufacturer's declaration that the product is in conformity with the applicable requirements set out in the European Union harmonization legislation providing for its affixing.
	IP65 protection code: The product is dust-tight and offers complete protection against contact as well as protection against water projected (by a nozzle) from any direction.

Personnel Requirements

Installation, commissioning, operation, maintenance, and shutdown of the product shall only be performed by personnel authorized by the operator and specially trained in handling and operating the product.

The operator must ensure that personnel are sufficiently qualified for the area in which the product is being used, in accordance with the applicable national regulations.

Safety

Residual Risks
Protos II 4400(X) has been developed and manufactured in accordance with generally accepted safety rules and regulations. However, it is not possible to rule out all risks.

Environmental Factors
The effects of moisture, ambient temperature, chemicals, and corrosion can negatively impact the safe operation of the product.
An ambient temperature below 0 °C or strong, direct sunlight may limit the readability of the LCD. This does not affect the measuring functions of the Protos II 4400 (X).
Knick Elektronische Messgeräte GmbH & Co. KG recommends installing the Protos II 4400(X) in a weather-proofed area of the plant or that a cover is used for protection against the weather.

Safety Training
Knick Elektronische Messgeräte GmbH & Co. KG will provide safety and product training during initial commissioning of the product. More information is available from the relevant Knick representatives.

Operation in Explosive Atmospheres
Protos II 4400X is certified for operation in explosive atmospheres.
- EU-Type Examination Certificate KEMA 03ATEX2530
- IECEx Certificate of Conformity IECEx DEK 11.0054
- JPEx Certificates DEK23.0087 and DEK23.0088

When installing the product in a hazardous location, observe the information in the attachment to the certificates.
Observe all applicable local and national codes and standards for the installation of electrical equipment in explosive atmospheres. For further guidance, consult the following:
- IEC 60079-14
- EU directives 2014/34/EU and 1999/92/EC (ATEX)
- User's Guide to Explosion-Proof Equipment in Factories JNIOSH-TR-NO.44 (2012)

The device 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.

The interconnection of Ex and non-Ex modules (mixed assembly) is not permitted.

The FRONT modules of the Protos II 4400X may be opened briefly during operation in order to change the memory cards.

The power terminal cover may only be removed when the Protos II 4400X is not connected to the power supply. For more information, see "Electrical Installation", page 24.

Protos II 4400X Markings
Information on the Protos II 4400X markings can be found in the attachment for the certificates.

Electrostatic Discharge
Some materials used in the product are electrostatic insulators and may be electrostatically charged. To prevent electrostatic discharge, please observe the following instructions:

- Clean non-metallic components with a damp cloth only, and allow them to dry.
- Connect the equipotential bonding clamp of the BASE module to the equipotential bonding of the system. Further information can be found in the product installation guide.

Certificates
The current versions of the applicable certificates are available at www.knick.de.

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.
Information on installation is provided in the installation guide for the Protos II 4400(X). The following general safety instructions must be observed when installing the product.

Electrical Power Sources
An appropriately arranged and easily accessible disconnecting device for the product 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 a way that enables the associated product to be identified.

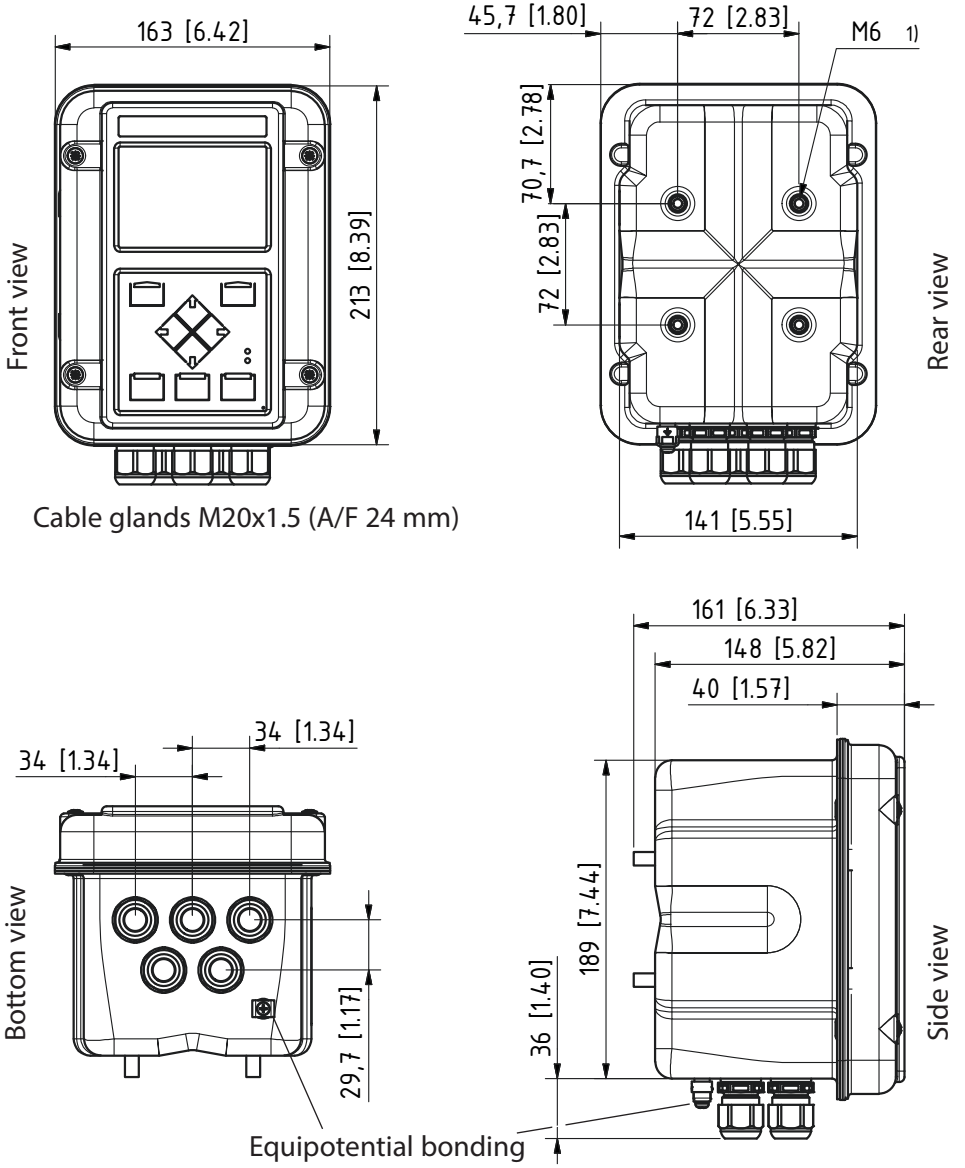
Parameter Setting, Calibration, and Adjustment
Incorrect parameter setting, calibration or adjustment may result in incorrect measurements being recorded. The Protos II 4400(X) must therefore be commissioned by a system specialist, all its parameters must be set, and it must be fully adjusted.

Measurement
Measurement operations must not be carried out while the Protos II 4400(X) is in the function check (HOLD) mode, as this may put the user at risk due to unexpected system behavior.
Function check (HOLD) is active:
- during calibration (the selected channel only)
- during maintenance (current source, measuring point maintenance)
- during parameter setting at the Operator level or the Administrator level
- during an automatic rinse cycle in conjunction with a Unical 9000 (X) or Uniclean 900(X) controller.

Maintenance
The Protos II 4400(X) modules cannot be repaired by the user.
For inquiries regarding repairs, please contact Knick Elektronische Messgeräte GmbH & Co. KG at www.knick.de.

Assembly

Dimension Drawings

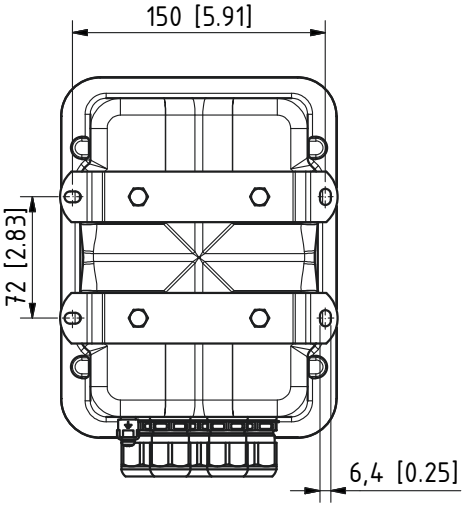


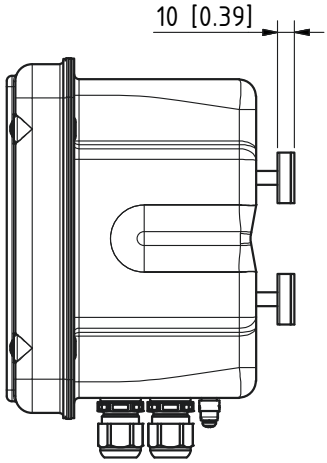
1) Female thread

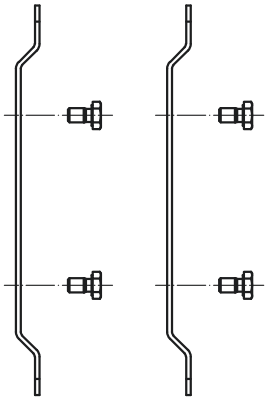
All dimensions in mm [inches]

Assembly

Wall Mounting







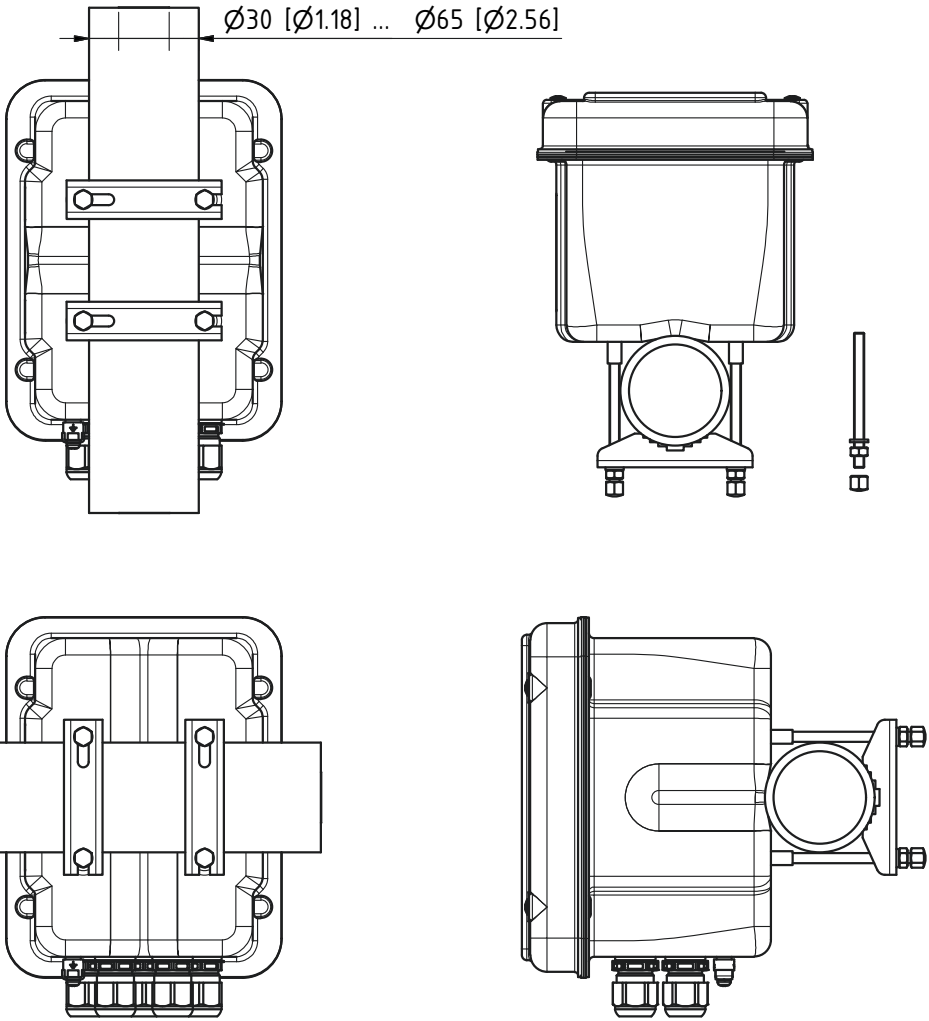
2x wall mounting brackets (stainless steel A4)
4x hex bolt M6x10
(A/F 10 mm, stainless steel A4)

(included in the package)

All dimensions in mm [inches]

Assembly

Pipe Mounting



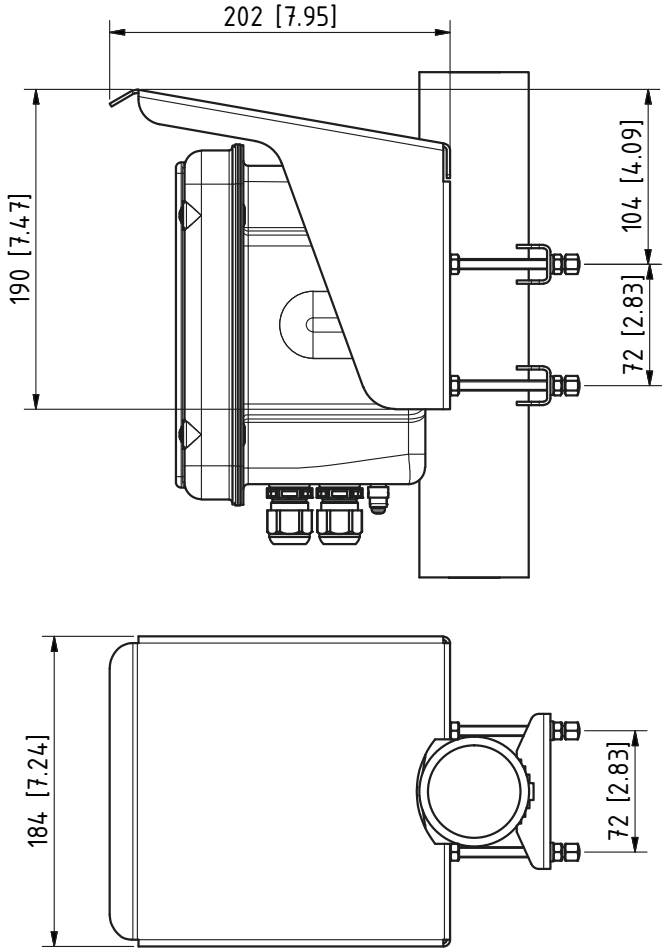
Pipe-mount kit ZU0544:
2x pipe clamp (stainless steel A4)
4x threaded bolt M6 (stainless steel A4)
4x washer, nut, cap nut (stainless steel A4)

All dimensions in mm [inches]

Assembly

Protective Hood ZU0548

1x protective hood (stainless steel A2)
4x nut M6 (stainless steel A4)



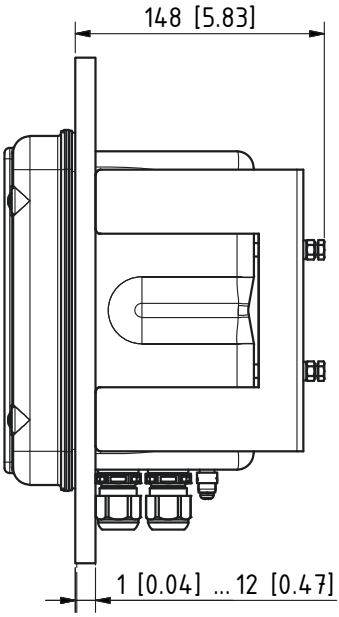
Note

The protective hood can only be used with pipe mounting. The package should contain 4 M6 nuts for fastening the protective hood on the threaded bolt of the pipe-mount kit.

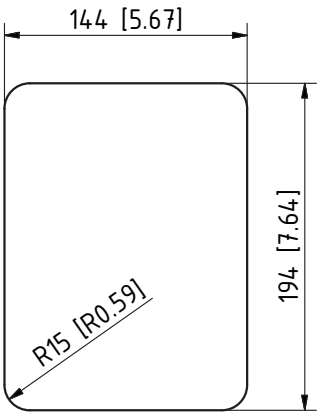
All dimensions in mm [inches]

Assembly

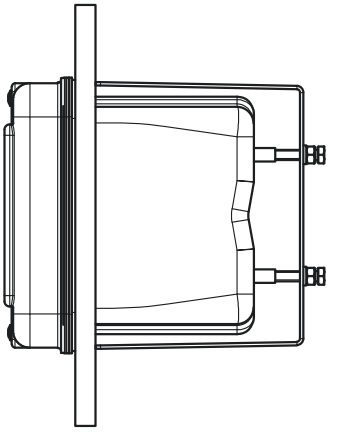
Panel-Mount Kit ZU0545



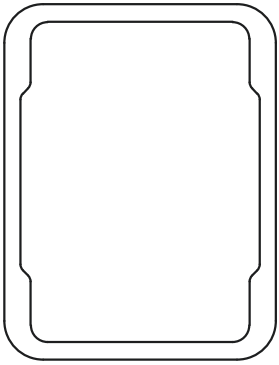
Panel mounting



Control panel cutout



Panel sealing

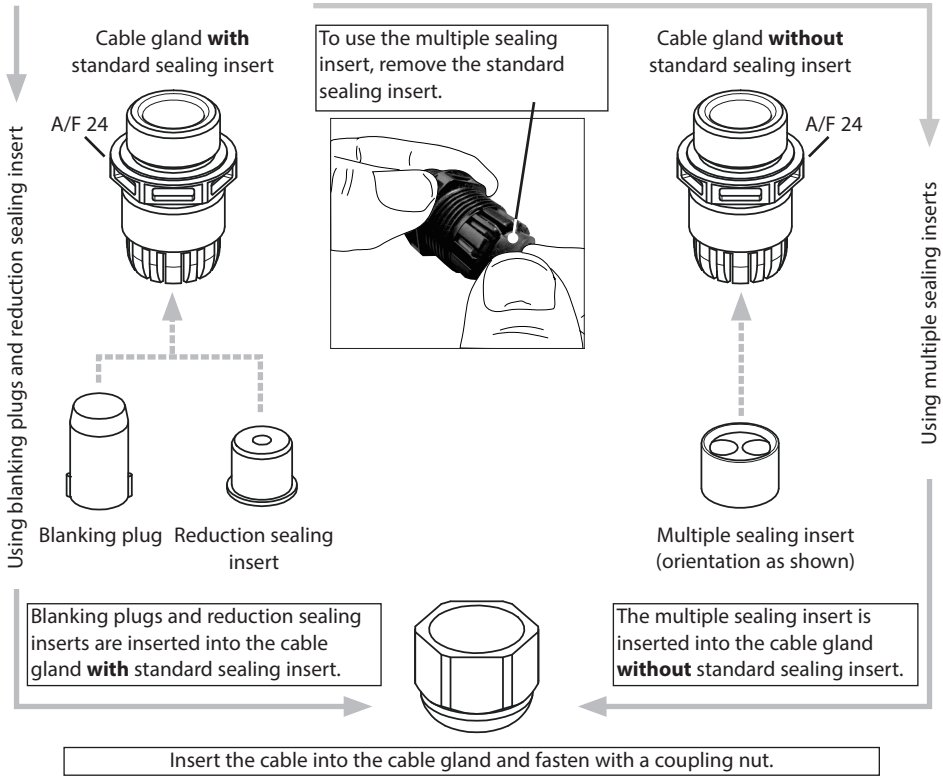


All dimensions in mm [inches]

Assembly

Blanking Plugs, Reduction Sealing Inserts, Multiple Sealing Inserts

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



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

Cable Glands in Hazardous Locations
In a hazardous location, only cable glands with suitable approvals may be used. The installation instructions of the manufacturer must be observed. The cable glands are only suitable for "fixed installation" (see Specifications chapter).

Electrical Installation

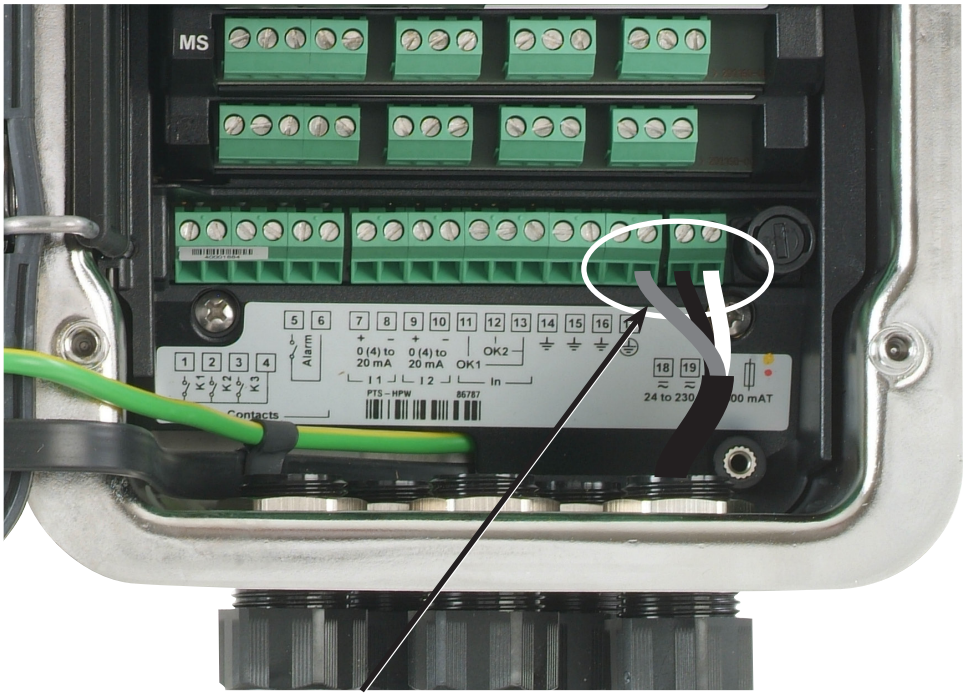
⚠ **WARNING!** Shock potential.
An appropriately arranged and easily accessible disconnecting device for the product must be present in the system installation. The disconnecting device must disconnect all non-grounded, current-carrying wires. The disconnecting device must be labeled in a way that enables the associated product to be identified.

Installation of the device shall only be performed by qualified personnel authorized by the operating company and specially trained in handling and operating the product in accordance with this user manual and as per applicable local and national codes.

Before commencing with the installation, make sure that all lines to be connected are de-energized.

NOTICE! Strip the insulation from the wires using a suitable tool to prevent damage.

1) Connect the current outputs
   (or deactivate later during parameter setting).
2) Connect relay contacts and inputs as required.
3) For Ex version: Remove power terminal cover.
4) Connect the protective ground connection ⏚ of the BASE module to the equipotential bonding of the system.
5) For Ex version: Connect the equipotential bonding clamp on the BASE Module (underside of the housing) to the equipotential bonding of the system.
6) For Ex version: Replace power terminal cover.
7) Insert module (see module installation guide).
8) Connect sensor (see module installation guide).
9) Check whether all connections are correctly wired.
10) Close the device and tighten the screws on the front.
11) Before switching on the power supply, make sure its voltage is within the specified range (for values see following pages).
12) Switch on the power supply.



Connecting the Power Supply (Example: BASE 4400-029 Module)

The Protos II 4400(X) comes in three different versions.
The terminal plates and wirings are shown on the following pages.

1. **BASE 4400-029 Module (Standard Version)**
   VariPower broad-range power supply, 24 (- 15 %) ... 230 (+ 10 %) V AC/DC
2. **BASE 4400X-025/VPW Module (Ex Version)**
   VariPower broad-range power supply unit, 100 ... 230 V AC (- 15 %, + 10 %)
3. **BASE 4400X-026/24V Module (Ex Version)**
   Power supply 24 V AC (- 15 %, + 10 %) or 24 V DC (- 15 %, + 20 %)

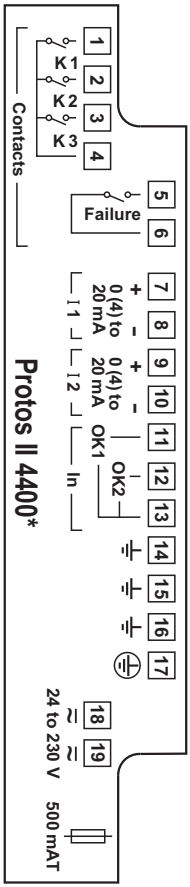
Electrical Installation

BASE 4400-029 Module
Standard version. Not suitable for hazardous-area applications!

Power Supply

With the VariPower broad-range power supply unit, the device can be operated with a power supply of 24 (- 15 %) to 230 (+ 10 %) V AC/DC, making it suitable for all public power grids in the world.
The terminals are suitable for single wires and flexible leads up to 2.5 mm^2 (AWG 14).

BASE 4400-029 Module Terminal Plate/Wiring



1		K1	Relay contacts, freely assignable
2		K2	
3		K3	
4		K1, K2, K3	
5		Failure	Relay contact
6			
7	+	I1	Current output 1 0(4) ... 20 mA
8	–		
9	+	I2	Current output 2 0(4) ... 20 mA
10	–		
11		OK1	Optocoupler input
12		OK2	
13		OK1, OK2	
14		⏚	Ground
15		⏚	
16		⏚	
17*		⏚	Protective ground
18		≈	Voltage supply 24 ... 230 V AC / DC
19		≈	
			500mAT fuse

*) Terminal 17 must be connected.

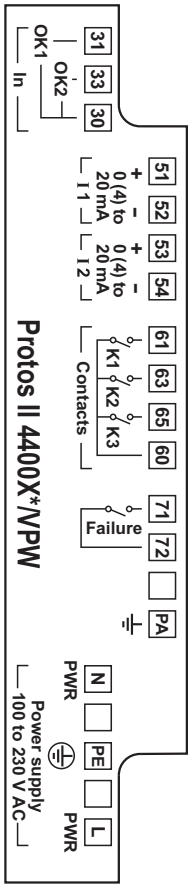
Electrical Installation

BASE 4400X-025/VPW Module
Ex-version with VariPower power supply

⚠ WARNING!
Read installation instructions for Ex devices, see p. 9

Power Supply
With the VariPower broad-range power supply unit, the device can be operated with a power supply of 100 to 230 V AC (- 15 %, + 10 %).
The terminals are suitable for single wires and flexible leads up to 2.5 mm² (AWG 14).

BASE 4400X-025/VPW Module Terminal Plate/Wiring



31	OK1	Optocoupler input
33	OK2	
30	OK1, OK2	
51+	I1	Current output 1 0(4) ... 20 mA
52 –		
53+	I2	Current output 2 0(4) ... 20 mA
54 –		
61	K1	Relay contacts, freely assignable
63	K2	
65	K3	
60	K1, K2, K3	
71	Failure	Relay contact
72		
PA	⏚	Ground (equipotential bonding)
N	PWR	Voltage supply 100 ... 230 V AC
PE*	⏚	Protective ground
L	PWR	Voltage supply 100 ... 230 V AC

*) Terminal PE must be connected.

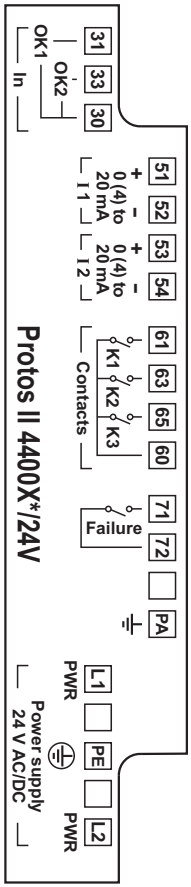
Electrical Installation

BASE 4400X-026/24V Module
Ex version with 24 V power supply unit

⚠ WARNING!
Read installation instructions for Ex devices, see p. 9

Power Supply
With the power supply unit, the device can be operated with a power supply of 24 V AC (- 15 %, + 10 %) or 24 V DC (- 15 %, + 20 %).
The terminals are suitable for single wires and flexible leads up to 2.5 mm² (AWG 14).

BASE 4400X-026/24V Module Terminal Plate/Wiring



31	OK1	Optocoupler input
33	OK2	
30	OK1, OK2	
51+	I1	Current output 1 0(4) ... 20 mA
52 –		
53+	I2	Current output 2 0(4) ... 20 mA
54 –		
61	K1	Relay contacts, freely assignable
63	K2	
65	K3	
60	K1, K2, K3	
71	Failure	Relay contact
72		
PA	⏚	Ground (equipotential bonding)
L1	PWR	Voltage supply 24 V AC / DC
PE*	⏚	Protective ground
L2	PWR	Voltage supply 24 V AC / DC

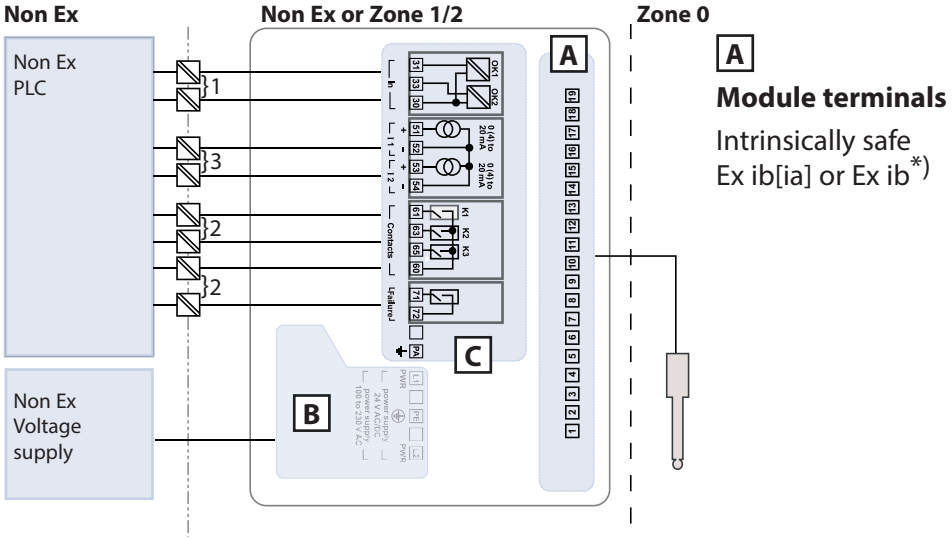
*) Terminal PE must be connected.

Electrical Installation

Protos II 4400X Wiring

With Power Terminal Cover (Package Contents)

The power terminal cover included in the package contents covers only the power terminals B . All other connections must be connected in an intrinsically safe way (see table: Electronic accessories for intrinsically safe connection).



A

Module terminals

Intrinsically safe
Ex ib[ia] or Ex ib*)

B

Power terminals

Increased safety Ex eb

U_m = 253 V

C

Signal terminals

Intrinsic safety Ex ib

U_m = 60 V*)

Electronic Accessories for Intrinsically Safe Connection

	Designation	Type	Manufacturer
1	Valve control module	KFD2-SL2-Ex1.B	Pepperl + Fuchs
2	Switch amplifier	KF**-SR2-Ex1.W.**	Pepperl + Fuchs
3	Loop-powered isolator	IsoTrans® 36A7	Knick

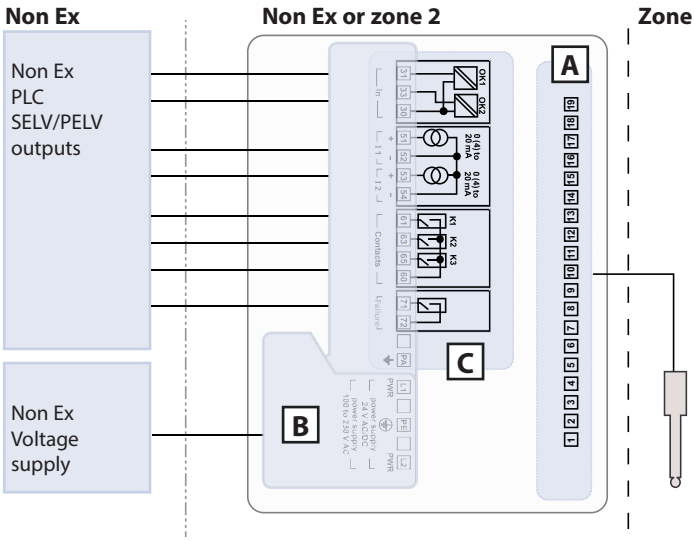
*) See attachment for certificates or control drawings for electrical parameters

Electrical Installation

Protos II 4400X Wiring

With Terminal Cover ZU1042 (Optional)

The optionally available ZU1042 terminal cover covers the signal terminals C in addition to the power terminals B. This obviates the need for the electronic accessories upstream of the BASE module inputs and outputs.



A

Module terminals

Intrinsically safe
Ex ib[ia] or Ex ib*)

B

Power terminals

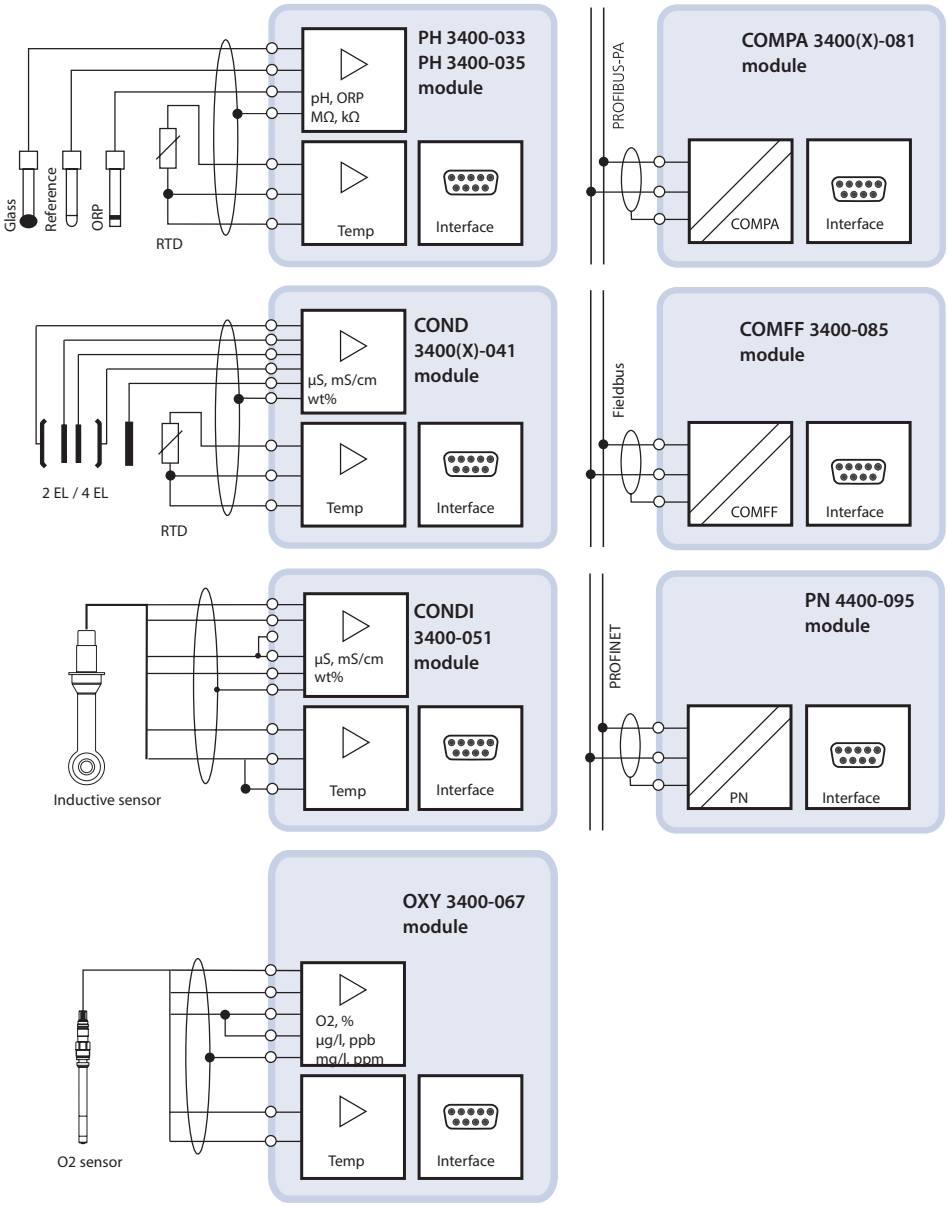
Increased safety Ex eb

U_m = 253 V

*) See attachment for certificates or control drawings for electrical parameters

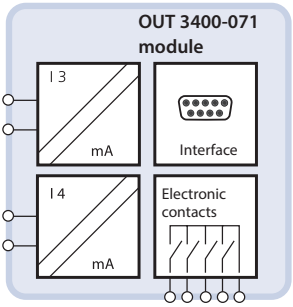
System Overview

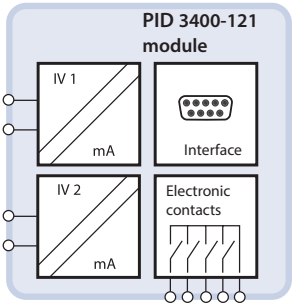
Protos II 4400(X) Modular Process Analysis System

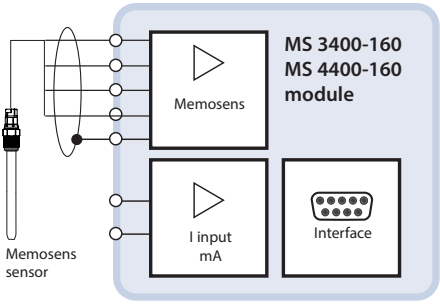


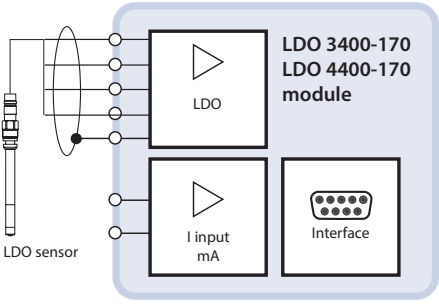
System Overview

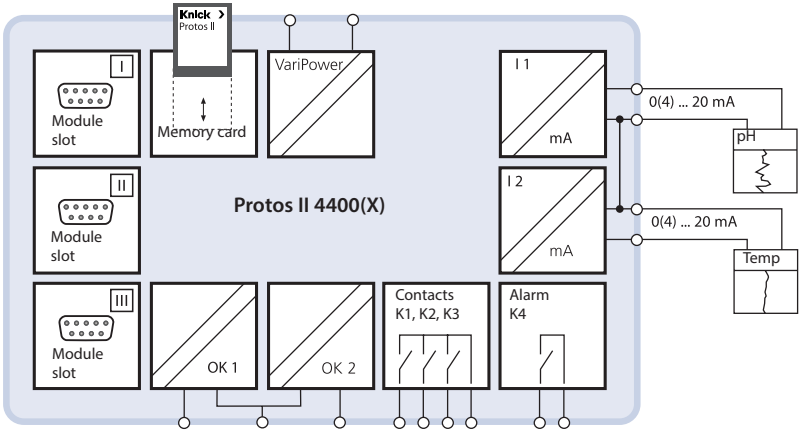
Protos II 4400(X) Modular Process Analysis System









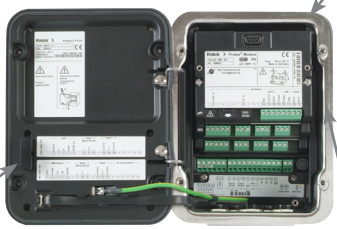


Brief Description

Modular Concept
Basic Unit, Measuring Module, Add-On Functions

The Protos II 4400(X) is a modular process analysis system.
The basic unit (FRONT and BASE modules) provides three slots which can be equipped by the user with any combination of measuring or communication modules. The firmware capabilities can be expanded by add-on functions (options). Add-on functions must be ordered separately. They are activated with a device-specific TAN.

Protos II 4400(X) Modular Process Analysis System



Measuring modules
- pH/ORP/temperature
- Oxygen/temperature
- Inductive conductivity/temperature
- Contacting conductivity/temperature
- pH/ORP, conductivity and oxygen with Memosens sensors

Memory card
Data recording/firmware update

3 module slots
for free combination of measuring and communication modules

Communication modules
- OUT (additional switching and current outputs)
- PID (analog and digital controller)
- PA (Profibus PA)
- FF (Foundation Fieldbus)
- PN (PROFINET)

Add-on functions
Activation via device-specific TAN

ProgaLog 4000
Windows® software for parameter setting and data evaluation

Documentation

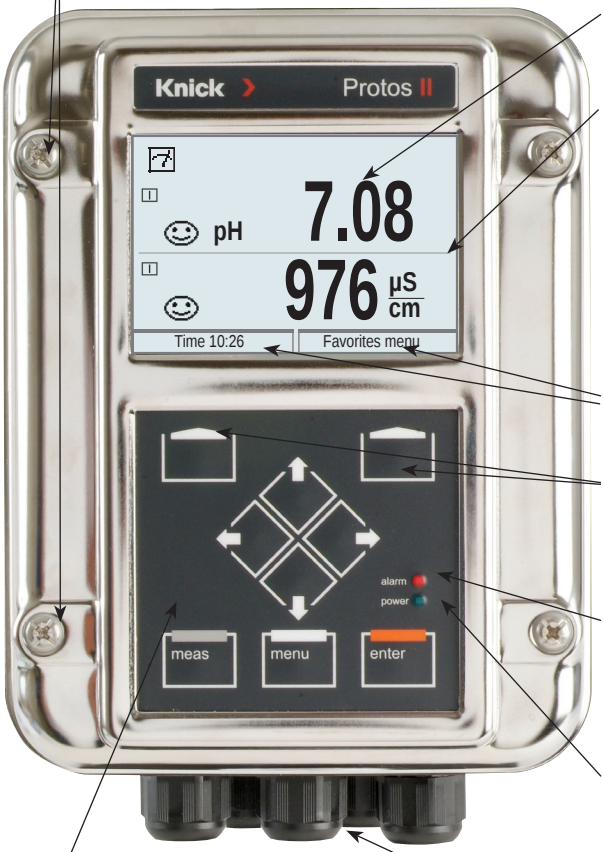
The latest product information and user manuals for earlier firmware releases are available at **www.knick.de**.

Brief Description

FRONT Module User Interface

4 captive screws
for opening the device
(***NOTICE!*** Make sure that the sealing between FRONT and BASE is properly seated and clean!)

Transflective LC graphic display
(240 x 160 pixels)
White backlighting, high resolution and high contrast



Measurement display

User interface
Plaintext menus as recommended by NAMUR.
Menu texts can be switched to: German, English, French, Italian, Spanish, Portuguese, Chinese, Korean, Swedish.

Secondary displays
Flexibly adjustable

2 softkeys
with context-sensitive functions

Red LED
signals failure (On) or maintenance request/function check (blinking) according to NE 44.

Green LED
Voltage supply okay

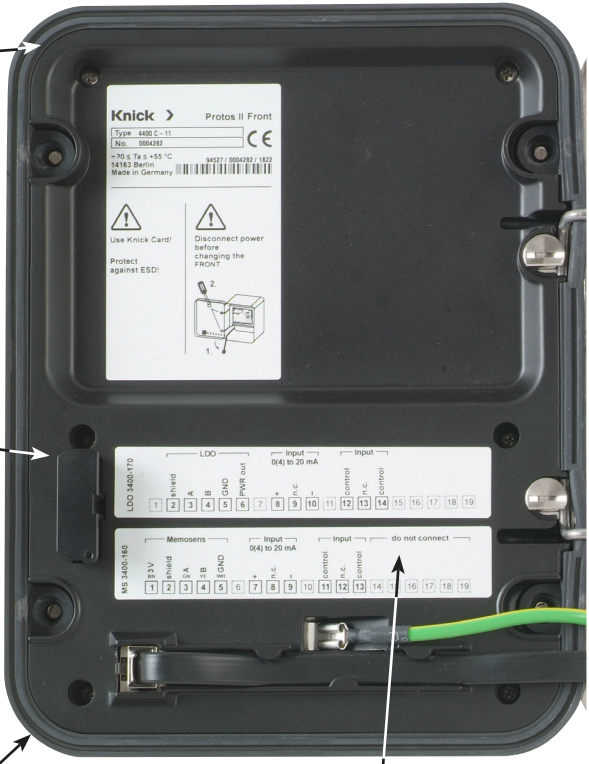
Control panel
3 function keys
(menu, meas, enter)
and 4 arrow keys for menu selection and data entry

5 self-sealing cable glands
M20 x 1.5
for entry of voltage supply and signal lines

Brief Description

View into the Open Device.
FRONT Module

⚠ **CAUTION!** Risk of losing the specified ingress protection.
The circumferential sealing ensures IP65/NEMA 4X protection.
Do not contaminate, do not damage.



Memory card slot
Observe installation guide for the memory card. Detailed information starting from page 78.

Replacement of FRONT module
See separate guide.

Terminal plate adhesive label ("concealed" modules)
The adhesive labels (Package Contents) for the modules at slot 1 or slot 2 can be affixed here. This simplifies maintenance and service.

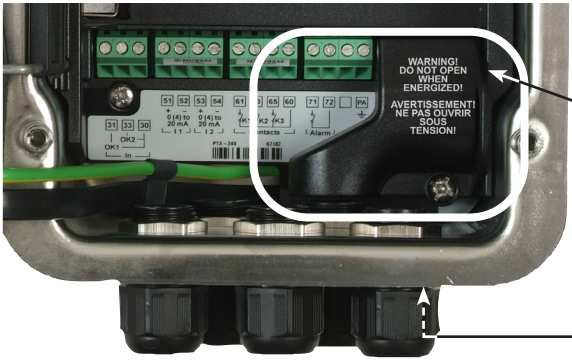
Brief Description

View into the Open Device.
BASE Module, 3 measuring/communication modules are inserted.

⚠ WARNING! Shock potential.
Make sure the device is de-energized before reaching into the terminal compartment.

Module configuration
Any combination of up to 3 measuring and communication modules is possible.
Module identification: Plug & Play

BASE module connections
Non-Ex version
2 current outputs
(free assignment of process variables),
4 relay contacts,
2 digital inputs

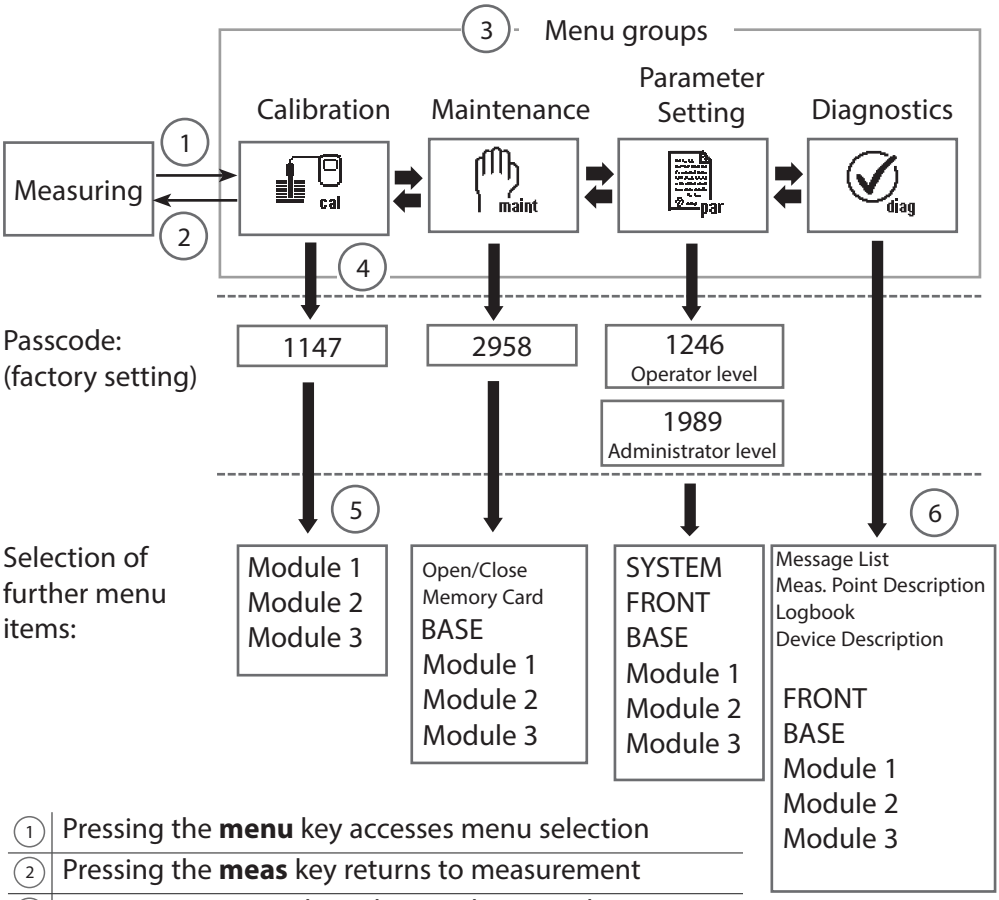


BASE module connections
Ex-version with small power terminal cover (Package Contents) or large ZU1042 terminal cover (accessory).

Equipotential bonding clamp
See dimension drawing for exact position.

Operation (FRONT Module)

Menu Structure



(1)	Pressing the **menu** key accesses menu selection
(2)	Pressing the **meas** key returns to measurement
(3)	Menu groups are selected using the arrow keys
(4)	Press **enter** to confirm, enter passcode
(5)	Further menu items are displayed
(6)	Selected functions of the Diagnostics menu can be recalled via softkey even when in measuring mode (see p. 45)

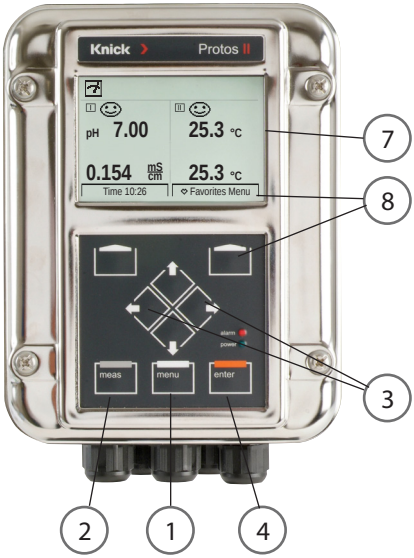
Legend: Arrow keys on keypad

Operation (FRONT Module)

Menu Selection

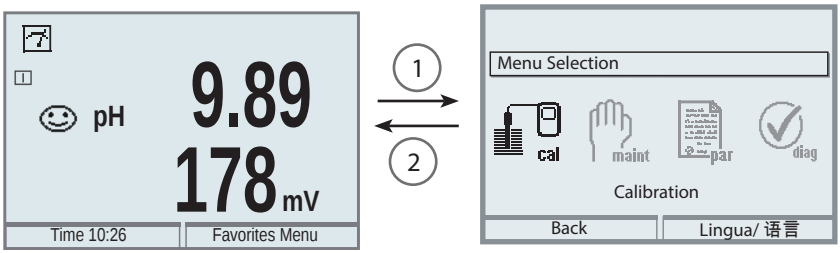
After switching on, the device first performs an internal test routine and automatically detects the number and type of modules installed. Then, the device goes to measuring mode.

- Set measurement display (7), see p. 38
- Set secondary displays/ softkeys (8), see p. 45



Menu Selection

(1) Pressing the **menu** key accesses menu selection.
(2) Pressing the **meas** key returns to measurement.



Measuring mode

Menu selection

Select the desired menu group using the arrow keys (3).
Press **enter** (4) to confirm your choice.
An overview of the menu structure is given on p. 32.

Status Indicators in the Display

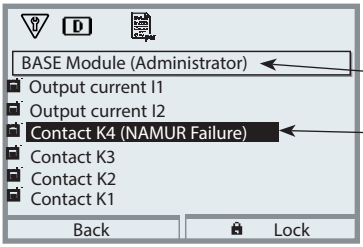
Icons

The plain-text user interface is supplemented by icons which provide information on the operating status:

Function Check (HOLD)
The NAMUR "HOLD" mode is active (NAMUR function check status signal);
as delivered, that is the K2 contact of the BASE module (normally open contact). This setting can be changed as required – the contacts K2 ... K3 are for free programming.
The current outputs behave as configured (you can adjust current measured value, last measured value, fixed value).

Memory Card (D for "Data Card")
located in FRONT module

Mode Indication
Parameter Setting



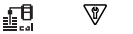
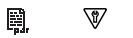
Menu Level (Administrator Level)

Current Selection
The current selection is displayed in reverse video. Gray display lines cannot be edited.

Safety of Operation
To ensure increased safety of operation, the device provides three operating levels:

- Administrator Level
  Access to all device parameters.
  Settings can be blocked against access from the Operator level.
- Operator Level
  Access to all functions which have been released at the Administrator level. Blocked functions are displayed in gray and cannot be edited.
- Viewing Level
  Display of all settings.
  No editing possible.

Status Indicators in the Display

Display	Explanation of display icons
	The device is in measuring mode
NAMUR signals 	**Function Check (HOLD)** The NAMUR "HOLD" contact is active; the red LED flashes (as delivered: Module BASE, Contact K2, N/O contact). Current outputs as configured: • Currently Measured Value: The currently measured value appears at the current output. • Last Usable Value: The last measured value is held at the current output. • Fixed Value: The current output supplies a fixed value.
	**Maintenance Request** The NAMUR "maintenance request" contact is active (factory setting: Module BASE, Contact K2, N/O contact). To view error message, access: Diagnostics Menu/Message List
	**Out of Specification**. The NAMUR "out of specification" contact is active. To view error message, access: Diagnostics Menu/Message List
	**Failure**. The NAMUR "failure" contact is active (factory setting: Module BASE, Contact K4, N/C contact). To view error message, access: Diagnostics Menu/Message List
	The device is in calibration mode. Function check (HOLD) is active.
	The device is in maintenance mode. Function check (HOLD) is active.
	The device is in parameter setting mode. Function check (HOLD) is active.
	The device is in diagnostics mode.
	There is an enabled Data Card in the device. During data recording the arrow in the icon flashes. Please note: "Close memory card" in the Maintenance menu before removing the memory card.
	There is an FW Update Card in the device. You can save the current device firmware or perform a firmware update from the memory card Be sure to check the configuration after the update is completed.
	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)
	Designates the module slot (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.
	In the plaintext display in front of a menu line: Access to next menu level with **enter**
	In the plaintext display in front of a menu line when it has been blocked by the Administrator against access from the Operator level.
	Hourglass indicates that a waiting time is running
TC	Calibration: Temperature compensation for process medium is activated

Status Indicators in the Display

Display	Explanation of display icons
	Calibration: Step 1 of product calibration has been executed. The device is waiting for the sample values.
Δ	Delta function is active (output value = measured value - delta value)
	Limit indication: Lower / upper range limit exceeded
	Sensocheck
	Rinse contact
	Displayed when the device is controlled via PROFIBUS PA. Only in conjunction with a COMPA module.
	Displayed when the device is controlled via FOUNDATION Fieldbus. Only in conjunction with a COMFF module.
	Displayed when the device is controlled via PROFINET Only in conjunction with a PN module.

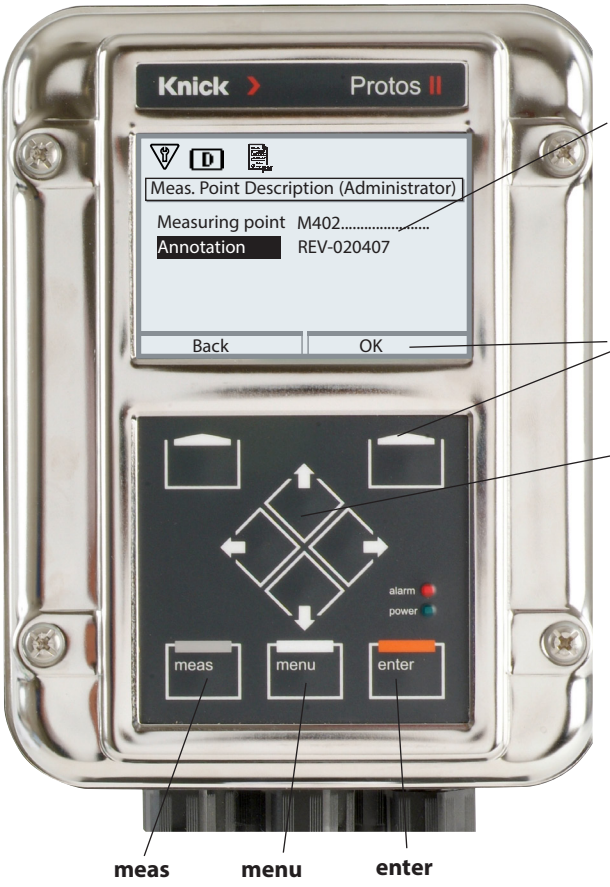
Entering Numbers and Text

FRONT Module

Select the position using the **left/right** keys,
then edit the number or letter using the **up/down** keys.
Confirm with **enter**.

Example: Entering a Measuring Point Description

1) Open the menu selection (**menu**)
2) Select parameter setting: Administrator Level, enter passcode
3) System Control
4) Meas. Point Description



Measuring Point Description
You can enter a tag number and notes for the point of measurement using the arrow keys.

Function which is assigned to the softkey underneath.

Arrow Keys
For selection of menu lines or entry of letters and numbers.

Configuring the Measurement Display

FRONT Module

Menu Selection: Parameter Setting > FRONT Module > Measurement Display

Pressing **meas** returns the device to the measuring mode from any function. (Pressing **meas** successively in measuring mode displays the activated special functions – if configured – such as measurement recorder).

All process variables coming from the modules can be displayed.

The table on the next page describes how to configure the measurement display.

Measurement Display
Typical measurement display (Example: Measuring modules for pH and oxygen, 4 values/2 channels)

Secondary Displays
Additional values, also date and time, can be displayed depending on the modules installed. They are selected using the softkeys (p. 45).

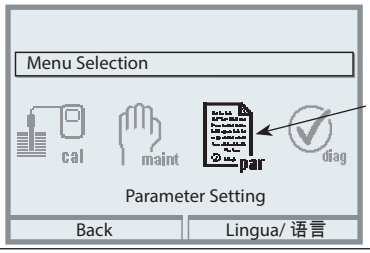
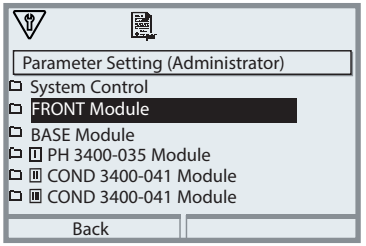
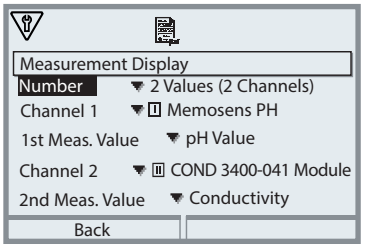
Softkeys
The Softkeys allow selection of values for the secondary displays. In addition, Diagnostics functions which are set as "Favorites" can be called up (p. 45).

If required, you can also change the parameter set via softkey (p. 45). The softkeys also include self-explanatory, context-sensitive functions, e.g. with measurement recorder activated.

If required, the measurement display can turn itself off if not used, see p. 63.

Configuring the Measurement Display

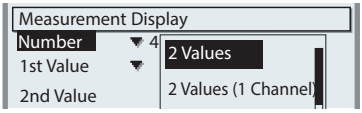
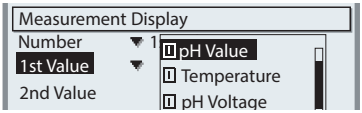
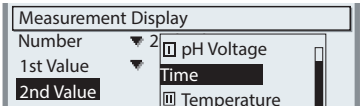
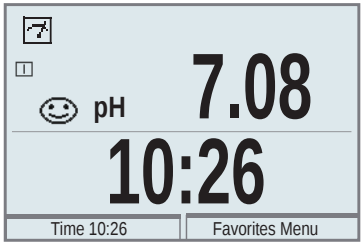
Menu Selection: Parameter Setting > FRONT Module > Measurement Display

Menu	Display	Action
		**Configuring the Measurement Display** Press **menu** key to select menu. Select parameter setting using arrow keys, press **enter** to confirm. Select: "Administrator Level" Passcode 1989 (preset)
par	 	Parameter setting – basic procedure: 1) Select "FRONT Module" 2) Select "Measurement Display" 3) Set "Number" of measured values to be displayed (up to 8) Selection options: • 2 values (1 channel) • 2 values (2 channels) • 2 values (2 channels) • 2 values • 4 values • 6 values • 8 values Further display depending on selection. 4) As required, assign channels and select process variable(s) to be displayed. Confirm with **enter**. Pressing the **meas** key returns to measurement. **Example settings** can be found on the following pages.

Configuring the Measurement Display

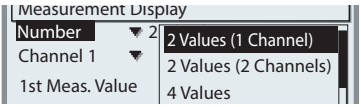
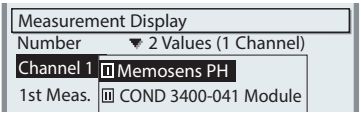
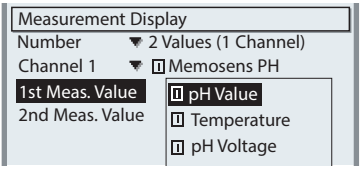
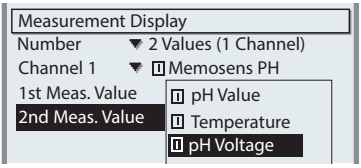
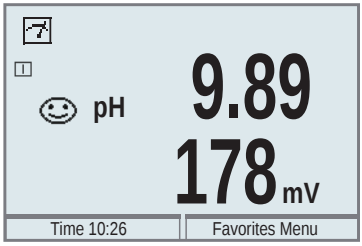
Examples

Selection	Result
2, 4, 6 or 8 values **without** measuring channel selection	Any display of measured values from the measuring modules and/or the basic device possible
2 or 4 values **with** measuring channel selection I, II or III	Only display of measured values from the measuring modules possible

Selection		Result
2 values	Selection of two process variables from measuring channels and the basic device	
	 Select number of values. Confirm with **enter**.	
	 Select first process variable with channel. Confirm with **enter**.	
	 Select second process variable. Confirm with **enter**. Proceed with **meas**	

Configuring the Measurement Display

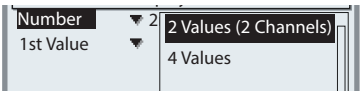
Examples

Selection		Result
2 values (1 channel)	Select two process variables within one measuring channel	
	 Select number of values and channels. Confirm with **enter**.	
	 Assign a module to the channel. Confirm with **enter**.	
	 Select first process variable for the module. Confirm with **enter**.	
	 Select second process variable for the module. Confirm with **enter**. Proceed with **meas**	

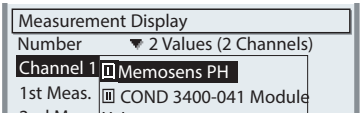
Configuring the Measurement Display

Examples

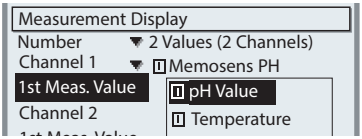
Selection		Result
2 values (2 channels)	Select two process variables in two measuring channels	



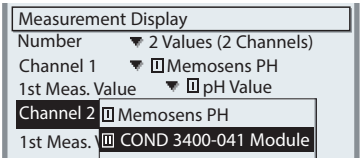
Select number of values and channels. Confirm with **enter**.



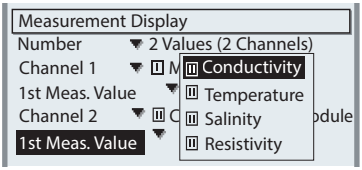
Assign a module to the first channel. Confirm with **enter**.



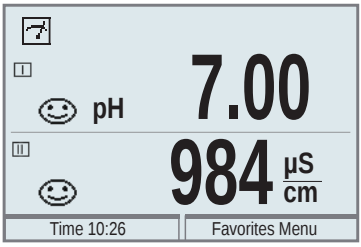
Select process variable for the first module. Confirm with **enter**.



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



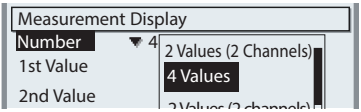
Select process variable for the second module. Confirm with **enter**. Proceed with **meas**



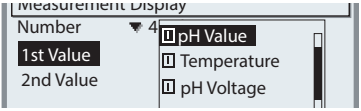
Configuring the Measurement Display

Examples

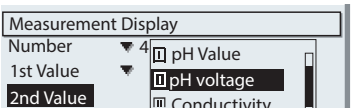
Selection		Result
4 (6, 8) values	Select four (six, eight) process variables from any measuring channels and the basic device	



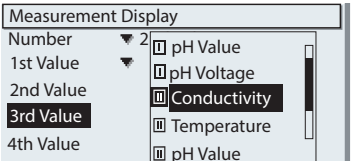
Select number of values.
Confirm with **enter**.



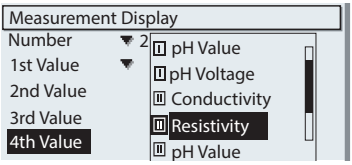
Select first process variable with channel.
Confirm with **enter**.



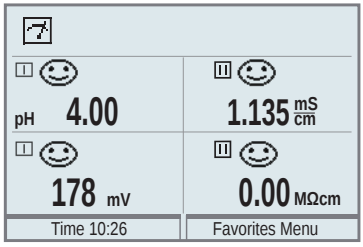
Select second process variable with channel. Confirm with **enter**.



Select third process variable with channel. Confirm with **enter**.



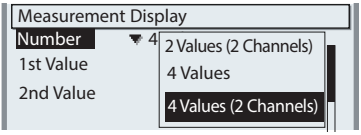
Select fourth process variable with channel.
Confirm with **enter**.
Proceed with **meas**



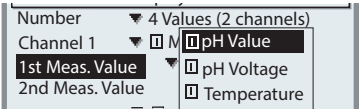
Configuring the Measurement Display

Examples

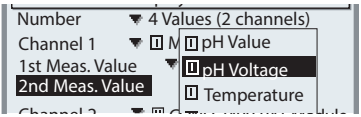
Selection	Result
4 values 2 channels	Select four process variables in two measuring channels



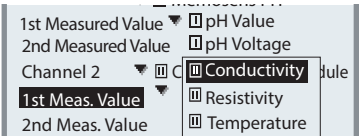
Select number of values and channels.
Confirm with **enter**.



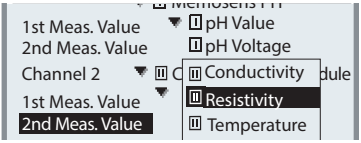
Select first process variable in channel 1.
Confirm with **enter**.



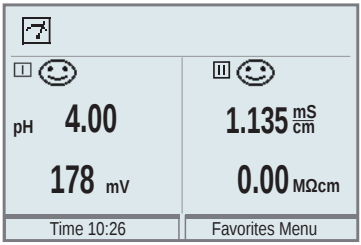
Select second process variable in channel 1.
Confirm with **enter**.



Select first process variable in channel 2.
Confirm with **enter**.



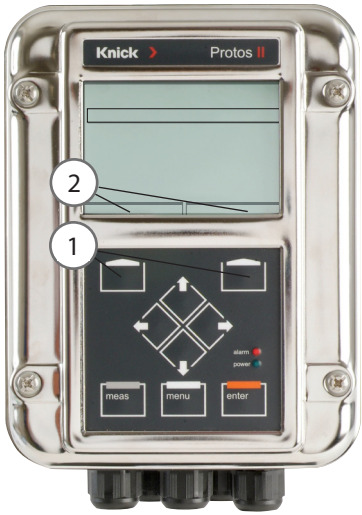
Select second process variable in channel 2.
Confirm with **enter**.
Proceed with **meas**



Softkey Function (Function Control)

FRONT Module
Menu Selection: Parameter Setting > System Control > Function Control

Secondary Displays (2)
Additional measured values can be displayed here in accordance with factory settings.
When the respective softkey (1) is pressed, the process variables measured by the modules plus date or time are displayed.
In addition, you can use the **softkeys (1)** to control functions.
To assign a function to a softkey, select Parameter Setting > System Control > Function Control



Softkey-Controllable Functions:

- Value rotation: The available measured values can be displayed in succession. The last measured value always remains visible in the secondary display.
- Parameter set selection (see p. 61)
- Favorites (see Diagnostic Functions chapter, p. 96)

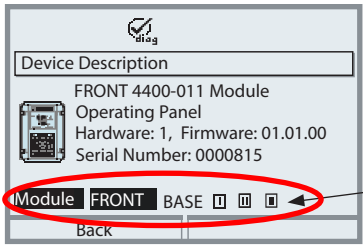
Protos II 4400(X) Firmware

Menu Selection: Diagnostics > Device Description

Query Current Device Firmware/Module Firmware

When the device is in measuring mode:

1) Press the **menu** key.
2) Open the Diagnostics menu.
3) Select "Device Description".

Menu	Display	Action
		Provides information on all modules installed: Module type and function, serial number, hardware and firmware version, and device options. Select the different modules (FRONT, BASE, slots 1 - 3) using the arrow keys.

Operating States

Operating Mode	Current outputs	Contacts	Controller (PID module)	Timeout [1]
Measuring				–
Diagnostics				–
Calibration [2]				–
Maintenance [2]				
Sensor monitor				–
Current source				–
Manual controller				–
Parameter setting [2]				20 min
Rinse function [2]		[3]		At end of rinse time

Legend:

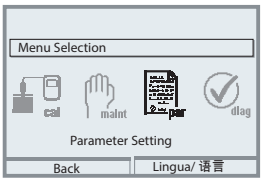
- Active (output functions normally)
- Last value or fixed default value
- Manual control of outputs
- Depending on parameter setting

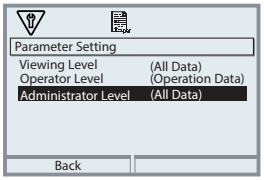
1) "Timeout" means that the device will switch to measuring mode after 20 minutes with no key activity.

2) Function check (HOLD) is active.

3) Rinse contact is active.

Parameter Setting Menu





Parameter Setting

From measuring mode: Press **menu** key to select menu.
Select parameter setting using arrow keys,
press **enter** to confirm.

Administrator Level
Access to all functions, also passcode setting. Releasing or blocking functions for access from the Operator level.

Operator Level
Access to all functions which have been released at the Administrator level. Blocked functions are displayed in gray and cannot be edited.

Viewing Level
Only display, no editing possible!

System Control

Memory Card	Menu only appears when a memory card is inserted and the corresponding add-on function has been enabled.
Transfer Configuration	The complete configuration of a device can be written on a memory card. This allows transferring all device settings to other devices with identical equipment (exception: options and passcodes).
Parameter Sets	2 parameter sets (A, B) are available in the device. The currently active parameter set is shown in the display. Parameter sets contain all settings except: sensor type, options, system control settings Up to 5 parameter sets (1, 2, 3, 4, 5) are available when a memory card (Option) is used.
Function Control	Select the functions to be controlled via softkeys and OK inputs
Calculation Blocks	Calculate measured variables to new variables
Time/Date	Time, date, display format
Meas. Point Description	Free input of a tag number, can be called from the diagnostics menu
Option Activation	Option activation via TAN
Restore Factory Settings	Reset all parameters to factory setting
Passcode Entry	Change passcodes
Firmware Update	Update the firmware using an FW Update Card
Logbook	Select the events to be recorded

Parameter Setting Menu

FRONT Module: Display Settings	
Language	Select the menu language
Units	Select the measurement units
Formats	Select the display format
Measurement Display	Set the measurement display
Measurement Recorder	See detailed "TAN Options" manual
BASE Module: Signal Outputs and Inputs, Contacts	
Output Current I1, I2	Configure current outputs
Contact K4	Configure failure signaling
Contacts K3, K2, K1	Configure relay contacts
Inputs OK1, OK2	Configure optocoupler signal inputs

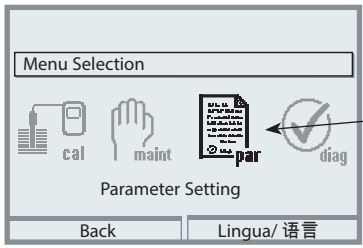
Parameter Setting

⚠ CAUTION! Incorrect parameter settings or adjustments can result in incorrect outputs.
The Protos II 4400(X) must therefore be commissioned by a system specialist, all its parameters must be set, and it must be fully adjusted.

NOTICE!

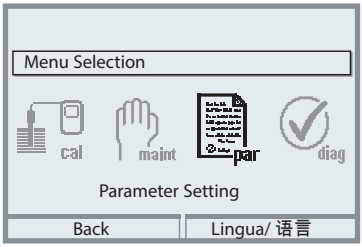
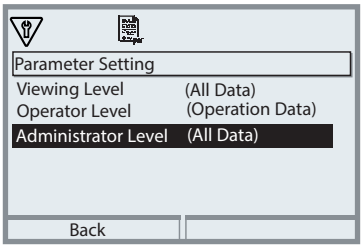
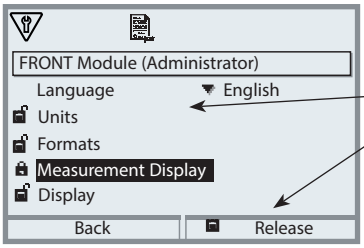
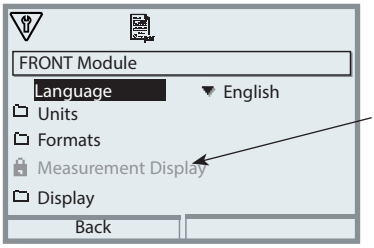
The "function check" (HOLD) NAMUR contact is active during parameter setting. The behavior of the current outputs depends on the parameter setting, i.e., they may be frozen at the last measurement or set to a fixed value. The red "Alarm" LED blinks.

Measurement operations on the Protos II 4400(X) must not be carried out while the device is in function check (HOLD) mode, as this may put the user at risk due to unexpected system behavior.

Menu	Display	Action
		**Open the Parameter Setting menu** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, press **enter** to confirm

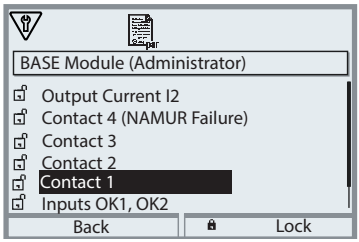
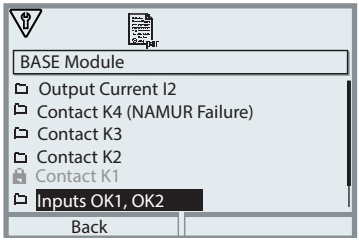
Operating Levels

Parameter Setting: Viewing Level, Operator Level, Administrator Level
Note: Function check (HOLD) active

Menu	Display	Action
par		**Open the Parameter Setting Menu** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, press **enter** to confirm.
		**Administrator Level** Access to all functions, also passcode setting. Releasing or blocking functions for access from the operator level.
		Functions which can be blocked for the operator level are marked with the "lock" icon. The functions are released or blocked using the softkey.
		**Operator Level** Access to all functions which have been released at the Administrator level. Blocked functions are displayed in gray and cannot be edited (Fig.). **Viewing Level** Display of all settings. No editing possible!

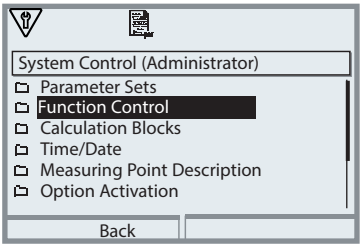
Locking a Function

Administrator level: Enable / lock functions for Operator level
Note: Function check (HOLD) active

Menu	Display	Action
		**Example:** Blocking access to the configuration of relay contact K1 (BASE module) from the Operator level **Open the Parameter Setting Menu** 1) Administrator level 2) Enter passcode (1989) 3) Select "BASE Module" with arrow keys, press **enter** to confirm. 4) Select "Contact 1" with arrow keys 5) "Lock" using softkey
		Now, the "Contact 1" line is marked with the "lock" icon 🔒. This function cannot be accessed from the operator level anymore. The softkey function changes to "Enable". At the operator level, the locked function is shown in gray (see figure).

Parameter Setting: System Control

Menu Selection: Parameter Setting > System Control
Note: Function check (HOLD) active

Menu	Display	Action
		**Open the Parameter Setting Menu** 1) Administrator level 2) Enter passcode (1989) 3) Select System Control using arrow keys, press **enter** to confirm. Submenus of system control: • Parameter Sets • Function Control • Calculation Blocks • Time/Date • Measuring Point Description • Option Activation • Restore Factory Settings • Passcode Entry • Firmware Update ... more, depending on options. **Function Control** Allocation of functions for activation by softkey or optocoupler input OK2: • Parameter set selection • Favorites (see Diagnostic Functions chapter, p. 96) **Time/Date** Enter date format, enter date and time

Parameter Setting: System Control

Menu Selection: Parameter Setting > System Control
Note: Function check (HOLD) active

Menu	Action
	**Measuring Point Description** You can enter a tag number or notes (e.g. date of last maintenance). Select position: left/right arrow keys Select character A-Z 0-9 _ # * + - / : < = > Space: up/down arrow keys. Confirm the entry with **enter**. For display of the measuring point description in the Diagnostics menu, see p. 99
	Passcode Entry Passcodes (factory settings): Calibration 1147 Maintenance 2958 Operator Level 1246 Administrator Level 1989 **Note** If you lose the administrator passcode, system access is locked! The manufacturer can generate a rescue TAN.
	Option Activation (Activate Add-On Function) The add-on functions (options) are device-specific. When ordering an add-on function, you therefore have to specify the serial number of your FRONT module in addition to the respective order number. The manufacturer then supplies a TAN (transaction number) to activate the add-on function. Display serial number: Diagnostics > Device Description If you have purchased an option that can be activated by TAN (add-on function): 1) Parameter Setting, Administrator Level 2) System Control 3) Option Activation 4) Set option to “active”. You are prompted for the TAN. The option is available after the TAN has been entered.

Parameter Setting: System Control

Menu Selection: Parameter Setting > System Control
Note: Function check (HOLD) active

Menu	Action
	**Logbook** Selecting the events to be recorded in the logbook. The last 100 events are recorded with date and time and can be viewed in the Diagnostics menu. When using the Data Card with add-on function FW4400-104, 20,000 entries or more can be stored on the card, depending on the memory load. This permits quality management documentation to ISO 9001.
	Restore Factory Settings Allows the parameters to be reset to their factory setting. When this menu is opened, the device displays a warning.

Calculation Blocks (System Control)

Menu Selection: Parameter Setting > System Control > Calculation Blocks
Calculating Measured Variables to New Variables

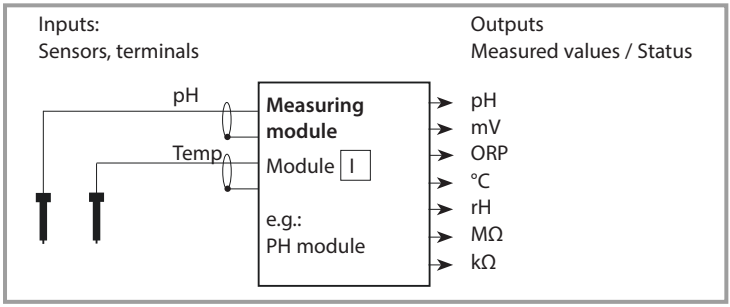
Calculation Blocks

Two measuring modules with all their measured values serve as input for the calculation block. In addition, the general device status (NAMUR signals) is taken into account. The following variables are calculated from the existing values:

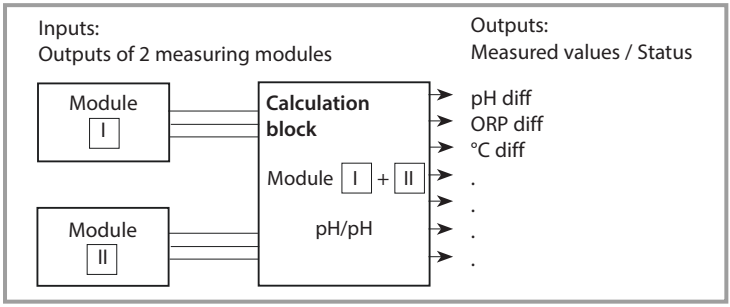
- Ratio
- Pass (passage)
- Reject (rejection)
- Measured value difference
- Deviation
- pH value calculation by means of dual conductivity measurement

These output variables are then available in the system and can be assigned to the outputs (current, limit values, display ...). See page 58.

Functionality of Measuring Module



Functionality of Calculation Block



Activating Calculation Blocks

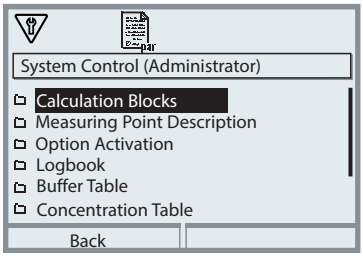
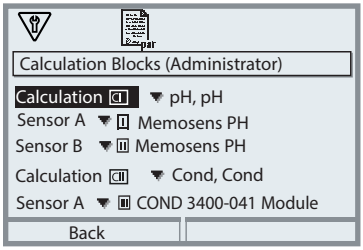
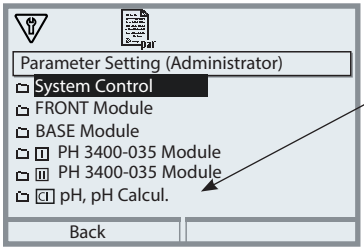
Menu Selection: Parameter Setting > System Control > Calculation Blocks
Allocating Measuring Modules to Calculation Blocks

Combining Measuring Modules

With three measuring modules, the following calculation block combinations are possible:

I + II , I + III , II + III

Two calculation blocks can be activated.

Menu	Display	Action
		**Calculation Blocks** • Open the Parameter Setting menu • System Control • Select "Calculation Blocks"
		The possible combinations for calculation blocks are offered depending on the modules installed.
		During parameter setting, the calculation blocks are displayed like modules.

Overview of Calculation Blocks

Module Combinations, Calculation Block, Process Variables

Measuring module combination	Calculation block	Process variables calculated by calculation block		
pH + pH	pH/pH	Difference Difference Difference		pH ORP °C
Cond + Cond CondI + CondI Cond + CondI	Cond/Cond	Difference Difference Difference Ratio Passage Rejection Deviation	 (Pass) (Reject) (Deviat)	S/cm Ohm*cm °C S/cm [] S/cm[%] S/cm[%] S/cm[%]
Oxy + Oxy	Oxy/Oxy	Difference Difference Difference Difference Difference		%Air %O_2 g/l ppm °C

New Process Variables and Signal Processing

Current Outputs
All current outputs can be set to output the new process variables formed by the calculation blocks.

Measurement Display
All new process variables can be displayed as primary or as secondary value.

Controller
Controller functions are not supported.

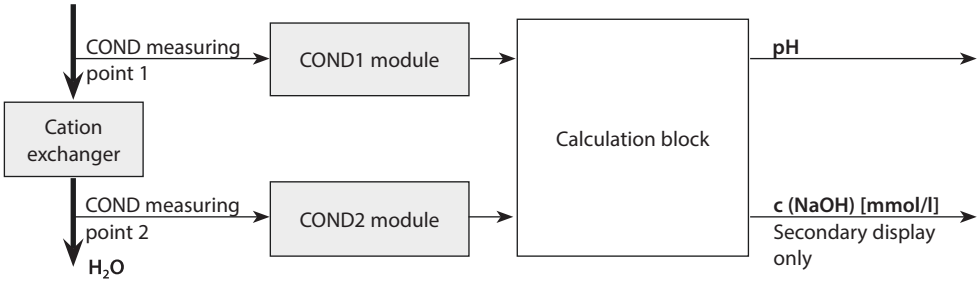
Calculation Formulas

Module Combinations, Calculation Block, Process Variables

Process variable	Calculation formula	Range	Span
Difference (selectable in menu)	DIFF = A - B or DIFF = B - A	Process variable	Process variable
Ratio (selectable in menu)	$RATIO = \frac{A}{B}$	0.00 ... 19.99	0.10
Passage	$PASS = \frac{B}{A} \cdot 100$	0.00 ... 199.9	10%
Rejection	$REJECT = \left(1 - \frac{B}{A}\right) 100\ \%$	-199.9 ... 199.9	10%
Deviation	$DEVIAT = \left(\frac{B}{A} - 1\right) 100\ \%$	-199.9 ... 199.9	10%

pH Value Calculation by Means of Dual Conductivity Measurement

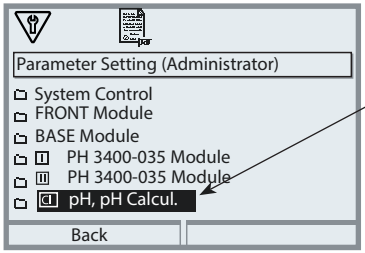
Principle:



$$c(NaOH) = \frac{COND1 - 1/3\ COND2}{243} \qquad pH = 11 + \log[c(NaOH)]$$

Configuring a Calculation Block

Menu Selection: Parameter Setting > System Control > Calculation Blocks
Setting the Process Variable to be Calculated

Menu	Display	Action
par		**Select Calculation Block** 1) Parameter Setting 2) Select calculation block

The possible combinations for calculation blocks are offered depending on the modules installed.

Messages
You can activate messages for the selected process variables.

Variables which have been set as "Off" cannot be processed further.

The measured values which are to release a message are set using the arrow keys (left/right: select position, up/down: edit number)
Confirm with **enter**.

Parameter Sets A, B

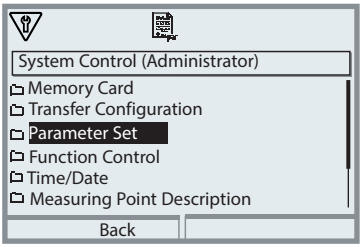
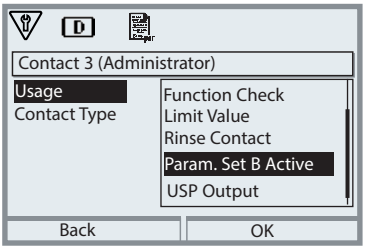
Menu Selection: Parameter Setting > System Control
Note: Function check (HOLD) active

2 complete parameter sets (A, B) can be stored in the device.
An icon in the measurement display shows which parameter set is active:
A or B
The control element for switching between the parameter sets
(optocoupler input OK2:) is selected in
"Parameter Setting > System Control > Function Control".
The currently activated set can be signaled by a relay contact.

Menu	Action
par	**Select Control Element for Switching Between Parameter Sets** 1) Parameter Setting, Administrator Level 2) Enter passcode 3) System Control: Function Control 4) Select control element

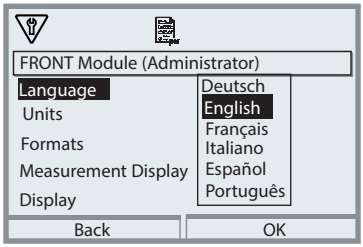
Note
The selection has no effect when working on a memory card with FW4400-102.

Parameter Sets A, B

Menu	Display	Action
		**Parameter Sets A, B** 1) Parameter Setting, Administrator Level 2) Enter passcode 3) System Control 4) Parameter Set **Save Parameter Set** The active parameter set A overwrites the internal parameter set B. **Load Parameter Set** Parameter set B is loaded.
	Parameter Setting > BASE Module > Contact > Usage:	
		**Signaling Active Parameter Set via Relay Contact** 1) Parameter Setting 2) BASE Module 3) Contact ... 4) Usage: "Parameter Set B Active".

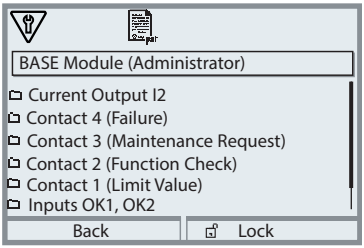
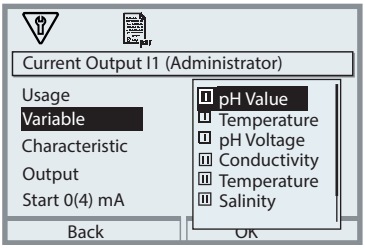
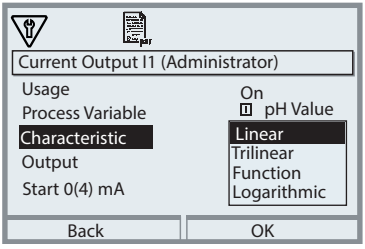
Parameter Setting: FRONT Module

Menu Selection: Parameter Setting > FRONT Module
Note: Function check (HOLD) active

Menu	Display	Action
		**Language Setting** 1) Parameter Setting 2) FRONT Module 3) Language **Units:** Select units. **Formats:** Select display format (e.g. number of decimal points), depending on process variable. **Measurement Display:** Select number and type of measured values to be displayed; for a description, see p. 38. **Display** • Brightness/contrast: Adjust display to match local light conditions. • Auto-Off: Select the number of minutes before the display switches off if not used. • The display can be switched back on by pressing a button.

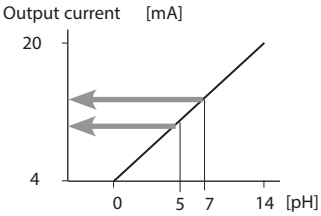
Parameter Setting: BASE Module

Menu Selection: Parameter Setting > BASE Module
Note: Function check (HOLD) active

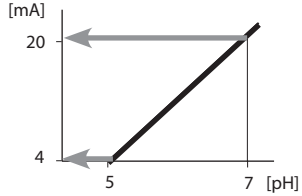
Menu	Display	Action
		**Setting the Current Output** 1) Parameter Setting 2) Enter passcode 3) BASE Module 4) Current Output I...
		5) Select process variable
		6) Select characteristic e.g., "linear" The process variable is represented by a linear output current curve. The desired range of the process variable is specified by the values for "Start" and "End".

Assignment of Measured Values: Start (4 mA) and End (20 mA)

Example 1: Range pH 0 ... 14



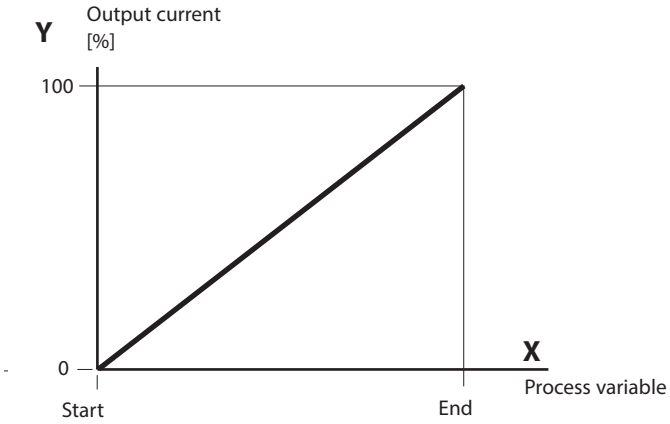
Example 2: Range pH 5 ... 7
Advantage: Higher resolution in range of interest



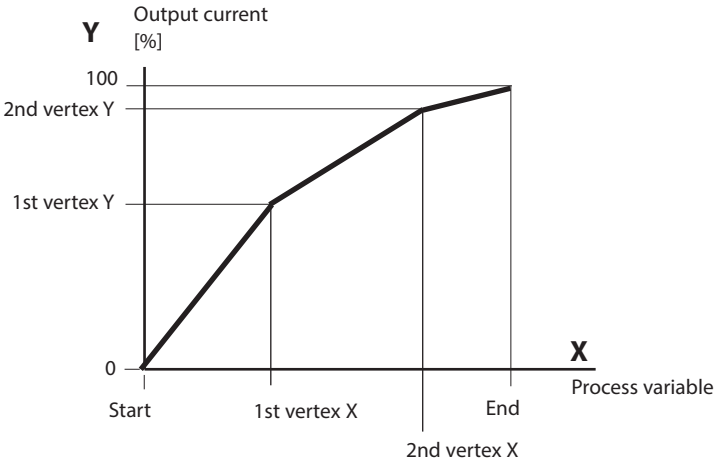
Current Outputs: Characteristic Curves

Parameter Setting > BASE Module > Current Output ... > Characteristic
Note: Function check (HOLD) active

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



Trilinear Curve
You must enter two additional vertices:

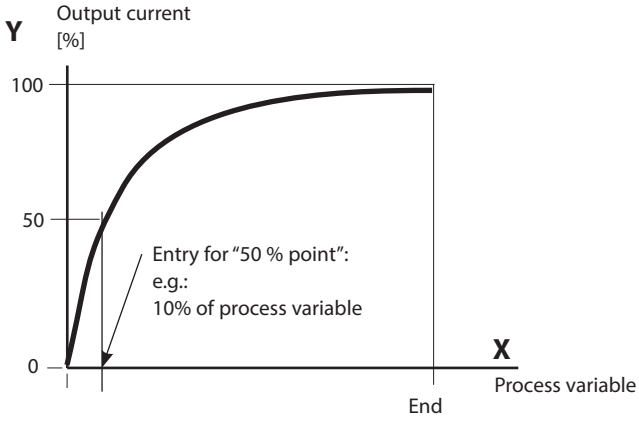


Note: Bilinear Curve
For a bilinear characteristic, identical parameters are entered for the two vertices (1st vertex, 2nd vertex)

Function Curve

Nonlinear output current characteristic: allows measurements over several decades, e.g. measuring very low values with a high resolution and high values with a low resolution.

Required: Entering a value for 50 % output current.



Equation

$$\text{Output current (4 to 20 mA)} = \frac{(1+K)x}{1+Kx} \cdot 16\text{ mA} + 4\text{ mA}$$

$$K = \frac{E + S - 2 * X50\%}{X50\% - S} \qquad x = \frac{M - S}{E - S}$$

S: Start value at 4 mA
X50%: 50% value at 12 mA (output current range 4 to 20 mA)
E: End value at 20 mA
M: Measured value

Logarithmic Output Curve Over One Decade:
S: 10% of maximum process variable
X50%: 31.6% of maximum process variable
E: Maximum process variable

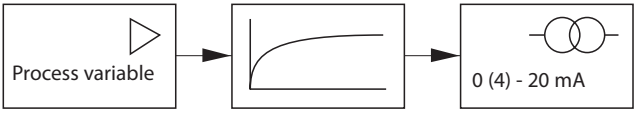
Logarithmic Output Curve Over Two Decades:
S: 1% of maximum process variable
X50%: 10% of maximum process variable
E: Maximum process variable

Current Outputs: Output Filter

Parameter Setting > BASE Module > Current Output ... > Output Filter
Note: Function check (HOLD) active

Time Averaging Filter
To smoothen 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 from 0 to 120 sec. If the time interval is set to 0 sec, the current output follows the input.

Note:
The filter only acts on the current output and the current value of the secondary display, not on the measurement display, the limit values, or the controller!

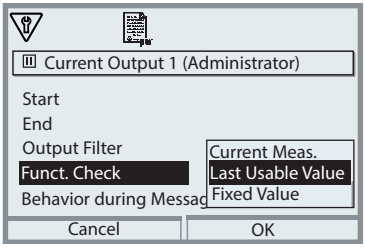


Time interval 0 ... 120 sec

Current Outputs: Messages

Parameter Setting > BASE Module > Current Output ... > Funct. Check
Note: Function check (HOLD) active

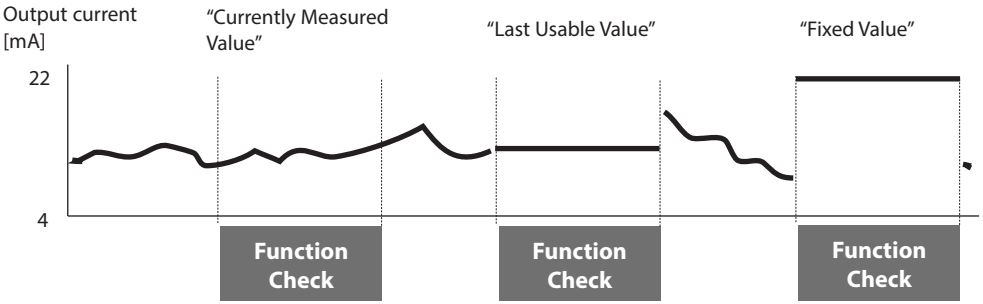
Behavior During Messages



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

- Currently measured value
- Last measured value (HOLD function)
- Fixed value

In the case of a fault, a 22-mA signal can be generated for the selected process variable (1st primary value).



Message when the Current Range is Exceeded

As delivered, the "Maintenance request" message is generated when the current range is exceeded (< 3.8 mA or > 20.5 mA).
This setting can be changed in the Parameter Setting menu of the respective measuring module at "Messages".

To generate a "Failure" message, the limit value monitoring must be set to "Variable Limits":
Parameter Setting > [Measuring Module] > Messages > Variable Limits > Failure Limit ...
Note: Different settings apply to Memosens modules (see following page 69).

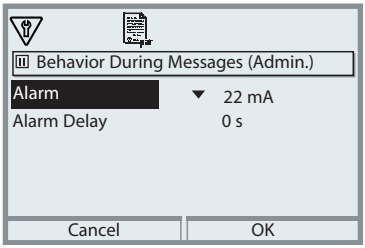
Enter the same values for the failure limits as for the current output:
Parameter Setting, BASE Module, Current Output, Process Variable Start/End.

Memosens: Report Malfunctions

During Memosens operation, communication errors or breakdowns and Sensochecks can be reported to the control room (output current 3.6 mA or 22 mA). To do so, the following settings must be made in the configuration:

1. In the BASE module, set the alarm to 3.6 mA or 22 mA for output current 1 or 2 in the "Behavior During Messages" submenu. If required, enter an alarm delay.
   Menu Selection: BASE Module > Current Output > Behavior During Messages

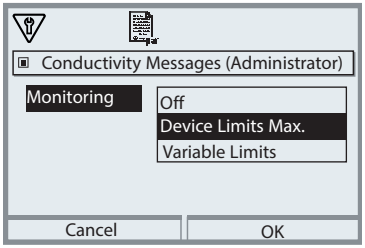
Behavior During Messages: Set Alarm to 22 mA



A 22 mA signal is generated in the event of an error for the selected current output and the assigned process variable.

2. Enable messages for the process variable output at the respective output current in the "Messages" menu of the communication module (MS 3400(X)-160 or MS 4400(X)-160).
   Menu Selection: [Measuring Module] > Messages > Messages [Process Variable] > Monitoring

Messages: Set Monitoring to "Max. Device Limits"



Max. Device Limits:
Messages are generated when the process variable is outside the measuring range. The "Failure" icon is displayed ⊗, the NAMUR "Failure" contact is activated (BASE module, factory setting: contact K4, N/C contact).
The current outputs can signal a 22 mA message (user-defined).

The delay between the occurrence of a fault (message on display) and the output of the 22 mA fault current is adjustable.

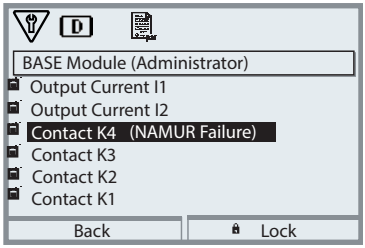
Relay Contacts: NAMUR Status Signals

Menu Selection: Parameter Setting > BASE Module > Contact K...
Note: Function check (HOLD) active

NAMUR Status Signals

As delivered, the floating relay outputs of the BASE module are assigned to the NAMUR status signals:

Failure	Contact K4, normally closed (signaling current failure)
Maintenance request	Contact K3, normally open, freely adjustable
Function check (HOLD)	Contact K2, normally open, freely adjustable
Out of specification	Contact K1, normally open, freely adjustable

Menu	Display	Action
		• Open the Parameter Setting menu • Administrator level (enter passcode) • Select BASE module • You can define a delay time for "Maintenance request", "failure" and "Out of specification". If an alarm message is released, for example, the contact will only be activated after expiry of this delay time.

Failure is active
when a value has exceeded (or fallen below) a preset "Failure Limit Hi" or "Failure Limit Lo", when the measured value is out of range, or in the event of other failure messages. That means that the equipment no longer operates properly or that process parameters have reached a critical value.
The relay contact is not activated for "Function check" (HOLD).

Relay Contacts: NAMUR Status Signals

 **Maintenance request** is active
when messages appear that require maintenance. That 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 meter detected a worn sensor.
The relay contact is not activated for "Function check" (HOLD).

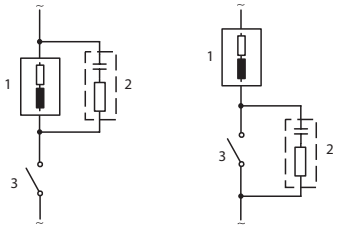
 **Out of specification** is active
when a value has exceeded (or fallen below) a preset "Out of Specification Hi" or "Out of Specification Lo", when the device has detected deviations from the permissible ambient or process conditions, or if faults are present indicating that the measurement uncertainty is probably greater than to be expected under normal operating conditions.
The relay contact is not activated for "Function check" (HOLD).

 **Function check** (HOLD) is active
- during calibration (only the corresponding channel)
- during maintenance (current source, measuring point maintenance)
- during parameter setting at the operator level or the administrator level
- during an automatic rinse cycle.

The output signal is temporarily frozen.

Relay Contacts: Protective Wiring

Protective Wiring of Relay Contacts
Relay contacts are subject to electrical erosion. Especially with inductive and capacitive loads, the service life of the contacts will be reduced. For suppression of sparks and arcing, components such as RC combinations, nonlinear resistors, series resistors, and diodes should be used.



Typical AC applications with inductive load

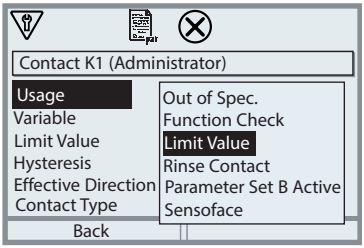
1 Load
2 RC combination, e.g. RIFA PMR 209
Typical RC combinations
e.g.
Capacitor 0.1 µF,
Resistor 100 ohms / 1 W
3 Contact

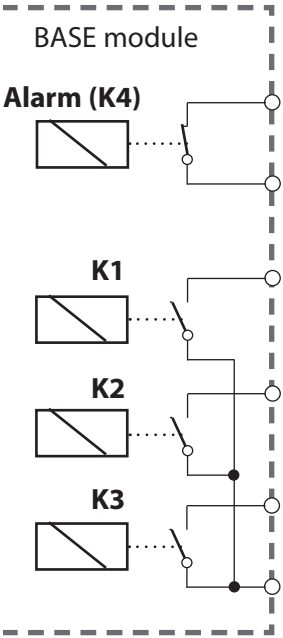
NOTICE!
Make sure that the maximum ratings of the relay contacts are not exceeded even during switching!

Information Concerning Relay Contacts
As delivered, the relay contacts are suitable for low signal currents (down to 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.

Relay Contacts: Parameter Setting

Menu Selection: Parameter Setting > BASE Module > Contact K...
Note: Function check (HOLD) active

Menu	Display	Action
		**Relay Contacts, Usage** 1) Parameter Setting 2) Enter passcode. 3) BASE Module 4) Contact K... 5) Usage (Fig.)



Contact assignment:
See terminal plate of BASE module

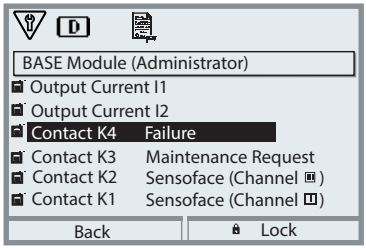
The BASE module provides 4 relay contacts (max. AC/DC rating 30 V / 3 A each).
Contact K4 is provided for failure message. The switching behavior (normally open or normally closed), as well as a switch-on or switch-off delay can be defined.

K1-K3 are User-Definable ("Usage"):

- Off
- Failure
- Maintenance request
- Out of specification
- Function check (HOLD)
- Limit value
- Rinse contact
- Parameter set B active
- USP output (COND module only)
- Sensoface

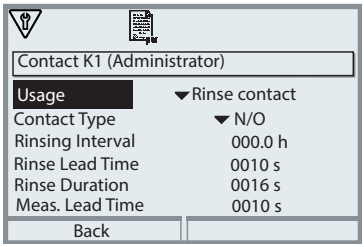
Relay Contacts: Sensoface Messages

Parameter Setting > BASE Module > Contact K... > Usage > Sensoface
Note: Function check (HOLD) active

Menu	Display	Action
par		**Assign Sensoface Messages to Relay Contacts** When more than one measuring module is used, the Sensoface messages of the modules can be assigned to different contacts.
		Relay Contacts, Usage 1) Parameter Setting 2) Enter passcode. 3) BASE module 4) Contact K... (e.g. K1) 5) Assign Sensoface message of desired measuring module to selected relay contact.
		Set Contact Parameters • Contact type (e.g. "N/O") • Switch-on and switch-off delay

Relay Contacts: Rinse Contact

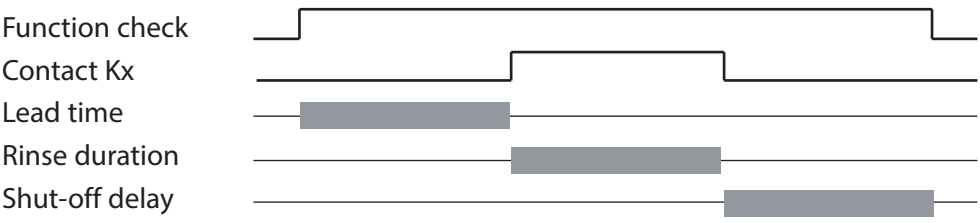
Parameter Setting > BASE Module > Contact K... > Usage > Rinse Contact
Note: Function check (HOLD) active

Menu	Display	Action
		**Relay Contacts, Usage** 1) Parameter Setting 2) Enter passcode. 3) BASE module 4) Contact K... (e.g. K1) 5) Usage: Rinse contact
		**Set Rinse Contact Parameters** • Select contact type (e.g. "N/O") • Specify rinsing interval • Specify rinse duration • Lead time: Function check (HOLD) is active during the defined "... Lead Time" • Logbook entry: off/on

Please Note when Configuring the "Rinse Contact" Function

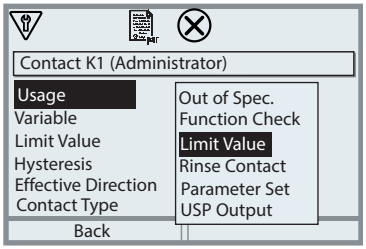
- The "function check" (HOLD) mode (e.g. during parameter setting) delays the execution of the "rinse contact" function.
- Up to 3 rinse functions (contacts K1 ... K3) can be configured independently of each other.
- The individual rinse functions are not synchronized with each other.

Time Response

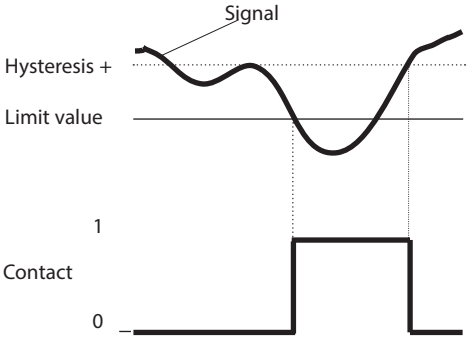


Relay Contacts: Limit Value

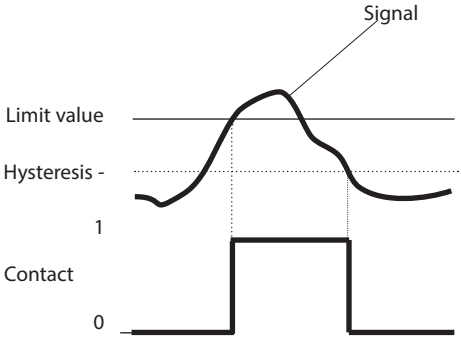
Parameter Setting > BASE Module > Contact K... > Usage
Note: Function check (HOLD) active

Menu	Display	Action
		**Relay Output: Limit Value** 1) Parameter Setting 2) Enter passcode. 3) BASE module 4) Contact K... 5) Usage: Limit Value

"Minimum" Effective Direction



"Maximum" Effective Direction



Icons in the Measurement Display

▼ Measured value falls below limit ▲ Measured value exceeds limit

Hysteresis
Tolerance band around the limit value, within which the contact is not actuated. Serves to obtain appropriate switching behavior at the output and suppress slight fluctuations of the measured variable (fig.)

Contact Type
Specifies whether the active contact is closed (N/O) or open (N/C).

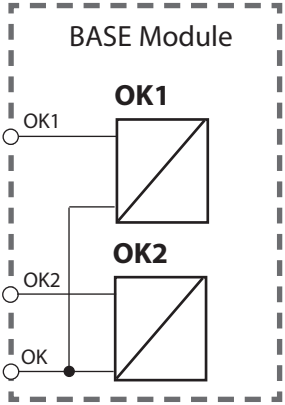
Optocoupler Inputs OK1, OK2

Menu Selection: Parameter Setting>BASE Module>Control Inputs OK1, OK2
Note: Function check (HOLD) active

Menu	Action
par	**OK1 Usage** 1) Parameter Setting 2) Enter passcode 3) BASE Module 4) Control Inputs OK1/OK2 5) OK1 Usage
	OK1/OK2 Input Level 1) Parameter Setting 2) Enter passcode 3) BASE Module 4) Control Inputs OK1/OK2 5) OK... Input 6) Specify active input level

The BASE module provides 2 digital optocoupler inputs (OK1, OK2).
The following functions (depending on the parameter setting) can be started via a control signal:

- OK1: "Off" or "Funct. Check Total" or "Funct. Check Channel"
- OK2: Selection in menu Parameter Setting > System Control > Function Control: "Off", "Parameter Set A/B"
(see also page 53)



The switching level for the control signal must be specified:
(active 10 ... 30 V or active < 2 V).

Memory Card

Inserting/Removing the Memory Card

Safety Instructions

All memory cards are available in a non-Ex and an Ex version.
Never mix Ex and non-Ex components.
When working in a hazardous location, observe all applicable local and national codes and standards for the installation of electrical equipment in explosive atmospheres.
See the information in the Safety Guide for Protos II 4400(X).

Notes on Using the Memory Card

The device must be opened to insert or replace the memory card.
Power can remain on.
When closing the device, make sure that the sealing is properly seated and clean.

⚠ **WARNING!** Shock potential.
Make sure the device is de-energized before reaching into the terminal compartment.

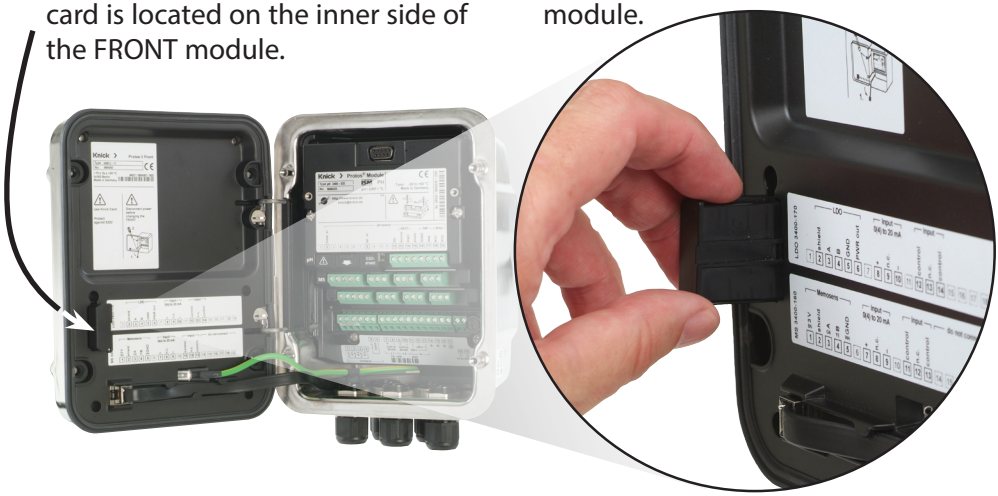
Opening the Device

1) Loosen the 4 front screws.
2) Open the FRONT module at its right side (pivot hinge inside at the left).

The slot for inserting the memory card is located on the inner side of the FRONT module.

Inserting the Memory Card

3) Take the memory card out of its packaging.
4) Insert the memory card with the connections at the front into the memory card slot of the FRONT module.



Removing the Memory Card
When using a Data Card:
The memory card must be closed before removal in order to avoid data loss (see Maintenance chapter, p. 89).
Menu Selection:
Maintenance > Open/Close Memory Card > Close Memory Card
The memory card icon will no longer appear on the display.

If the memory card is not removed after being closed, it must be opened again for reactivation.
Menu Selection:
Maintenance > Open/Close Memory Card > Open Memory Card

If using a different memory card, e.g. an FW Update Card, this step can be omitted.

Memory Card

Card Types

Card Types (ZU1080-P-*)	Purpose
Data Card (X)	Records data
FW Update Card (X)	Firmware update for function expansion
FW Repair Card (X)	Firmware repair in case of malfunction
Custom FW Update Card	Customer-specific FW versions
Custom FW Repair Card	Customer-specific FW versions

Data Card
This type of card allows the storage of data (e.g. configuration, parameter sets, logbook, measurement recorder data). The icon blinks to indicate active data transmission. The Data Card can be used in combination with the following add-on functions: FW4400-102 5 Parameter Sets, FW4400-103 Measurement Recorder, FW4400-104 Logbook

FW Update Card
This memory card enables firmware updates (add-on function FW4400-106). In this case, the previous operating program of the device (“firmware“) will be replaced by a new version.
Note: Before the firmware update, we recommend saving the previous version on the memory card.
General data cannot be stored on an FW Update Card.

FW Repair Card
Memory card for firmware updates in the event of device errors.
The add-on function FW4400-106 is not required here.

Custom FW Update/Repair Card
When using custom cards, the firmware version can be selected, e.g. in order to standardize the firmware of all available devices.

Memory Card

Connection to Computer
Connect the memory card to the computer via a micro USB cable.

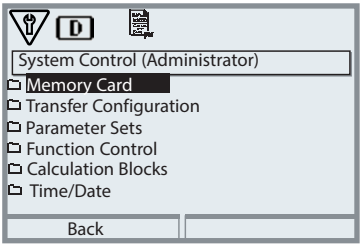
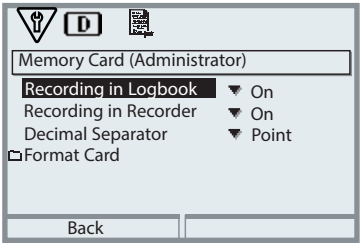
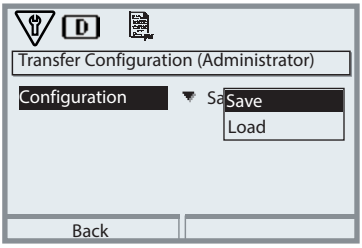
Micro USB port

Protos II 4400(X)
system connection

Note: Outside the hazardous location, the Ex memory card may be connected to a normal computer.

Memory Card

Parameter Setting > System Control > Memory Card

Menu	Display	Action
		Using the Data Card 1) Insert the Data Card 2) Menu selection 3) Parameter Setting, Administrator Level 4) Enter passcode. 5) System Control: Memory Card
par	 	When the Data Card is inserted, the display shown on the left appears. (The "Memory Card" line is displayed only if a Data Card is in the slot.) • Select "Memory Card", press **enter** to confirm. The menu is self-explanatory. **Behavior when the memory card is full:** Alert that recording has stopped (card replacement necessary).
		**Transfer Configuration** (See next page) • Save: Save all device data on the Data Card • Load: Overwrite all device data with the data from the Data Card **Note:** Close Data Card before removing (Maintenance menu)

Memory Card

Data Card: Save/Load Device Configuration
Parameter Setting > System Control > Transfer Configuration.

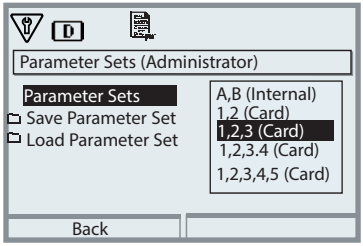
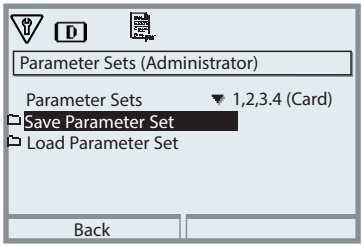
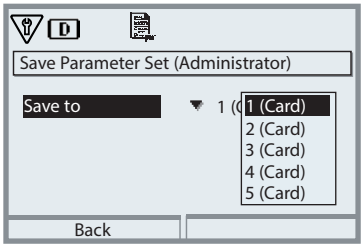
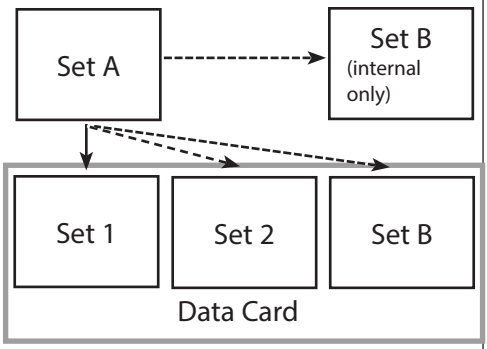
Saving/Loading the Complete Device Configuration
"Save" configuration means that the complete device configuration (except the passcode) is written on the Data Card.
"Load" configuration means that the complete device configuration is read from the Data Card and programmed.
Backup file generated on the Data Card: param/config.par

Transferring Complete Device Configuration from One Device to Further Devices
Prerequisite:
The devices have the same hardware equipment,
the modules are all placed in the same slots
(e.g. PH 3400 -035 in slot I, COND 3400-041 in slot II, etc.).
Options (add-on functions)
All required options must be enabled in the "master device", the options in the "slave devices" can be a subset of them.
The option parameters, not the options themselves, are transferred.
When an option is enabled in a "slave device" at a later point in time, the parameters of this option are already initialized according to the master device.

1) Write device configuration of configured device on Data Card:
   Parameter Setting > System Control > Transfer Configuration > Save:
   Softkey "Execute"
2) Change to Maintenance menu. Select "Close Memory Card".
3) Remove the Data Card. Now you can transfer the device configuration to further identically equipped devices.
4) To do so, insert the Data Card containing the configuration in the next device to be configured.
5) Select
   Parameter Setting > System Control > Transfer Configuration > Load:
   Softkey "Execute"
6) Change to Maintenance menu. Select "Close Memory Card".
7) Remove the Data Card.

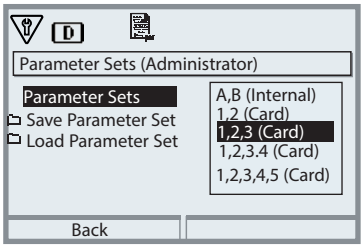
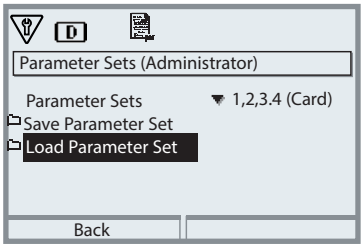
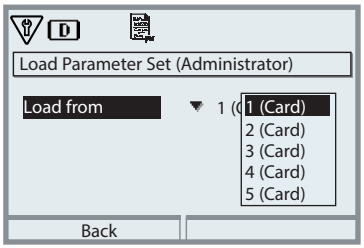
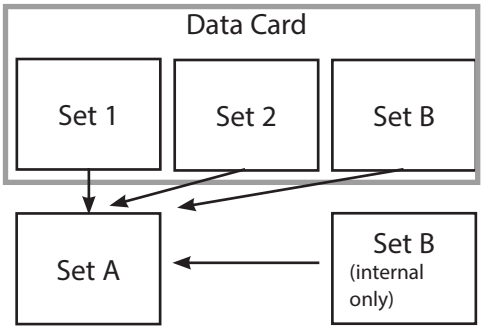
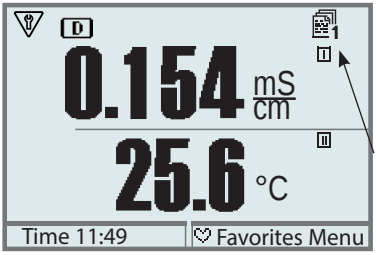
FW4400-102: 5 Parameter Sets

Parameter Setting > System Control > Parameter Sets
Note: Add-on function FW4400-102 required.

Menu	Display	Action
	  	**Saving a Parameter Set on the Data Card** 1) Parameter Setting 2) System Control 3) “Parameter Sets” (fig.) 2 complete parameter sets (A, B) are stored in the device. Up to 5 parameter sets can be loaded to the Data Card. To do so, a parameter set (1, 2, 3, 4 or 5) on the Data Card is overwritten by the device-internal parameter set A. Select parameter set from Data Card  The parameter set is saved as a file on the Data Card.

FW4400-102: 5 Parameter Sets

Parameter Setting >System Control > Parameter Sets

Menu	Display	Action
par		**Loading a Parameter Set from the Data Card** 1) Parameter Setting 2) System Control 3) “Parameter Sets” (fig.)
		2 complete parameter sets (A, B) are stored in the device. 5 parameter sets can be stored on the Data Card. One of those can be saved as parameter set A to the device:
		 • Select parameter set to be loaded. The activated parameter set is displayed in measuring mode. **Note:** Remote switching between A and B is possible via the OK2 input.
		

FW4400-106: Firmware Update

The firmware update with add-on function FW4400-106 is activated by TAN in the device (see p. 54). The firmware for the update is available separately.
The device replaces its own firmware (operating program) by the supplied FW version on the FW Update Card ("update").

NOTICE!
The device is not operable during a firmware update. Its outputs are in an undefined state.
After a firmware update, the configuration must be checked.

Note:
First check whether your device really requires a firmware update.
To check your installed firmware version, go to:
Menu Selection/Diagnostics/Device Description/FRONT Module

This icon indicates that a FW Update Card is inserted in the slot. The Update Card enables storage of the current device firmware on the card as well as loading of new firmware into the device.

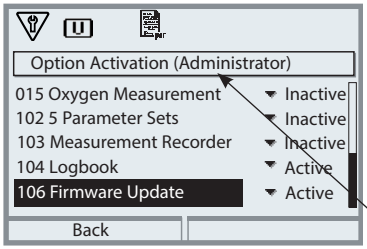
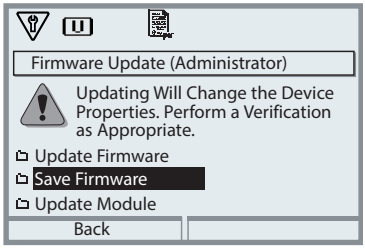
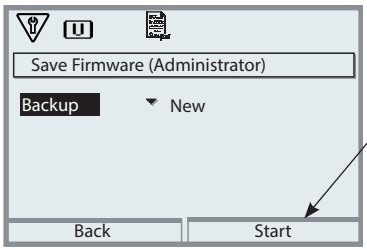
1) Place the Update Card in the card slot (see p. 78)
2) Recommendation:
   Save the firmware currently installed in your device (p. 87)
3) Load the firmware update as described on p. 88.

Procedure with FW Repair Card:
1) Switch off device
2) Place card in card slot
3) Switch on device
4) The automatic update process starts.

Note: The firmware update add-on function need not be active for trouble-shooting with the FW Repair Card.

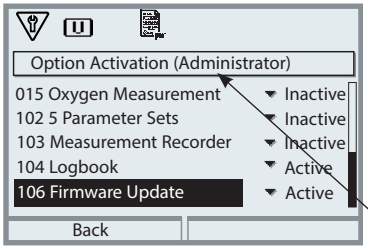
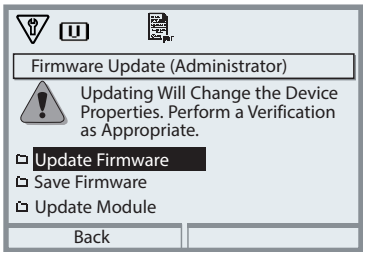
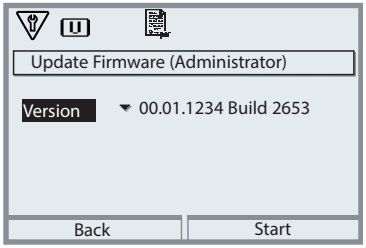
Firmware Update: Save Firmware

Parameter Setting > System Control > Firmware Update > Save Firmware

Menu	Display	Action
par		**Save Firmware** 1) Insert the FW Update Card. 2) Menu Selection: Parameter Setting, Administrator Level 3) Enter passcode. 4) System Control **Select Option Activation** (Firmware update FW4400-106) Set option to “active”. Enter the TAN at the prompt. The option is available after the TAN has been entered.
	 	**Perform Backup** 1) System Control: Firmware Update 2) Select “Save Firmware” 3) “Start” starts the process. When the backup process has finished, the device returns to measuring mode. 4) Remove the memory card or carry out a firmware update (see next page).

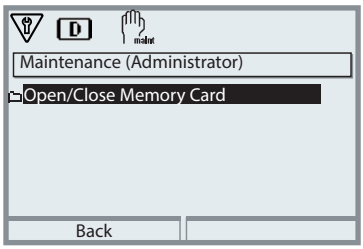
Firmware Update: Load Firmware

Parameter Setting > System Control > Firmware Update > Load Firmware

Menu	Display	Action
par	  	**Firmware Update** 1) Insert the FW Update Card. 2) Select menu: Parameter Setting, Administrator Level 3) Enter passcode. 4) System Control **Select Option Activation** (Firmware Update FW4400-106) Set option to "Active". Enter the TAN at the prompt. The option is available after the TAN has been entered. **Perform Update:** 1) System Control: Firmware Update 2) Select "Update Firmware". 3) Select a version using the arrow keys. 4) Confirm with **enter**. 5) Start the firmware update with the "Start" softkey. When the update has finished, the unit will return to measuring mode. 6) Remove the memory card **Update Module Firmware** A firmware update can also be carried out for specific modules. 1) Select "Update Module". 2) Select a module. 3) Proceed as set out above.

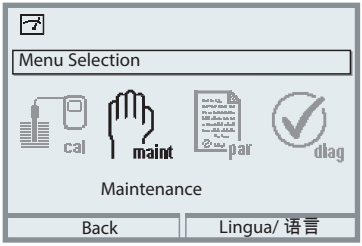
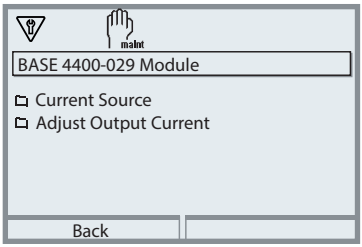
Maintenance Functions

Closing a Memory Card
Maintenance > Open and Close Memory Card
Note: Function check (HOLD) active

Menu	Display	Action
maint		***NOTICE!* Close memory card prior to removing** Otherwise you risk losing data. **Remove the Memory Card** 1) Menu Selection: Maintenance 2) Open/Close Memory Card 3) "Close" memory card The card icon will no longer appear on the display. "Close Memory Card" to terminate access to the memory card. Must be executed before removing the card from the memory card slot to prevent data loss. **Open the Memory Card** If the card is not removed after being closed, it must be opened again for reactivation. 1) Menu Selection: Maintenance 2) Open/Close Memory Card 3) "Open Memory Card" The memory card icon appears on the display again.

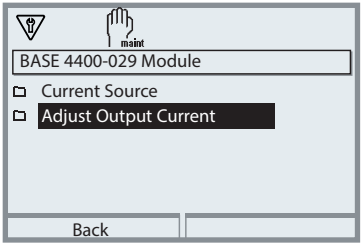
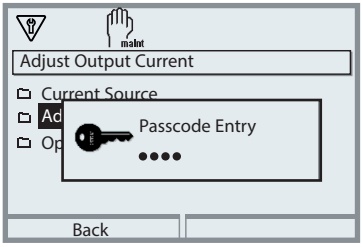
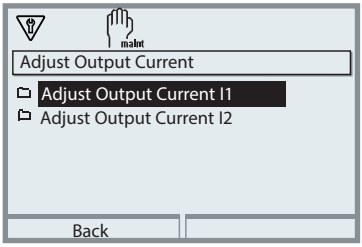
Maintenance Functions

Maintenance > BASE ... Module
Note: Function check (HOLD) active

Menu	Display	Action
maint	 	**Open the Maintenance Menu** From measuring mode: Press **menu** key to select menu. Select Maintenance using arrow keys, confirm using **enter**. Then select "Module BASE". **Current Source** For testing purposes, the output current can be manually specified (range 0 ... 22 mA).

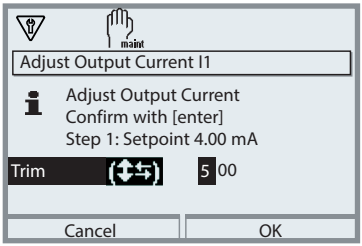
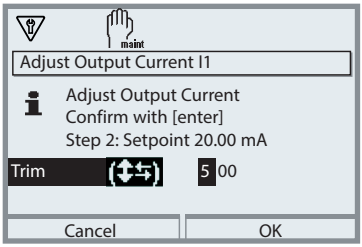
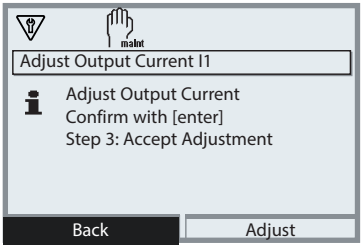
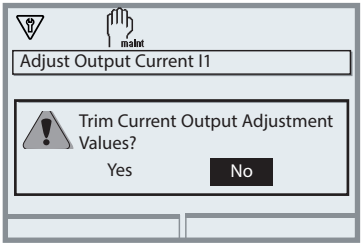
Maintenance Functions

Maintenance > BASE ... Module > Adjust Output Current I...
Note: Function check (HOLD) active

Menu	Display	Action
maint		**Adjusting the Current Outputs** Use the arrow keys to select "Adjust Output Current", press **enter** to confirm.
		Enter the passcode: 2014 (preset)
		Select the current output to be adjusted.

Maintenance Functions

Maintenance > BASE ... Module > Adjust Output Current I...
Note: Function check (HOLD) active

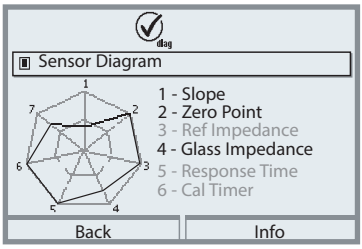
Menu	Display	Action
maint		**First Adjustment Step: 4 mA** Select the desired output current using the arrow keys. The adjustment range is limited to approx. ± 0.5 mA (0 … 999 counts). Then press the "OK" softkey to save the value for 4 mA.
		**Second Adjustment Step: 20 mA** Select the desired output current using the arrow keys. The adjustment range is limited to approx. ± 0.5 mA (0 … 999 counts). Then press the "OK" softkey to save the value for 20 mA.
		**Third Step:** Use the "Adjust" softkey to adjust the current output with the two saved values. Prior to final adjustment, a confirmation prompt appears and must be confirmed with the "Yes" softkey.
		***NOTICE!*** If the function is called again, it starts the adjustment with the default values; adjustment must be carried out again from scratch! Current output 2 can be adjusted in the same way.

Diagnostic Functions

Overview
Selected Diagnostic Functions for Quality Management

To meet the quality management requirements, Protos provides comprehensive diagnostics and safety functions such as Sensocheck sensor monitoring, a logbook for recording function activations with FW4400-104, and NAMUR messages with indication of date and time.
Further features are:

Sensor Diagram
(PH and OXY modules only, in Diagnostics menu of the module)



Example: Radar chart for a digital pH sensor (Memosens)

The sensor diagram clearly indicates the status of the following parameters in the connected sensor:

- Slope
- Zero point (operating point with Memosens ISFET)
- Sensocheck (pH) or leakage current (ISFET and Oxy)
- Response time
- Calibration timer
- Wear (Memosens)

Parameters that cannot be checked are shown as inactive (gray) and set to 100% (e.g. Sensocheck with analog sensors).
The parameter values should lie between the outer (100%) and inner (50%) hexagon.

Diagnostic Functions

Overview
Selected Diagnostic Functions for Quality Management

Sensor Monitor
Shows the available raw measured values of the connected sensor:
(in the Diagnostics menu of the measuring module)

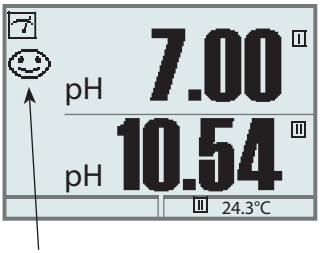
pH Analog	mV, temperature, temperature probe, temperature resistor
pH Digital Glass	mV, temperature, glass impedance
pH Digital ISFET	mV, leakage current, temperature
pH ORP	mV, temperature
Cond Analog	Resistance, conductance, temperature, temperature probe, temperature resistor
Cond Digital	Resistance, conductance, temperature
Oxy Digital	Sensor current, leakage current, polarization voltage, partial pressure, air pressure, temperature
Oxy Digital Optical	Partial pressure, temperature

Diagnostic Functions

Sensocheck/Sensoface

Sensoface

Sensoface is a graphic indication of the sensor condition.



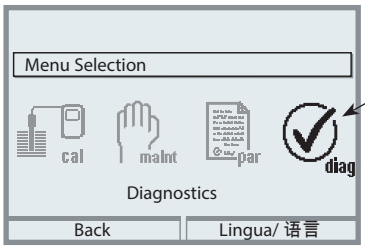
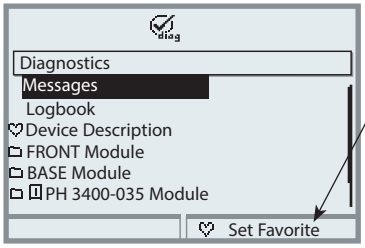
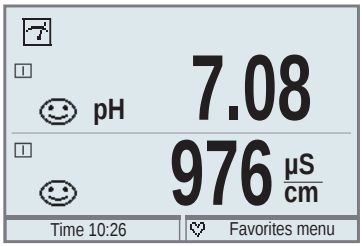
The “smileys” provide information on wear and required maintenance of the sensor (“friendly”– “neutral”– “sad”).

Sensocheck Sensor Monitoring

Module	Sensocheck function
OXY:	Monitoring membrane/electrolyte
COND(I):	Information on sensor condition
PH:	Automatic monitoring of glass and reference electrode

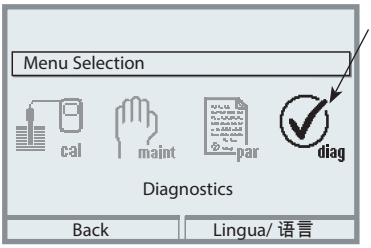
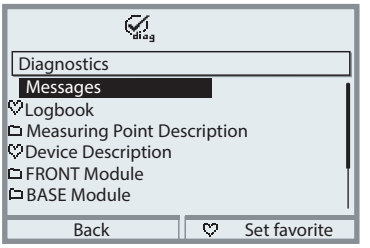
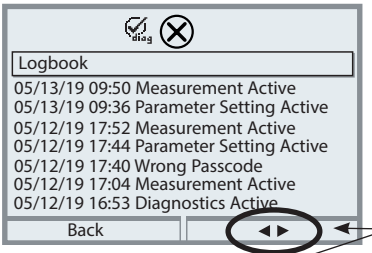
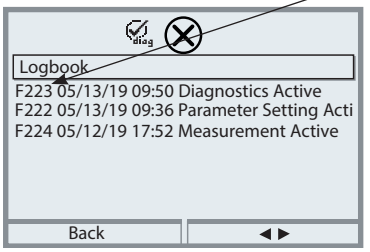
Menu	Display	Action
par	Parameter Setting (Administrator) System Control FRONT Module BASE Module PH 3400-035 Module PH 3400-035 Module Back	**Activate Sensocheck** 1) Parameter Setting, Administrator Level 2) Enter passcode. 3) Measuring module (e.g. “PH”) 4) Sensor Data > Sensor Monitoring Details 5) Monitoring: On 6) Message: Off, Failure, Maintenance Required

Note: Sensocheck messages can be assigned to a relay contact.
(Parameter Setting > BASE Module > Contact > Usage)

Menu	Display	Action
diag		**Favorites Menu** Diagnostic functions can be called up directly from the measuring mode using a softkey. The "Favorites" are selected in the Diagnostics menu. **Select Favorites** Press **menu** key to select menu. Select Diagnostics using arrow keys, press **enter** to confirm.
		Set/delete favorite: "Set Favorite" allows activation of the selected diagnostic function directly from the measuring mode via softkey. The respective function is marked with a heart icon.
		Pressing the **meas** key returns to measurement. When the softkey has been assigned to "Favorites", "Favorites Menu" is read in the secondary display. (See Softkey Function, p. 45) Diagnostic functions set as "Favorites" can be called directly by softkey in measuring mode.

Diagnostic Functions

General Status Information of the Measuring System

Menu	Display	Action
diag		**Open the Diagnostics Menu** From the measuring mode: Press **menu** key to select menu. Select Diagnostics using arrow keys, press **enter** to confirm.
		The "Diagnostics" menu gives an overview of all functions available. Functions which have been set as "Favorite" can be directly accessed from the measuring mode.
		**Logbook** Always shows the last 100 events with date and time, e.g. calibrations, NAMUR messages, power failure etc. Pressing the right softkey displays the message identifier.
		With add-on function FW4400-104, 20,000 entries or more can be saved on a memory card, see p. 98. This permits quality management documentation as required by ISO 9001.

Add-On Function FW4400-104: Logbook

The logbook uses the FW4400-104 add-on function to record all entries in a file. When using the Data Card, 20,000 entries or more can be stored on the Data Card, depending on the memory load.
Select menu: Parameter Setting > System Control > Memory Card > Recording in Logbook On

A new file is generated for each month. The date is encoded in the file name.

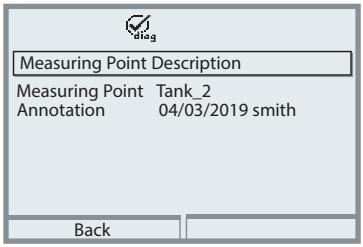
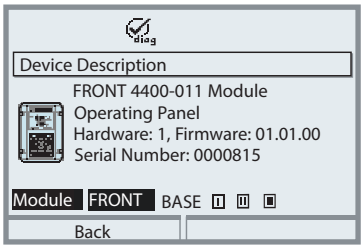
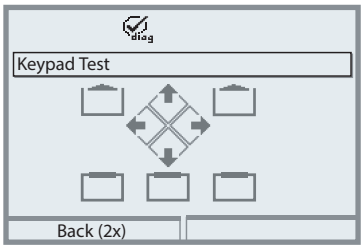
Example for a file generated on the Data Card:
\LOGBOOK\L_YYMM00.TXT Recorder data of YYMM
(YY = year, MM = month)

The data is recorded as ASCII file with the extension .TXT. The individual columns are separated by tabs. This makes the file readable with word processing or spreadsheet programs (e.g. Microsoft Excel). Each time the Data Card is inserted in the slot, a "Device Info" consisting of Model number, BASE serial number and tag number is written. Thus, a Data Card can also be used to collect the logbook data of several devices.

Example:

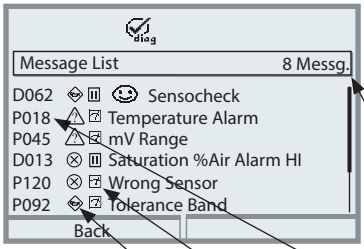
```
LOGBOOK

No.    Time Stamp         Status   Message

<< PROTOS 4400 - Serial 5555555                    >>
F224   06/28/2019 16:13:37        Main Menu Active
F225   06/28/2019 16:13:48        Measurement Display Active
F223   06/28/2019 16:13:52        Diagnostics Menu Active
F225   06/28/2019 16:13:54        Measurement Display Active
F224   06/28/2019 16:14:01        Main Menu Active
F222   06/28/2019 16:14:09        Parameter Setting Active
F227   06/28/2019 16:16:58        Power Supply ON
B072   06/28/2019 16:17:04   (x)  Current I1 > 20 mA
```

Time stamp	Time stamp of logbook entry
Status	(x) - Message activated ( ) - Message deactivated
Message	Message text (in selected operator language)

Menu	Display	Action
diag		**Measuring Point Description** Displays point of measurement and annotations. Entry in menu Parameter Setting > System Control > Meas. Point Description, see p. 54
		**Device Description** Provides information on all modules installed: Module type and function, serial number, hardware and firmware versions and device options (example: FRONT).
		**FRONT Module** The module contains the display and keypad control. Test possibilities: • Module Diagnostics • Display Test • Keypad Test (fig.) (Correct functioning of each key can be checked by pressing it down.)
		BASE Module The module generates the standard output signals. Test possibilities: • Module Diagnostics • Input/Output Status

Diagnostic Functions

General status information of the measuring system
Menu Selection: Diagnostics > Messages

Menu	Display	Action
diag		**Message List** Shows the currently activated warning or failure messages in plain text. (See tables on following pages.) **Number of messages** When there are more than 7 messages, a vertical scrollbar appears. Scroll with the up/down arrow keys. **Message identifier** See message list for description. **Module identifier** Specifies the module that has generated the message. **NAMUR icon** Shows the message type: ◈ Maintenance request ⚠ Out of specification ⊗ Failure

Messages

FRONT 4400-011 / 4400X-015 Module

⊗ Failure ⚠ Out of specification ◈ Maintenance request

No.	Message type	FRONT message
F008	Failure	Meas. Processing (factory settings)
F009	Failure	Firmware Error
F029	Failure	No Sensor Connected
F030	Failure	Wrong Sensor Connected
F031	Failure	No Module Connected
F032	Info	Sensor Detected
F033	Info	Sensor Removed
F034	Info	Module Identified
F035	Info	Module Removed
F036	Info	Sensor Devaluated
F037	Info	Firware Update Required
F038	Info	Sensor Defective
F190	Info	Measurement Recorder Full
F191	Info	Measurement Recorder Data Inconsistent
F200	Failure	Configuration Data Loss
F201	Failure	Communications Error (system bus)
F202	Failure	System Failure
F203	Failure	Configuration Inconsistent
F210	Maint. request	Device Diagnostics (self test signals error)
F211	Maint. request	Memory Card Error
F212	Maint. request	Time/Date
F213	Maint. request	Module Temperature (range exceeded)
F215	Maint. request	Memory Card Full

FRONT 4400-011 / 4400X-015 Module

⊗ Failure ⚠ Out of specification ◈ Maintenance request

No.	Message type	FRONT message
F220	Info	Calibration Menu Active
F221	Info	Maintenance Menu Active
F222	Info	Parameter Setting Menu Active
F223	Info	Diagnostics Menu Active
F224	Info	Main Menu Active
F225	Info	Measurement Display Active
F226	Info	Power Supply OFF
F227	Info	Power Supply ON
F228	Info	Firmware Update
F229	Info	Wrong Passcode
F230	Info	Factory Setting
F231	Info	Configuration Changed
F232	Failure	Module Equipment Ex/Non Ex
F233	Failure	Module Equipment Ex
F234	Info	Key Lock Active
F240	Info	Calibration Mode Active

BASE 4400-029 / 4400X-025/VPW / 4400X-026/24V Module

⊗ Failure ⚠ Out of specification ◈ Maintenance request

No.	Message type	BASE message
B008	Failure	Meas. Processing (factory settings)
B009	Failure	Firmware Error
B070	Maint. request	Current I1: Span
B071	Maint. request	Current I1 < 0/4 mA
B072	Maint. request	Current I1 > 20 mA
B073	Failure	Current I1: Load Error
B074	Maint. request	Current I1: Parameter
B075	Maint. request	Current I2: Span
B076	Maint. request	Current I2 < 0/4 mA
B077	Maint. request	Current I2 > 20 mA
B078	Failure	Current I2: Load Error
B079	Maint. request	Current I2: Parameter
B100	Info	Current: Manual Control
B101	Info	Relay: Manual Control
B102	Info	Analog Controller: Manual Control
B102	Info	Digital Controller: Manual Control
B200	Info	Rinse Contact Active
B201	Info	Contact Function Check
B254	Info	Module Reset

Protos II 4400 Specifications

Display[1)]	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 double assignment [meas] [menu] [cursor keys] [enter] [softkey 1] [softkey 2], NAMUR LED red and green.	
Logbook	Records function call-ups, NAMUR messages upon occurrence and disappearance with date and time. The last 100 events are displayed in the Diagnostics menu, without memory card or TAN.	
Storage capacity (FW4400-104)	Min. 20,000 entries, depending on capacity of memory card	
Measurement recorder (FW4400-103)	4-channel measurement recorder with marking of events (failure, maintenance request, function check, limit values) for a measured value	
Recording medium	Memory card	
Recording capacity	Min. 20,000 entries, depending on capacity of memory card	
Recording	Process variables and range freely adjustable	
Type of recording	Current value, min/max value, average	
Device self-test	Test of RAM, FLASH, EEPROM, display and keypad	
Clock	Real-time clock with date	
Power reserve	Approx. 1 day	
Data retention in case of power failure	Parameters and factory settings Logbook, statistics, records Measurement recorder or memory card (optional)	> 10 years (EEPROM) > 10 years (flash)
Module slots	3	

Protos II 4400 Specifications

Power supply (terminals 18/19) (BASE module 4400-029)	24 (– 15 %) ... 230 (+ 10 %) V AC/DC approx. 18 VA/10 W, AC: 48 ... 62 Hz
Overvoltage category	II
Protection class	I
Terminals, inside	Tightening torque 0.5 ... 0.6 Nm
Wiring	Single or stranded wires 0.2 ... 2.5 mm²
	Stripping length max. 7 mm
	Temperature resistance > 75 °C / 167 °F
Equipotential bonding clamp PA	Tightening torque 1 Nm
	Cross section > 4 mm²
Protection against electric shock (terminal 17)	Protective conductor terminal acc. to EN 61010-1
Input OK 1 [2] **(terminals 11/13)**	Galvanically separated (optocoupler)
	Vi ≤ 30 V, floating, galvanic isolation up to 60 V
Function	Switches the device to HOLD mode (function check)
Switching voltage	0 ... 2 V AC/DC inactive
	10 ... 30 V AC/DC active (can be inverted)
	Control current 5 mA
Input OK 2 [2] **(terminals 12/13)**	Galvanically separated (optocoupler)
	Vi ≤ 30 V, floating, galvanic isolation up to 60 V
Function	Switching to second parameter set
Switching voltage	0 ... 2 V AC/DC inactive
	10 ... 30 V AC/DC active (can be inverted)
	Control current 5 mA
Current output I1 [2] **(terminals 7/8)**	0/4... 20 mA (22 mA), max. 10 V,
	Galvanic isolation up to 60 V
	(galvanically connected with output I2)
Load monitoring	Error message if load is exceeded
Overrange	22 mA in the case of a message
Measurement error [3]	< 0.2 % of current value + 0.02 mA
Current source	0.00 ... 22.00 mA

Protos II 4400 Specifications

Current output I2 [2]	0/4 ... 20 mA (22 mA), max. 10 V,
(terminals 9/10)	galvanic isolation up to 60 V
	(galvanically connected with output I1)
Load monitoring	Error message if load is exceeded
Overrange	22 mA in the case of a message
Measurement error [3]	< 0.2 % of current value + 0.02 mA
Current source	0.00 ... 22.00 mA
Relay contacts [2]	4 relay contacts K1 ... K4, floating
(terminals 1/2/3/4/5/6)	Galvanic isolation up to 60 V
	K1, K2, K3 are interconnected on one side
Load capability	AC: < 30 V / < 3 A, < 90 VA
	DC: < 30 V / < 3 A, < 90 W
Usage	K1 - K3, user-definable as NAMUR maintenance request/ HOLD, limit values, parameter set B active, rinse contact, USP output, Sensoface, controller alarm
	K4 dedicated assignment as alarm contact (NAMUR failure)
RoHS conformity	According to EU directive 2011/65/EU
EMC	EN 61326-1, EN 61326-2-3
	NAMUR NE 21
Emitted interference	Industrial applications[4] (EN 55011 Group 1 Class A)
Interference immunity	Industrial applications
Lightning protection	to EN 61000-4-5, Installation class 2
Rated operating conditions	
Ambient temperature	-20 ... 55 °C / -4 ... 131 °F
Relative humidity	5 ... 95 %
Climatic class	3K5 according to EN 60721-3-3
Location class	C1 according to EN 60654-1
Pollution degree	2
Transport/storage temperature	-20 ... 70 °C / -4 ... 158 °F

Protos II 4400 Specifications

Housing	Protos II 4400 C: Stainless steel, coated Protos II 4400 S: Stainless steel, polished, 1.4305
Mounting	Wall mounting Pipe mounting Panel mounting, sealed against panel
Dimensions	See dimension drawing, p. 12
Degree of protection	IP65/NEMA 4X
Cable glands	5 knockouts for cable glands M20 x 1.5 A/F 24 mm WISKA Model ESKV M20
Clamping ranges	Standard sealing insert: 6 ... 13 mm Reduction sealing insert: 4 ... 8 mm Multiple sealing insert: 5 ... 6.5 mm
Tensile load	Not permitted, suitable for "fixed installation" only
Tightening torque	Connecting thread: 2.3 Nm Cap nut: 1.5 Nm
Weight	Approx. 3.2 kg / 7.05 lb plus approx. 160 g / 0.35 lb per module

1) ***NOTICE!*** Never expose the display to strong direct sunlight.
When the ambient temperature is below 0 °C / 32 °F, the LC display may have limited readability.
This will not adversely affect the device functions.
2) User-definable
3) At rated operating conditions
4) This equipment is not designed for domestic use, and is unable to guarantee adequate protection of the radio reception in such environments.

Protos II 4400X Specifications

Display[1)]	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 double assignment [meas] [menu] [cursor keys] [enter] [softkey 1] [softkey 2], NAMUR LED red and green.
Logbook	Records function call-ups, NAMUR messages upon occurrence and disappearance with date and time. The last 100 events are displayed in the Diagnostics menu, without memory card or TAN.
Storage capacity (FW4400-104)	Min. 20,000 entries, depending on capacity of memory card
Measurement recorder (FW4400-103)	4-channel measurement recorder with marking of events (failure, maintenance request, function check, limit values) for a measured value
Recording medium	Memory card
Recording capacity	Min. 20,000 entries, depending on capacity of memory card
Recording	Process variables and range freely adjustable
Type of recording	Current value, min/max value, average
Device self-test	Test of RAM, FLASH, EEPROM, display and keypad
Clock	Real-time clock with date
Power reserve	Approx. 1 day
Data retention in case of power failure	Parameters and factory settings > 10 years (EEPROM) Logbook, statistics, records > 10 years (flash) Measurement recorder or memory card (optional)
Module slots	3
Explosion protection	EU-Type Examination Certificate KEMA 03ATEX2530 IECEx Certificate of Conformity IECEx DEK 11.0054 JPEx Certificates DEK23.0087/DEK23.0088 Ex eb ib mb [ia Ga] IIC T4 Gb For entity parameters, see attachment to certificates or control drawings.

Protos II 4400X Specifications

Power supply (terminals N/L/PE) (BASE 4400X-025/VPW module)	100 (– 15 %) ... 230 (+ 10 %) V AC < 15 VA, 48 ... 62 Hz
or	
Power supply (terminals L1/L2/PE) (BASE 4400X-026/24V module)	AC 24 V (- 15 %, + 10 %) < 15 VA, 48 ... 62 Hz DC 24 V (- 15 %, + 20 %) < 8 W
Overvoltage category	II
Protection class	I
Terminals, inside Wiring	Tightening torque 0.5 ... 0.6 Nm Single or stranded wires 0.2 ... 2.5 mm² Stripping length max. 7 mm Temperature resistance > 75 °C / 167 °F
Equipotential bonding clamp PA	Tightening torque 1 Nm Cross section > 4 mm²
Protection against electric shock (terminal PE)	Protective conductor terminal acc. to EN 61010-1
Input OK 1 [2] **(terminals 30/31)**	Galvanically separated (optocoupler) Vi ≤ 30 V, floating, galvanic isolation up to 60 V
Function	Switches the device to HOLD mode (function check)
Switching voltage	0 ... 2 V AC/DC inactive 10 ... 30 V AC/DC active (can be inverted) Control current 5 mA
Input OK 2 [2] **(terminals 30/33)**	Galvanically separated (optocoupler) Vi ≤ 30 V, floating, galvanic isolation up to 60 V
Function	Switching to second parameter set
Switching voltage	0 ... 2 V AC/DC inactive 10 ... 30 V AC/DC active (can be inverted) Control current 5 mA
Current output I1 [2] **(terminals 51/52)**	0/4... 20 mA (22 mA), max. 10 V Galvanic isolation up to 60 V (galvanically connected with output I2)
Load monitoring	Error message if load is exceeded
Overrange	22 mA in the case of a message
Measurement error [3]	< 0.2 % of current value + 0.02 mA
Current source	0.00 ... 22.00 mA

Current output I2 [2] **(terminals 53/54)**	0/4 ... 20 mA (22 mA), max. 10 V, galvanic isolation up to 60 V (galvanically connected with output I1)
Load monitoring	Error message if load is exceeded
Overrange	22 mA in the case of a message
Measurement error [3]	< 0.2 % of current value + 0.02 mA
Current source	0.00 ... 22.00 mA
Relay contacts [2] **(terminals 61/63/65/60/71/72)**	4 relay contacts K1 ... K4, floating Galvanic isolation up to 60 V K1, K2, K3 are connected on one side
Load capability	DC: < 30 V / < 500 mA, < 10 W
Usage	K3- K3, user definable as NAMUR maintenance request/ HOLD, limit values, parameter set B active, rinsing contact, USP output, Sensoface K4 permanently set as alarm contact (NAMUR failure)
RoHS conformity	According to EU directive 2011/65/EU
EMC	EN 61326-1, EN 61326-2-3 NAMUR NE 21
Emitted interference	Industrial applications[4] (EN 55011 Group 1 Class A)
Interference immunity	Industrial applications
Lightning protection	to EN 61000-4-5, Installation class 2

Protos II 4400X Specifications

Rated operating conditions	
Ambient temperature	-20 ... 50 °C / -4 ... 122 °F
Relative humidity	5 ... 95%
Climatic class	3K5 according to EN 60721-3-3
Location class	C1 according to EN 60654-1
Pollution degree	2
Transport/storage temperature	-20 ... 70 °C / -4 ... 158 °F
Housing	Protos II 4400X C: Stainless steel, coated Protos II 4400X S: Stainless steel, polished, 1.4305
Mounting	Wall mounting Pipe mounting Panel mounting, sealed against panel
Dimensions	See dimension drawing, p. 12
Degree of protection	IP65/NEMA 4X
Cable glands	5 knockouts for cable glands M20 x 1.5 A/F 24 mm WISKA Model ESKE/1 M20
Clamping ranges	Standard sealing insert: 7 ... 13 mm Reduction sealing insert: 4 ... 8 mm Multiple sealing insert Ex: 5.85 ... 6.5 mm
Tensile load	Not permitted, suitable for "fixed installation" only
Tightening torque	Connecting thread: 2.3 Nm Cap nut: 1.5 Nm
Weight	Approx. 3.9 kg / 8.6 lb plus approx. 160 g / 0.35 lb per module

1) ***NOTICE!*** Never expose the display to strong direct sunlight.
When the ambient temperature is below 0 °C / 32 °F, the LC display may have limited readability.
This will not adversely affect the device functions.
2) User-definable
3) At rated operating conditions
4) This equipment is not designed for domestic use, and is unable to guarantee adequate protection of the radio reception in such environments.

Glossary

Technical Terms

Administrator level
Menu level of the Parameter Setting menu. Access to all functions, also passcode setting. Releasing or blocking functions for access from the operator level..

Administrator passcode
Protects access to the administrator level. If you lose the administrator passcode, system access is locked! The manufacturer can generate a rescue TAN.

Alarm limit
For each process variable, you can define high and low warning and failure limits (NAMUR states: maintenance request, out of specification). The alarm can be activated individually for each variable.
If an alarm limit is exceeded, an error message appears and the corresponding NAMUR contact is activated.

ATEX
ATEX (atmosphère explosible) is a summary term for the standardized EU Directives 94/9/EC (for manufacturers of Ex equipment) and 1999/92/EC (for operators of Ex facilities) that govern safety requirements for explosive atmospheres.

Calibration/adjustment passcode
Protects access to the Calibration menu. Can be set or disabled at the administrator level.

Diagnostics menu
Display of all relevant information on the device status.

Failure
Alarm message and NAMUR contact. Failure means that the equipment no longer operates properly or that a process parameter has reached a critical value. Failure is disabled during "function check".

Firmware
Dedicated device software located in an area of memory that is protected in the event of a power failure.

Glossary

Technical Terms

Function check (HOLD)
NAMUR contact (status signal). Always active when the device does not output the configured measured value.

GLP/GMP
Good Laboratory Practice/Good Manufacturing Practice:
Rules for performance and documentation of measurements.

Hysteresis
Tolerance band around the limit value, within which the contact is not actuated. Serves to obtain appropriate switching behavior at the output and suppress slight fluctuations of the measured variable.

Limit contacts
Are controlled by a user-definable process variable. The limit contact is activated if the measured value falls below or exceeds an alarm limit, depending on the user-defined effective direction.

Logbook
The logbook always shows the last 100 events with date and time, e.g. calibrations, NAMUR messages, power failure etc. With add-on function FW4400-104, 20,000 entries or more can be saved on a memory card. This permits quality management documentation as required by ISO 9001.

Main display
Large measured value display in the measuring mode. The number and type of displayed process variables can be adjusted.

Maintenance menu
The Maintenance menu provides all functions for sensor maintenance and signal outputs.

Maintenance passcode
Protects access to the Maintenance menu. Can be set or disabled at the administrator level.

Glossary

Technical Terms

Maintenance request
NAMUR contact (status signal). Is active if messages appear that require maintenance. That means that the equipment is still operating properly but should be serviced, or that process parameters have reached a value requiring intervention.

Measuring mode
When no menu function is activated, the device is in measuring mode. The selected measured value is displayed. Pressing the **meas** key always returns you to the measuring mode.

Measuring point description
Can be defined to identify the unit and can be displayed in the Diagnostics menu.

Menu structure
The Protos provides a very clear menu structure. Menu selection is called up by pressing the **menu** key. Four basic functions can be accessed: Calibration, maintenance, parameter setting, diagnostics. From each of these functions, the individual module blocks (system control, FRONT module (display functions), BASE module (signal outputs, inputs) can be accessed, as well as all added measuring and communication modules.

Message list
The current message list shows active messages in plaintext and the module that generated the message.

NAMUR
German committee for measurement and control standards in the chemical industry

NAMUR contacts (status signals)
"Failure", "Function check" (HOLD), "Out of specification", "Maintenance request". Indicate status of process variable and measuring device.

Operator level
Menu level of the Parameter Setting menu. You can edit the device settings that have been enabled at the Administrator level.

Glossary

Technical Terms

Operator passcode
Protects access to the operator level. Can be set or disabled at the administrator level.

Out of specification
NAMUR contact (status signal). Is active when a user-defined limit value is exceeded or if process parameters reach a value that requires intervention.

Parameter Setting menu
The Parameter Setting menu provides 3 access levels:
Viewing, Operator, and Administrator level.

Passcodes
Access to calibration, maintenance, the operator and administrator levels can be protected by passcodes.
The passcodes can be defined or disabled at the administrator level.

Reference temperature
With temperature compensation activated, the measured value is calculated to the value at the reference temperature (usually 20 °C/68 °F oder 25 °C/77 °F) using the temperature coefficient.

Rinse duration
User-defined time during which the rinse contact is closed during a rinsing cycle.

Lead time
User-defined time during which the rinse contact is closed at the start/end of the rinsing cycle. The function check (HOLD) is active during the lead time.

RoHS Directive (2011/65/EU)
This Directive sets out down provisions on the restriction of the use of hazardous substances in electrical and electronic equipment in order to contribute to the protection of human health and the environment, including the environmentally sound recovery and disposal of waste electrical and electronic equipment.

Glossary

Technical Terms

Secondary displays
Two small displays located below the main display in measuring mode. The process variables to be displayed can be selected using the softkeys underneath.

Sensor coding
Here, internal settings for toroidal sensors are encoded.

Slope
The slope of a pH sensor is the voltage change per pH unit.
For an ideal pH sensor, it lies at -59.2 mV/pH (25 °C/77 °F).

Softkeys
Keys underneath the secondary displays; the function depends on the current display.

U_m
EN 60079-11: maximum r.m.s. value of the AC voltage or maximum DC voltage, i.e. maximum voltage that can be applied to the non-intrinsically safe connecting parts of the associated equipment without affecting the type of protection.

Viewing level
Menu level of the Parameter Setting menu. Display of all device settings, however no editing possible.

Zero point
The zero point is the voltage value supplied by a pH sensor at 25 °C/77 °F and pH = 7.00. For an ideal pH sensor, it lies at 0 mV.
In practice, the real zero point is slightly different.

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Knick
Elektronische Messgeräte
GmbH & Co. KG

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

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