Knick

Protos II 4400(X)
Process Analysis System

User Manual
English

TAN Options

Device-specific add-on functions
for expanding functionality

Read before installation.
Keep for future use.

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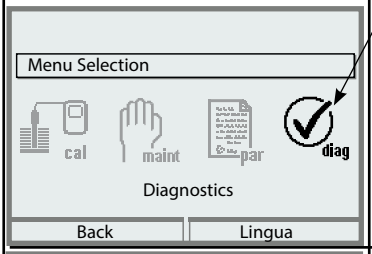
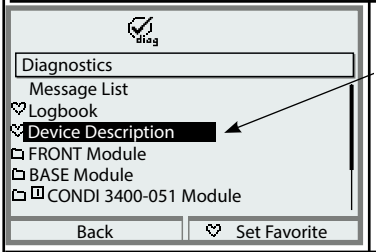
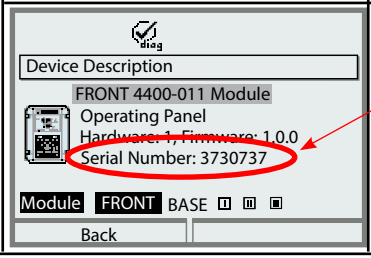
How to Order an Add-On Function

Add-on functions expand the device capabilities.
The add-on functions 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 FRONT module contains the Protos system control).
The manufacturer then supplies a TAN (transaction number) to activate the add-on function.

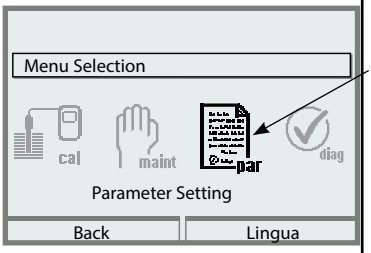
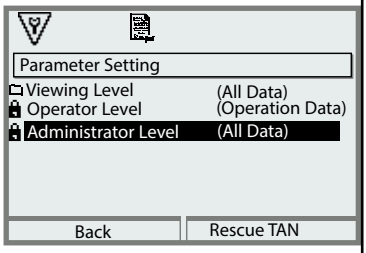
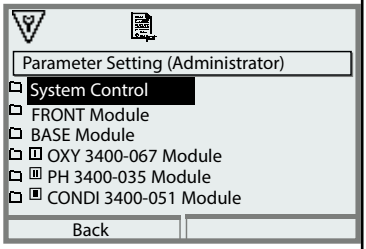
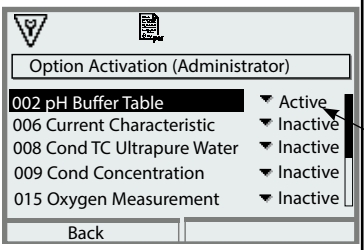
Serial Number of FRONT Module

Menu	Display	Action
diag		**Menu Selection** Open Diagnostics. From the measuring mode: Press **menu** key to select menu. Select Diagnostics using arrow keys, press **enter** to confirm.
		**Diagnostics** Select Device Description using arrow keys, confirm by pressing **enter**.
		**Device Description** Enter this serial number when ordering an add-on function.

Activating an Add-On Function

Parameter Setting/System Control/Option Activation

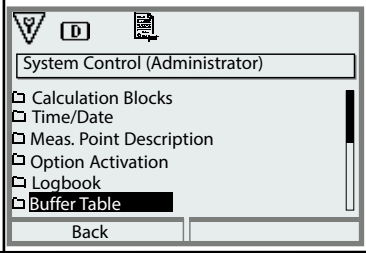
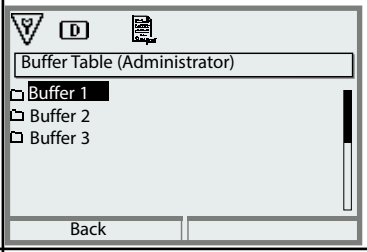
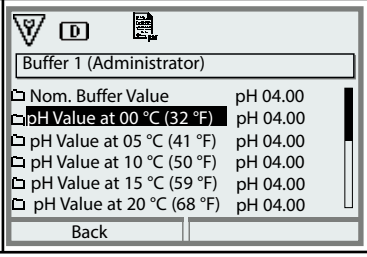
Note: The TAN for activating an add-on function is only valid for the device with the corresponding serial number (see previous page).

Menu	Display	Action
par		**Menu Selection** Open Parameter Setting. From the measuring mode: Press **menu** key to select menu. Select Parameter Setting using arrow keys, press **enter** to confirm.
		**Parameter Setting** Select Administrator Level using arrow keys, confirm with **enter**. Enter passcode and confirm (passcode as delivered: 1989).
		Select System Control using arrow keys, press **enter** to confirm. Then select Option Activation using arrow keys, press **enter** to confirm.
		**Option Activation** Select the add-on function to be activated. Set option to "Active". Enter the TAN at the prompt. The current serial number is shown. The option is available after the TAN has been entered.

FW4400-002: Buffer Table for pH Measurement

Parameter Setting/System Control/Buffer Table

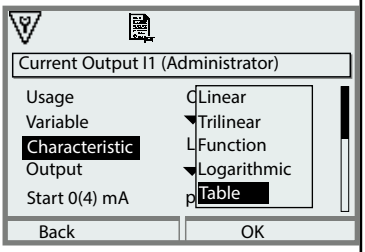
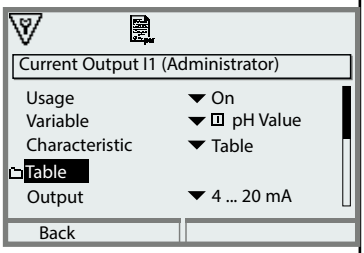
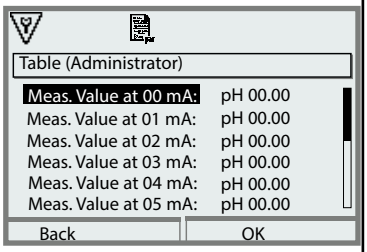
Specifying an Individual Buffer Set for pH Measurement
You can enter an individual buffer set with 3 buffer solutions. To do so, enter the nominal buffer values for the correct temperature (0 ... 95 °C / 32 ... 203 °F, 5 °C/9 °F step size). Then this buffer set is available as "Table" in addition to the permanently set standard buffer solutions.

Menu	Display	Action
par		**Entering a Buffer Set** 1) Parameter Setting 2) System Control 3) Buffer Table
		Select buffer to be entered. Enter the values for 3 complete buffer solutions in ascending order (e.g. pH 4, 7, 10). Minimum distance: 2 pH units
		Enter nominal buffer value and all other values for the correct temperature (right/left arrow keys to select position, up/down arrow keys to edit number, press **enter** to confirm.)

The individual buffer set is selected in the menu:
Parameter Setting/PH Module/Cal Presettings:
Calibration mode: Calimatic, Buffer Set: Table.

FW4400-006: Current Characteristic

Parameter Setting/BASE (OUT) Module/Current Output/Characteristic

Menu	Display	Action
par		**Table Characteristic** Assignment of output current to process variables in 1-mA increments. Select menu: Parameter Setting/BASE (OUT) Module/Current Output 1) Usage: On 2) Select process variable 3) Characteristic: Table
		The "Table" menu is displayed.
		The entered values must be continuously rising or falling. On the following page, you find a listing to write down your adjustments.

Current Characteristic Template

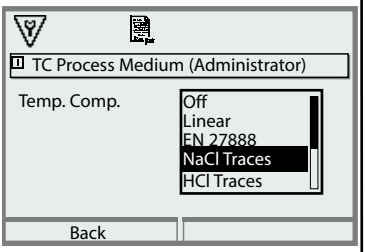
Parameter Setting/BASE (OUT) Module/
Current Output/Characteristic: Table, own settings

Measured values for *process variable*

00 mA ....._____
01 mA ....._____
02 mA ....._____
03 mA ....._____
04 mA ....._____
05 mA ....._____
06 mA ....._____
07 mA ....._____
08 mA ....._____
09 mA ....._____
10 mA ....._____
11 mA ....._____
12 mA ....._____
13 mA ....._____
14 mA ....._____
15 mA ....._____
16 mA ....._____
17 mA ....._____
18 mA ....._____
19 mA ....._____
20 mA ....._____

FW4400-008: Ultrapure Water: Temperature Compensation (COND)

Parameter Setting/COND Module/TC Process Medium

Menu	Display	Action
		**Ultrapure Water with Traces of Impurity** 1) Parameter Setting 2) COND Module 3) TC Process Medium 4) Temp. Comp.: … Traces Select type of impurity: **NaCl** Neutral ultrapure water, for conductivity measurement in water processing behind gravel bed filter **HCl** Acidic ultrapure water, for conductivity measurement behind cation filter **NH_3** Ammoniacal ultrapure water **NaOH** Alkaline ultrapure water

Concentration Determination
The substance concentration in percent by weight (wt%) is determined for H_2SO_4, HNO_3, HCl, NaOH, NaCl, and Oleum.

Conditions for Concentration Determination
The following pages present the conductivity curves depending on substance concentration and medium temperature.
The following conditions must be met for a reliable concentration determination:

- For calculation of concentration, the medium to be measured must be a purely binary mixture (e.g. water-hydrochloric acid). Presence of other dissolved substances (e.g. salts) leads to incorrect concentration values.
- In the region of small slopes (e.g. at the range limits) small changes in conductivity can correspond to large changes in concentration. This may lead to an unsteady display of the concentration value.
- As the concentration value is calculated from the measured conductivity and temperature values, accurate temperature measurement is very important. Therefore, you should make sure that conductivity sensor and process medium are in thermal equilibrium.

Messages
You can define limits for warning and failure messages for the concentration value:

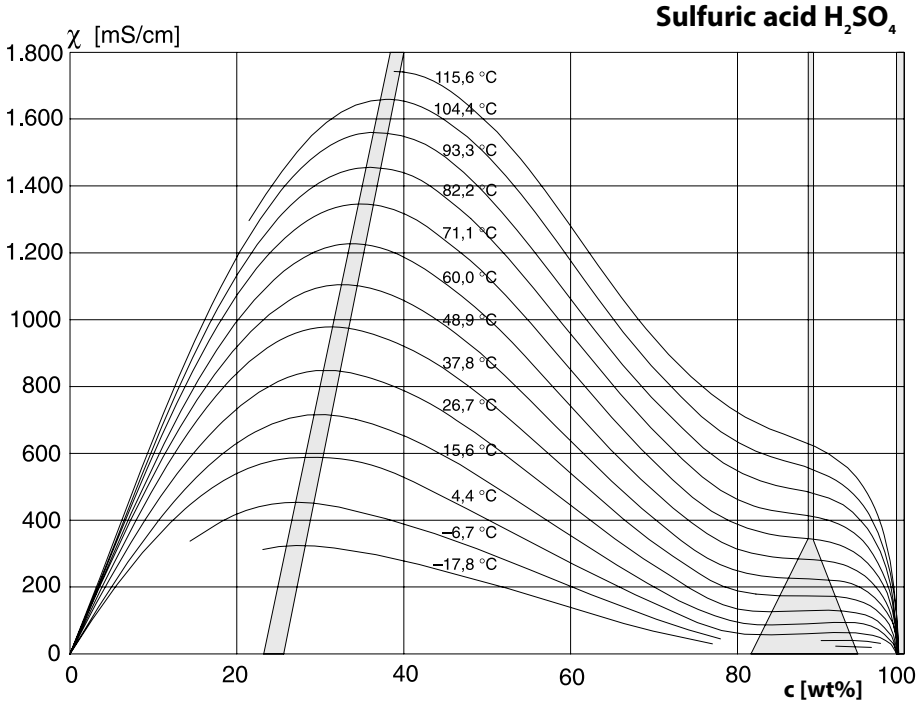
Select menu: Parameter Setting/System Control/COND Module/Messages

FW4400-009: Concentration Determination (COND)

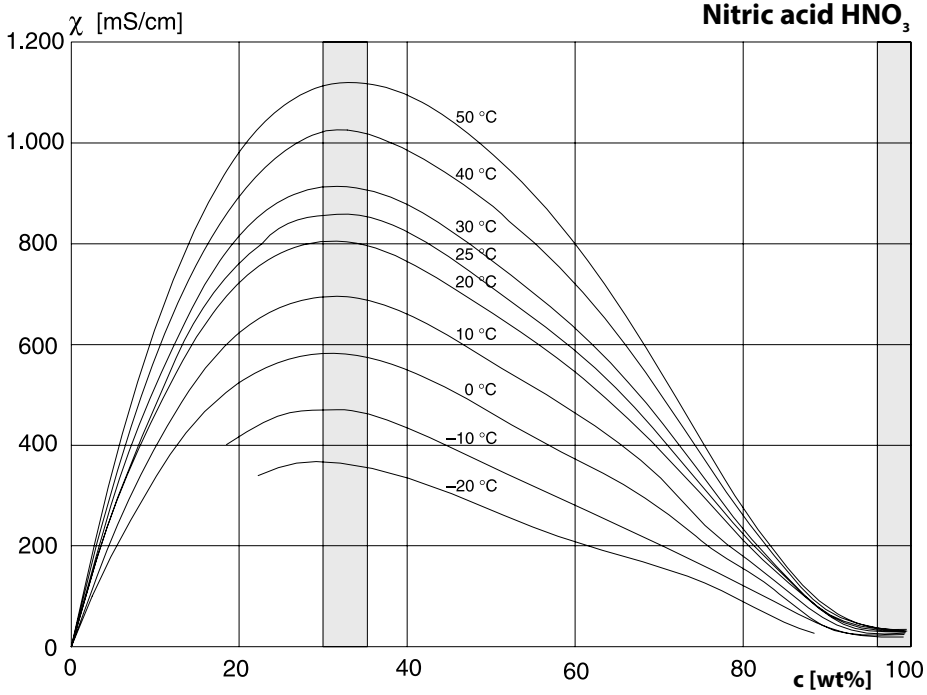
Parameter Setting/COND Module/Concentration
Note: Function check (HOLD) active

Default Setting and Selection Range / Concentration Curves

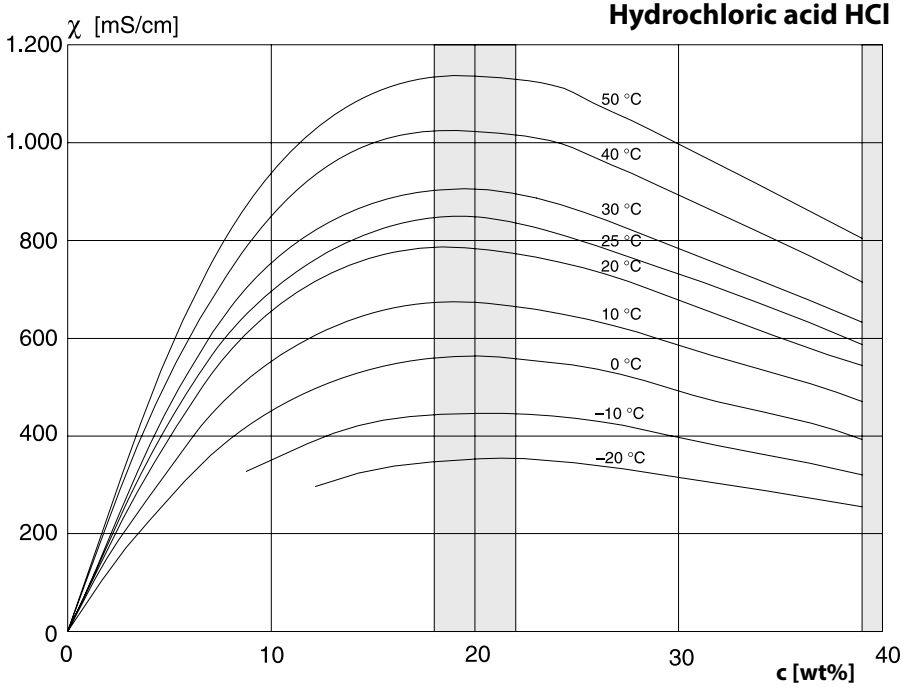
Parameter	Default	Selection / Range
Concentration • Medium ("On" selected)	Off H_2SO_4 (0-30%)	On, Off NaCl (0-28 %), HCl (0-18 %), NaOH (0-24 %), H_2SO_4 (0-37 %), HNO_3 (0-30 %), H_2SO_4 (89-99 %), HCl (22-39 %), HNO_3 (35-96 %), H_2SO_4 (28-88 %), NaOH (15-50 %), Oleum (12-45%) Table



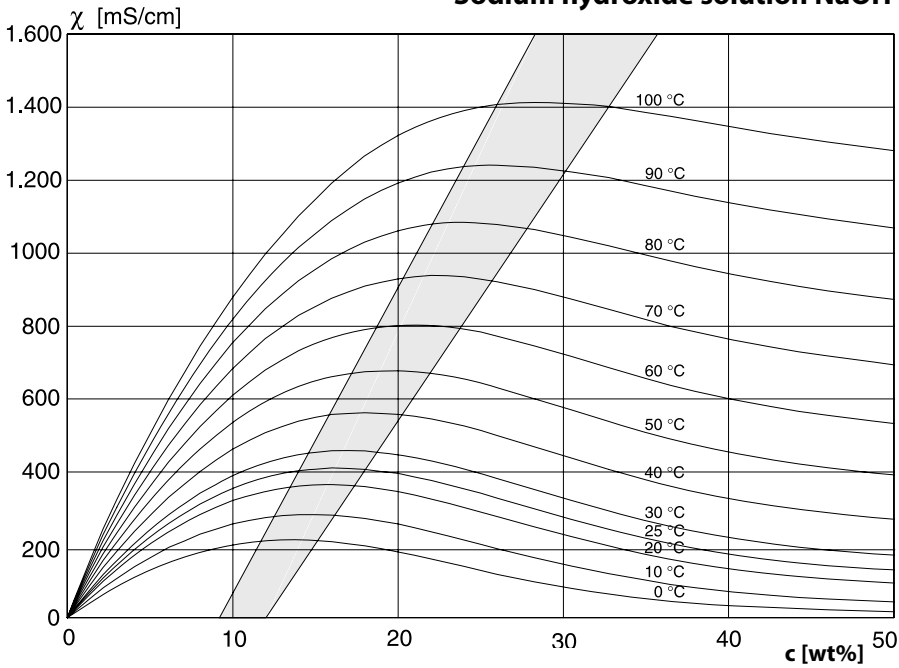
Nitric acid HNO_3



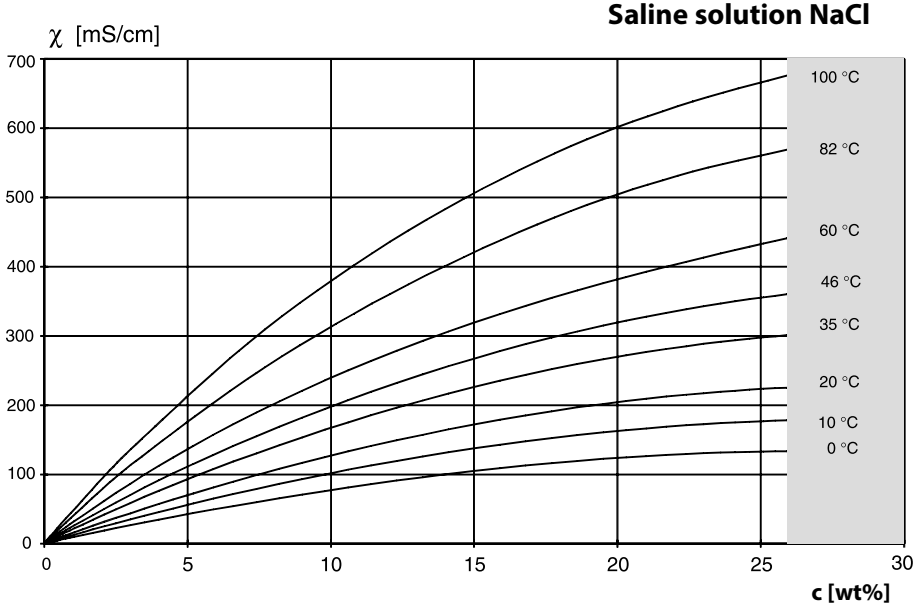
Hydrochloric acid HCl



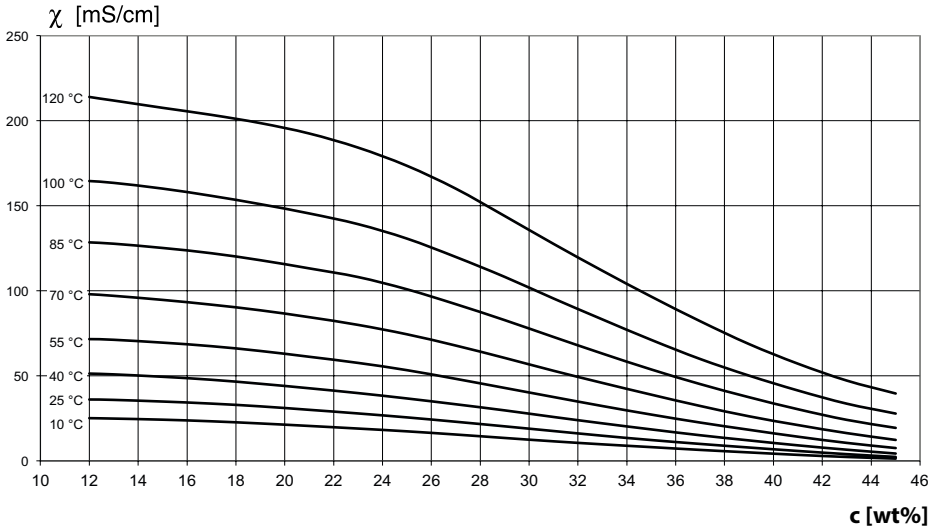
Sodium hydroxide solution NaOH



Saline solution NaCl

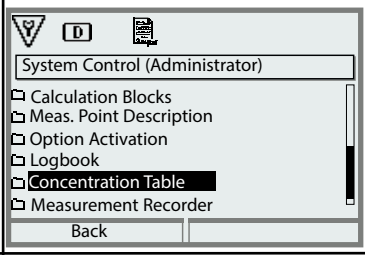
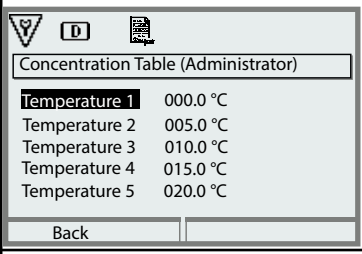
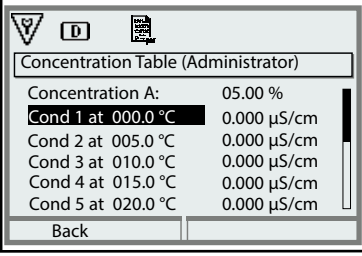


Oleum $H_2SO_4 \cdot SO_3$



Parameter Setting/System Control/Concentration Table

Specifying a Concentration Solution for Conductivity Measurement
To specify the customer-specific solution, 5 concentration values A-E are entered in a matrix together with 5 temperature values 1-5. To do so, first enter the 5 temperature values, then enter the respective conductivity values for each concentration A-E.
These solutions will then be available in addition to the permanently stored standard solutions (select "Table").

Menu	Display	Action
par		**Entering Values** 1) Parameter Setting 2) System Control 3) Concentration Table
		Enter 5 temperature values (right/left arrow keys to select position, up/down arrow keys to edit number, press **enter** to confirm.)
		Enter values for concentrations A-E for the respective temperatures. The table values must be continuous. Maxima/minima are not permitted. Incorrect entries are marked with ✕.

The concentration table is selected in the menu:
Parameter Setting/COND Module/Cal Presettings:
Calibration mode: Automatic, Cal Solution: Table.

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

Conditions for the Table:

- The temperature values must be rising
  (Temp 1 is the lowest, Temp 5 the highest temperature).

- The concentration values must be in ascending order
  (Conc. A is the lowest, Conc. E is the highest concentration).

- The table values A1 ... E1, A2 ... E2, etc. must all be rising within the table or all falling. Points of inflection are not allowed!

The device automatically checks the table values. Incorrect entries are marked.

FW4400-015: Oxygen Measurement

For MS 4400(X)-160 Module

Oxygen Measurement in the Saturation and ppb Range

Add-on function FW4400(X)-015 enables amperometric Memosens oxygen sensors to be used in the saturation and ppb range.

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.

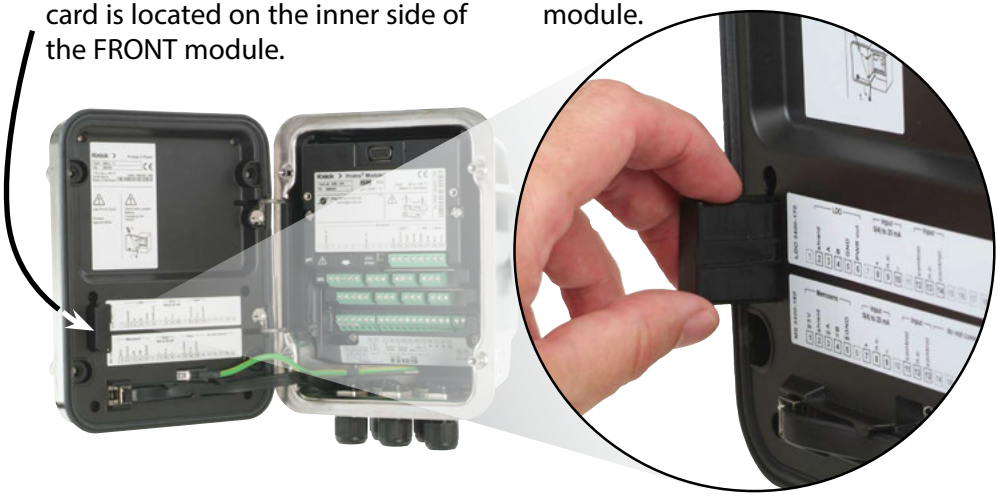
Opening the Device

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.
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.

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.

Card Types (ZU1080-P-*)	Purpose
Data Card (X)	Records data
Audit Trail Card (X)	Records data with security option
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

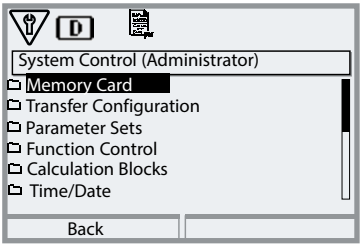
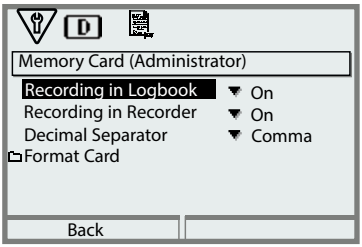
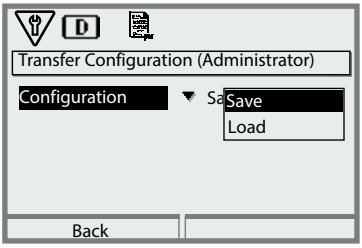
Data Card
This type of card allows the storage of data (e.g. configuration, parameter sets, logbook, measurement recorder data). The icon blinks to indicate active data transmission. The Data Card can be used in combination with the following add-on functions: FW4400-102 5 Parameter Sets, FW4400-103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

Audit Trail Card
Same function as Data Card, for storing audit trail data as per FDA CFR 21 Part 11, in conjunction with the FW4400-107 Audit Trail add-on function

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.

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)

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

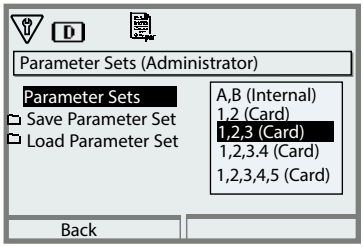
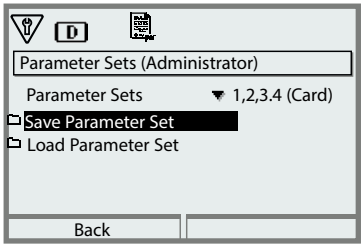
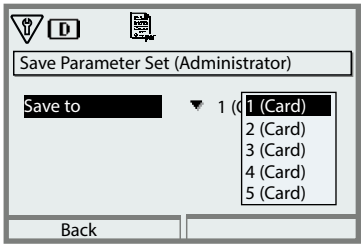
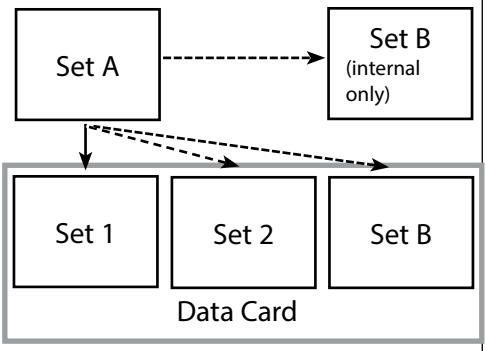
Saving/Loading the Complete Device Configuration

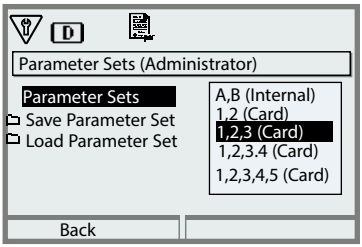
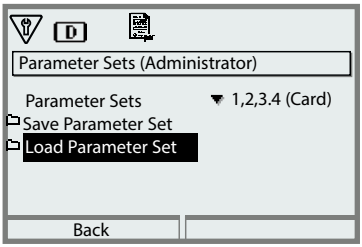
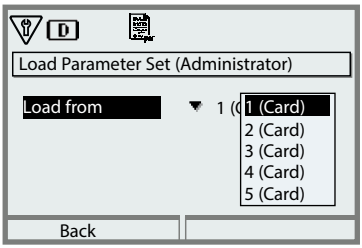
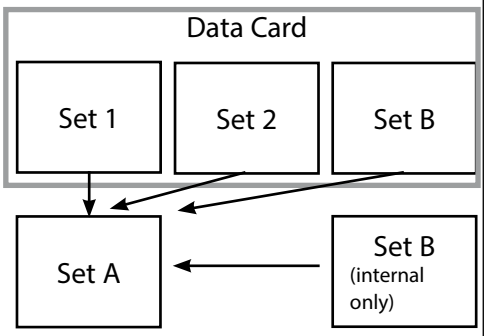
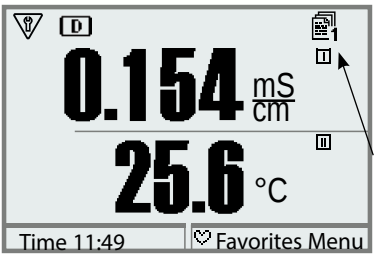
"Save" configuration means that the complete device configuration (except the passcode) is written on the Data Card.
"Load" configuration means that the complete device configuration is read from the Data Card and programmed.
Backup file generated on the Data Card: param/config.par

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.

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.

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.

FW4400-103: Measurement Recorder

Parameter Setting/FRONT Module/Measurement Recorder

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

Setting the Measurement Recorder Parameters

Parameter Setting/FRONT Module/Measurement Recorder

Parameter settings can be made for:

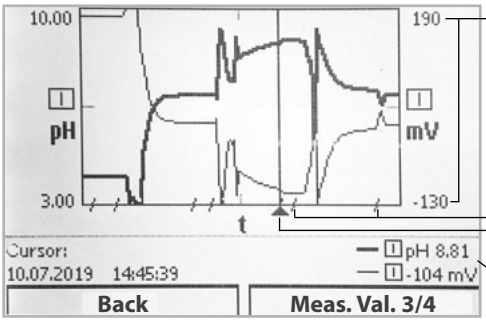
- Process variables to be displayed
- Start and end value for the process variable to be recorded
- Time base (recording interval, selectable from 10 s to 10 h)

In addition, the time axis can be stretched by factor 10 using the ”zoom” function.

Starting the Measurement Recorder

In measuring mode, press **meas**.

The measurement recorder saves all entries in a file. In the Protos display, the latest 100 entries are graphically presented (see figure).



Graphic range
Start and end value of the process variable

Ranges with fast measured value changes (automatic zoom function) are marked by lines.

Cursor (shift using arrow keys)
Currently measured values at cursor position

Up to 4 process variables are displayed. These 4 process variables are distributed to 2 measurement recorders. Use the right softkey to toggle between the measurement recorders.

The zoom function is automatically switched on for fast changes. It begins several pixels before the event. This makes process variable fluctuation traceable in detail.

Deleting Measurement Recorder Data

Parameter Setting/System Control/Measurement Recorder:
Clear Measurement Recorder: Yes. Press the “OK” softkey to confirm.

Parameter Setting/System Control/Memory Card/
Recording in Recorder: On

Saving to Data Card

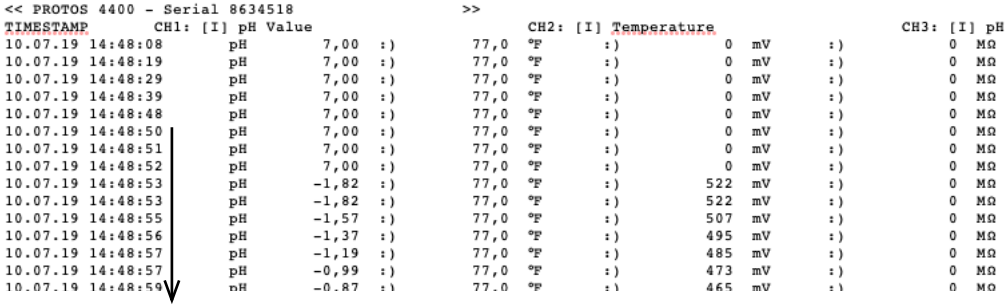
Note: The device's internal memory has limited capacity and continuously overwrites the oldest data set after reaching maximum memory capacity. For recording sessions that take a long time, a data card is absolutely necessary. The data saved on the data card can be read out and evaluated using a computer.

A new file is generated for each day. The date is encoded in the file name. Example for a file generated on the Data Card:

\RECORDER\R_YYMMDD.TXT Recorder data of YYMMDD
(YY = year, MM = month, DD = day)

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 measurement recorder data of several devices.

Example:



```
<< PROTOS 4400 - Serial 8634518                    >>
TIMESTAMP       CH1: [I] pH Value                        CH2: [I] Temperature                    CH3: [I] pH
10.07.19 14:48:08       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:19       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:29       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:39       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:48       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:50       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:51       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:52       pH        7,00  :)         77,0  °F       :)          0  mV      :)          0  MΩ
10.07.19 14:48:53       pH       -1,82  :)         77,0  °F       :)        522  mV      :)          0  MΩ
10.07.19 14:48:53       pH       -1,82  :)         77,0  °F       :)        522  mV      :)          0  MΩ
10.07.19 14:48:55       pH       -1,57  :)         77,0  °F       :)        507  mV      :)          0  MΩ
10.07.19 14:48:56       pH       -1,37  :)         77,0  °F       :)        495  mV      :)          0  MΩ
10.07.19 14:48:57       pH       -1,19  :)         77,0  °F       :)        485  mV      :)          0  MΩ
10.07.19 14:48:57       pH       -0,99  :)         77,0  °F       :)        473  mV      :)          0  MΩ
10.07.19 14:48:59       pH       -0,87  :)         77,0  °F       :)        465  mV      :)          0  MΩ
```

Zoom function activated – can be seen in shortened time intervals

Meaning of the entries in the recorder file:

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

* Term definition:
NAMUR = German committee for measurement and control standards in the chemical industry

Saving to Data Card

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)

FW4400-106: Firmware Update

The firmware update with add-on function FW4400-106 is activated by TAN in the device (see p. 6). 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.

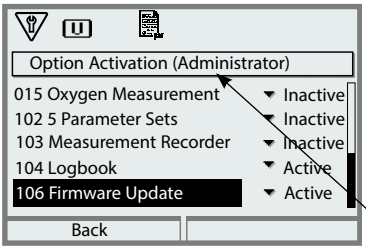
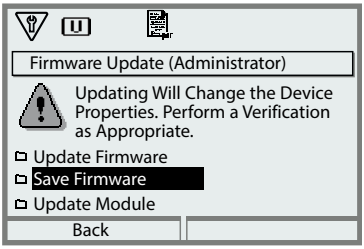
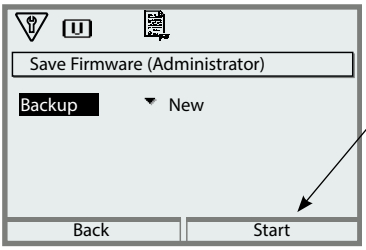
1) Place the Update Card in the card slot (see p. 19)
2) Recommendation:
   Save the firmware currently installed in your device (p. 31)
3) Load the firmware update as described on p. 32.

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.

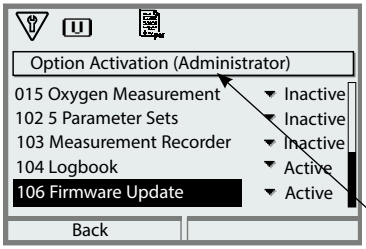
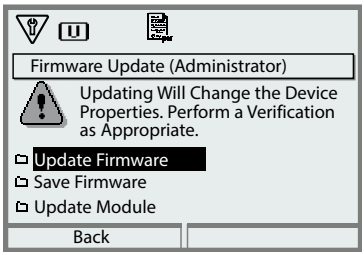
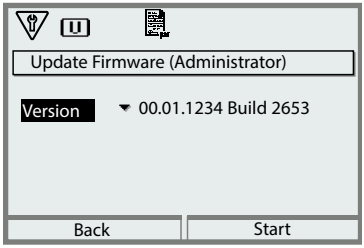
Firmware Update: Save Firmware

Parameter Setting/System Control/Firmware Update/Save Firmware

Menu	Display	Action
par		**Save Firmware** 1) Insert the FW Update Card. 2) 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 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.

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