Measuring Module
M 700® O$_2$ 4700(X)

For Oxygen Measurement in Liquids and Gases

52121221

METTLER TOLEDO

71938

Return of Products Under Warranty

Please contact our Service Team before returning a defective device. Ship the <u>cleaned</u> device to the address you have been given. If the device has been in contact with process fluids, it must be decontaminated/disinfected before shipment. In that case, please attach a corresponding certificate, for the health and safety of our service personnel.

Disposal

Please observe the applicable local or national regulations concerning the disposal of "waste electrical and electronic equipment".

Trademarks

The following registered trademarks are used in this instruction manual without further marking

SMARTMEDIA®
is a registered trademark of Toshiba Corp., Japan

FOUNDATION FIELDBUS™
is a trademark of Fieldbus Foundation, Austin, USA

Declaration of conformity
Konformitätserklärung
Déclaration de conformité

$C\,\epsilon$

Wer/ Wir/Nous	**Mettler-Toledo GmbH, Process Analytics**
	Im Hackacker 15
	8902 Urdorf
	Switzerland
	declare under our sole responsibility that the product,
	erklären in alleiniger Verantwortung, dass dieses Produkt,
	déclarons sous notre seule responsabilité que le produit,
Description	
Beschreibung/Description	**O₂ 4700**
	to which this declaration relates is in conformity with the following standard(s) or other normative document(s).
	auf welches sich diese Erklärung bezieht, mit der/den folgenden Norm(en) oder Richtlinie(n) übereinstimmt.
	auquel se réfère cette déclaration est conforme à la (aux) norme(s) ou au(x) document(s) normative(s).
EMC Directive/ EMV-Richtlinie	
Directive concernant la CEM	**89/336/EWG**
Place and Date of issue/	
Ausstellungsort/ - Datum	
Lieu et date d'émission	**Urdorf, September 22, 2004**

Mettler-Toledo GmbH, Process Analytics

Waldemar Rauch
General Manager PO Urdorf

Thomas Hösli
Head of Operations and R&D

Norm/ Standard/ Standard	**EN 61326/ VDE 0843 Teil 20**
	EN 61326 / A1/ VDE 0843 Teil 20 / A1

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CE_Transmitter_O2_4700.doc

Mettler-Toledo GmbH
Process Analytics

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 $C\epsilon$ 0344

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O₂ 4700X

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Richtlinie(n) übereinstimmt.
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document(s) normatif(s).

Explosion protection
Explosionsschutzrichtlinie
Prot. contre les explosions

94/9/EG
KEMA 04 ATEX 2056
NL-6812 AR Arnhem, KEMA 0344

Low-voltage directive
Niederspannungs-Richtlinie
Directive basse tension

73/23/EWG

EMC Directive
EMV-Richtlinie
Directive concernant la CEM

89/336/EWG

Place and Date of issue
Ausstellungsort / - Datum
Lieu et date d'émission

Urdorf, July 16, 2004

Mettler-Toledo GmbH, Process Analytics

Waldemar Rauch
General Manager Ingold

Christian Zwicky
Head of Marketing

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Norm/Standard/Standard	94/9/EG:	EN 50014	
		EN 50020	
		EN 50281-1-1	
		EN 50284	
	73/23/EWG:	DIN EN 61010-1 / VDE 0411 Teil 1:	2002-08
	89/336/EWG:	DIN EN 61326 / VDE 0843 Teil 20:	2002-03

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M 700 O$_2$ 4700(X)

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Intended Use

The module is used to measure oxygen in liquids and gases using the Mettler-Toledo InPro 6800 series sensors.
The module permits simultaneous measurement of oxygen partial pressure, barometric pressure, and temperature. In addition, oxygen saturation or concentration can be calculated and displayed.

The O_2 4700X module is intended for operation in locations subject to explosion hazards which require equipment of Group II, device category 2(1), gas/dust.

Conformity with FDA 21 CFR Part 11

In their directive "Title 21 Code of Federal Regulations, 21 CFR Part 11, Electronic Records; Electronic Signatures" the US American health agency FDA (Food and Drug Administration) regulates the production and processing of electronic documents for pharmaceutical development and production. This results in requirements for measuring devices used for corresponding applications. The following features ensure that the M 700(X) modular process analysis system meets the demands of FDA 21 CFR Part 11:

Electronic Signature
Access to the device functions is regulated and limited by individually adjustable codes – "Passcodes". This prevents unauthorized modification of device settings or manipulation of the measurement results. Appropriate use of these passcodes makes them suitable as electronic signature.

Audit Trail Log
Every change of device settings can be automatically recorded and documented in the Audit Trail Log on the SmartMedia card. The recording can be encrypted.

Safety Information

Application in Hazardous Locations

Caution!
Never try to open the module! If a repair should be required, return the module to our factory.

If the specifications in the instruction manual are not sufficient for assessing the safety of operation, please contact the manufacturer to make sure that your intended application is possible and safe.

Be sure to observe during installation:
• Switch off power supply before replacing or inserting a module.
• Protect the signal inputs of the modules against electrostatic discharge.
• Before commissioning it must be proved that the device may be connected with other equipment.
• Observe correct shielding: To avoid interferences, the cable shielding must be completely covered by the ESD shielding cap.

Application in Hazardous Locations:
O_2 4700X Module
When using the O_2 4700X module, the stipulations for electrical installations in hazardous areas (EN 60079-14) must be observed. When installing the device outside the range of applicability of the 94/9/EC directive, the appropriate standards and regulations in the country of use must be observed. The module has been developed and manufactured in compliance with the applicable European guidelines and standards.

Compliance with the European Harmonized Standards for use in hazardous locations is confirmed by the EC-Type-Examination Certificate.
Compliance with the European guidelines and standards is confirmed by the EC Declaration of Conformity.

There is no particular direct hazard caused by the operation of the device in the specified environment.

Software Version

M 700(X) O_2 4700(X) Module

Device Software M 700(X)
The O_2 4700(X) module is supported by software version 4.0 or higher.
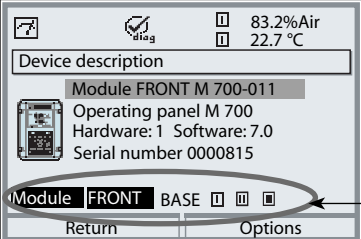
Module Software O_2 4700(X)

Software version 2.1	Measurement in gases Distinguishing between adjustment and calibration: Values determined by a calibration can only be taken over by an adjustment.
Software version 2.2	Membrane correction

Query Actual Device/Module Software
When the analyzer is in measuring mode:
Press **menu** key, open Diagnostics menu.

Menu	Display	Device description
✓ diag	83.2%Air 22.7 °C Device description Module FRONT M 700-011 Operating panel M 700 Hardware: 1 Software: 7.0 Serial number 0000815 Module FRONT BASE Ⅰ Ⅱ Ⅲ Return Options	Provides information about all modules installed: Module type and function, serial number, hardware and software version, and device options. Select the different modules (FRONT, BASE, slots 1 - 3) using the arrow keys.

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Modular Concept

Basic Unit, Measuring Module, Additional Functions

The M 700(X) is an expandable 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 software capabilities can be expanded by additional functions (options). Additional functions must be ordered separately. They are supplied with a device-specific TAN for function release.

M 700(X) Modular Process Analysis System

Additional functions
Activation via device-specific TAN

Measuring modules
• pH / ORP / Temp
• O_2/Temp
• Noncontacting conductivity/Temp
• Contacting conductivity/Temp

SmartMedia card
Data recording

3 module slots
for free combination of measuring and communication modules

Communication modules
• Out (additional switching and current outputs)
• PID (analog and digital controller)
• Profibus PA
• Foundation Fieldbus
• EC 400 probe controller

Documentation
The basic unit is accompanied by a CD-ROM containing the complete documentation.
Latest product information as well as instruction manuals for earlier software releases are available at **www.mt.com/pro**.

Short Description

Short Description: FRONT Module

4 captive screws
for opening the analyzer
(*Caution!* Make sure that the gasket 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
with plaintext menus as recommended by NAMUR.
Menu texts can be switched to: German, English, French, Italian, Swedish, and Spanish.
Intuitively acquirable menu logic, based on Windows standards.

Secondary displays

2 softkeys
with context-sensitive functions.

Red LED
signals failure (On) or maintenance request/function check (flashing) 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 entries

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

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Short Description: Menu Structure

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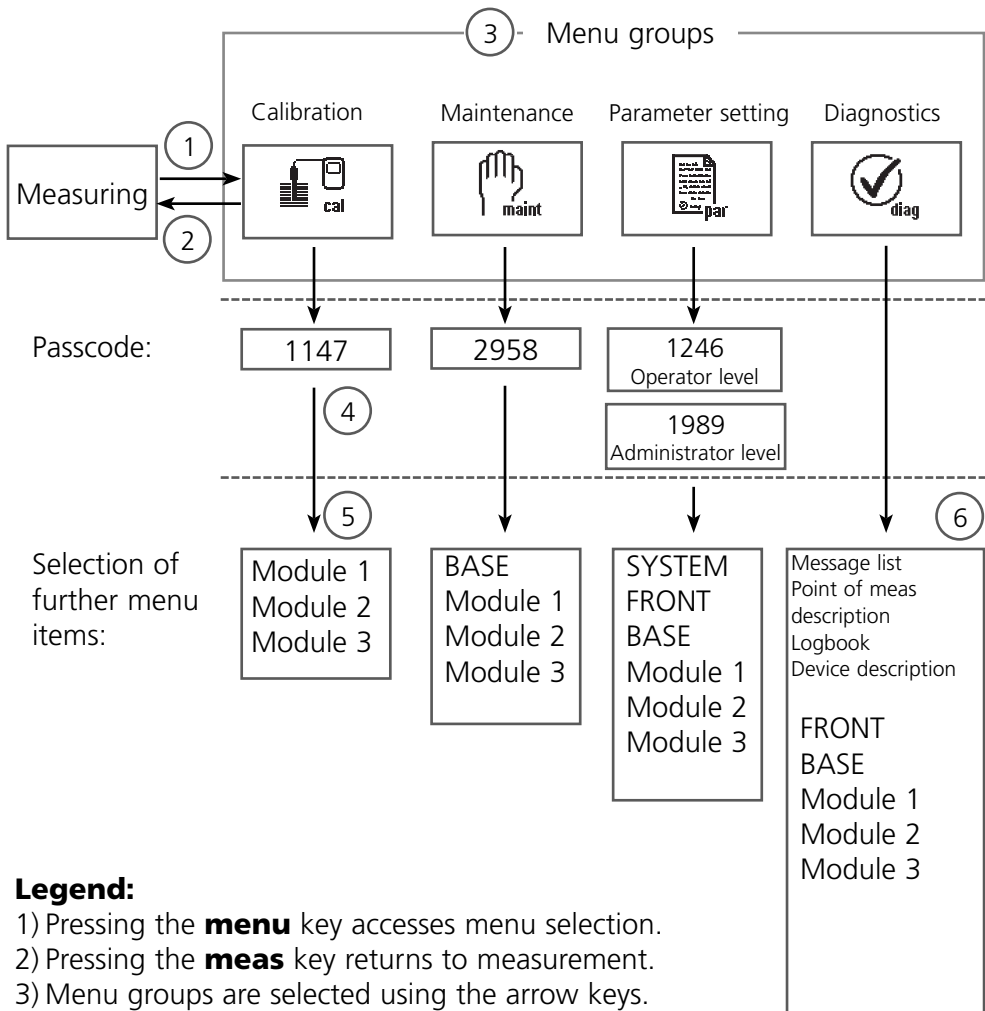
Legend:
1) Pressing the **menu** key accesses menu selection.
2) Pressing the **meas** key returns to measurement.
3) Menu groups are selected using the arrow keys.
4) Press **enter** to confirm, enter passcode.
5) Further menu items are displayed.
6) Selected functions of the Diagnostics menu can be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

Short Description: FRONT Module

View into the open device (FRONT module)

Slot for SmartMedia card
- Data recording
  The SmartMedia card expands the measurement recorder capacity to > 50000 records.

- Exchange of parameter sets
  5 parameter sets can be stored on the SmartMedia card. The 2 internal parameter sets can be switched by remote control.
  Configurations can be transmitted from one analyzer to the other.

- Function expansions
  are possible with additional software modules, which are released using transaction numbers (TAN)

- Software updates
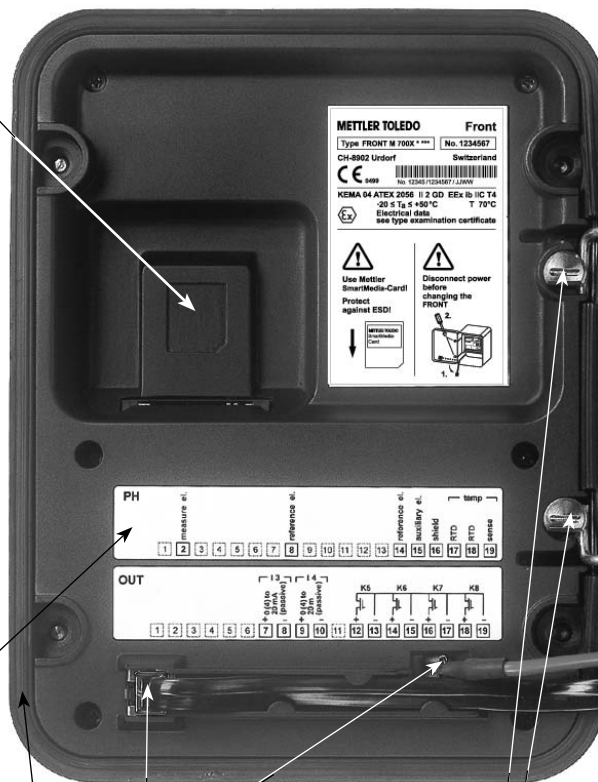
**Terminal plates
of "hidden" modules**
Each module comes with an adhesive label containing the contact assignments. This label should be stuck to the inner side of the front (as shown). Then, the terminal assignments remain visible even if further modules are inserted.

Replacing the front module
Pull off power cord and ground wire. To separate the FRONT module from the BASE module, turn the retaining screws of the pivot hinge by 90°.
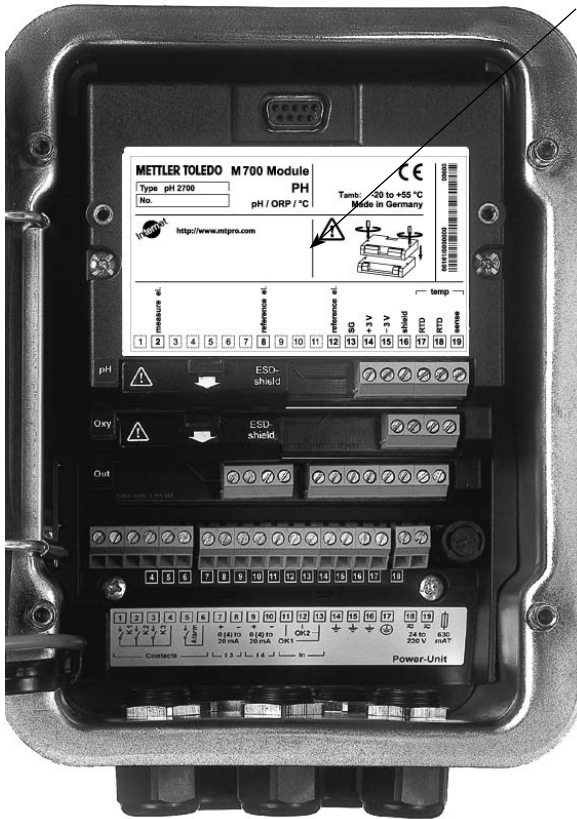
The circumferential sealing
guarantees IP 65 protection and allows spray cleaning / disinfection.
Caution! Keep clean!

Short Description: BASE Module

View into the open device (BASE module, 3 function modules installed)

Module equipment
Module identification: Plug & Play.
Up to 3 modules can be combined as
desired. Several input and communication
modules are available.

BASE module
2 current outputs (free assignment of
process variable) and 4 relay contacts,
2 digital inputs.
VariPower broad-range power supply,
20 ... 265 V AC/DC, suitable for all public
mains supplies in the world.

Power supply units, IS version:
100 ... 230 V AC or
24 V AC/DC
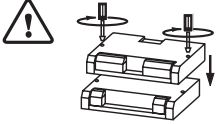
Warning!
Do not touch the terminal compartment, there may be
dangerous contact voltages!

Important Notice Concerning SmartMedia Card
The SmartMedia card may be inserted or replaced with the power supply
switched on. Before a memory card is removed, it must be "closed" in the
maintenance menu. When closing the device, make sure that the sealing is
properly seated and clean.
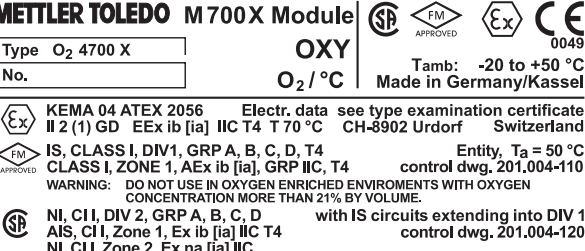
Terminal Plate O$_2$ 4700(X) Module

Terminal Plate O$_2$ 4700 Module:

Terminal Plate O$_2$ 4700X Module:

Attaching the Terminal Plates

The terminal plates of the lower modules
can be stuck to the inner side of the door.
This facilitates maintenance and service.

Inserting the Module

Note: Be sure to connect the shielding properly!
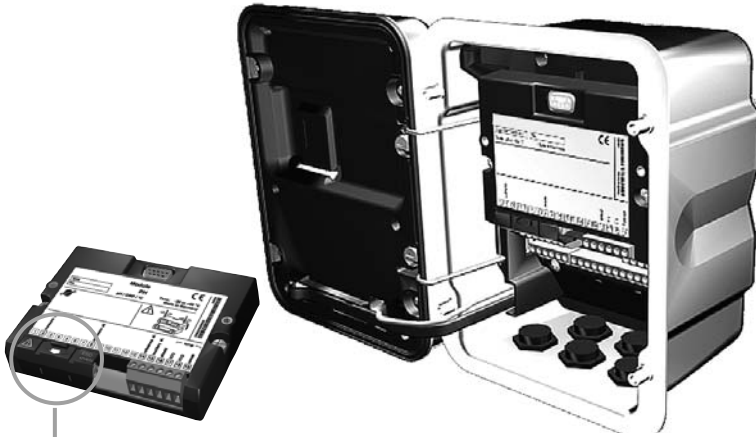
The terminals 2 and 8 are covered by an ESD shield. To connect the sensor cable, just pull it back.

Make sure that the cable glands are tightly closed to protect against humidity.

1. Switch off power supply
2. Open the device (loosen the 4 screws at the front)
3. Place module in slot (D-SUB connector)
4. Tighten fastening screws of the module
5. Open ESD shielding cap (covering terminals 2 and 8)
6. Connect sensor cable.
   To avoid interferences, the cable shielding must be completely covered by the ESD shielding cap.
7. Close ESD shielding cap (covering terminals 2 and 8)
8. Close device, tighten screws at the front
9. Switch on power supply
10. Set parameters

Wiring Examples

Mettler-Toledo InPro 6800, VP cable

O₂ 4700(X)
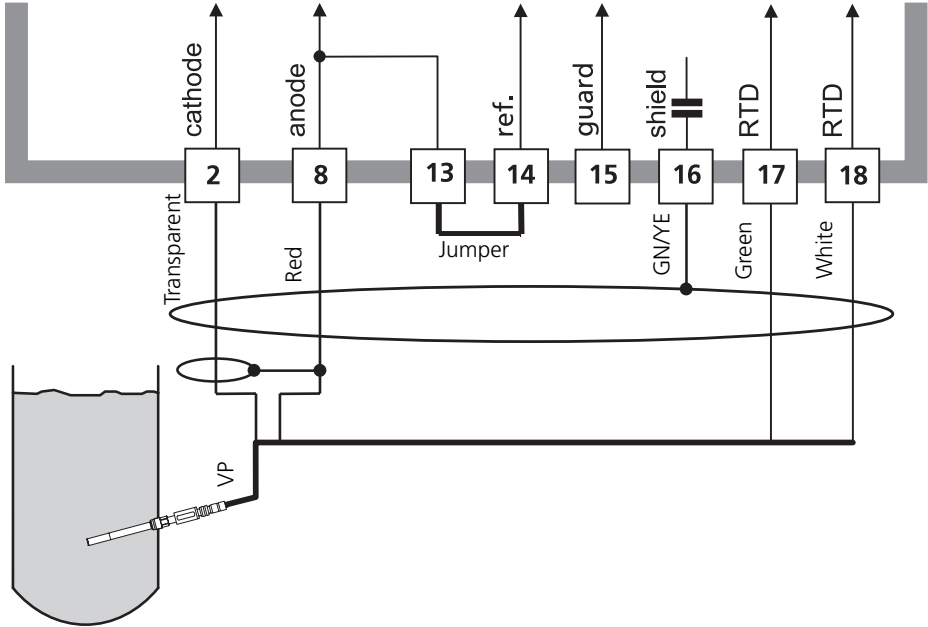
Module		**Sensor**
Connection	Terminal	VP cable
cathode	2	Transparent
anode	8	Red
(Jumper 13-14)	13-14	
guard	15	Gray
shield	16	Green-Yellow
RTD	17	Green
RTD	18	White
		Blue, gray not connected

Wiring Examples

Mettler-Toledo InPro 6900 with guard

O₂ 4700(X)
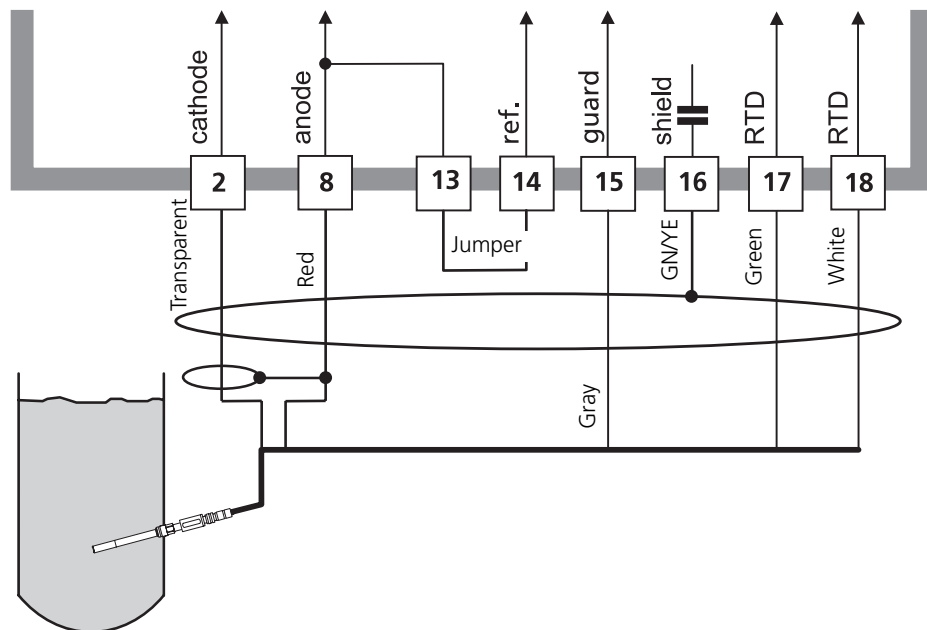
Menu Selection

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

1 Pressing **menu** accesses menu selection.
2 Pressing **meas** returns to measurement.
3 Arrow keys for selecting a menu group
4 **enter** key for confirming a selection

Menu Structure

③ Menu groups (Select using arrow keys)

	Calibration	Maintenance	Parameter setting	Diagnostics

Measure

Passcode (as delivered)

| 1147 | 2958 | 1246 Operator level | |
| | | 1989 Administrator level | |

Selection of further menu items:

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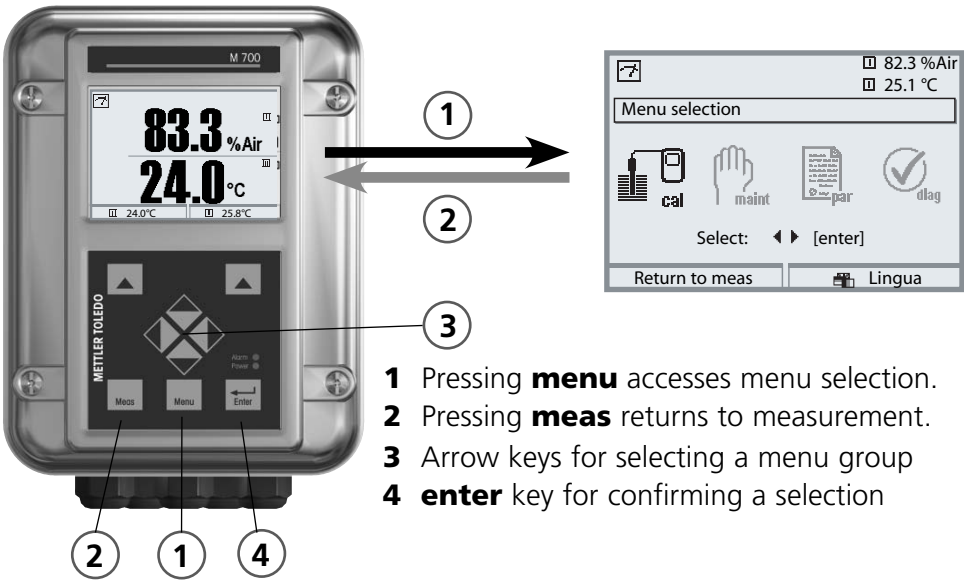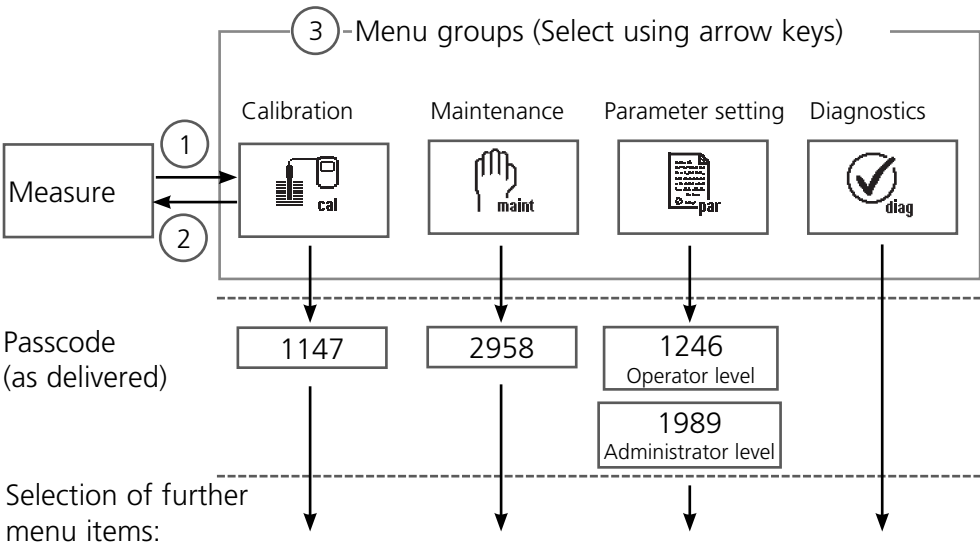
Passcode Entry

To enter a passcode
Select the position using the left/right keys, then edit the number using the up/down keys.
When all numbers have been entered, confirm with **enter**.

To change a passcode
- Open the menu selection (**menu**)
- Select parameter setting
- Administrator level, enter passcode
- Select System control: Passcode entry

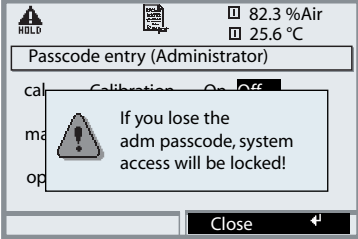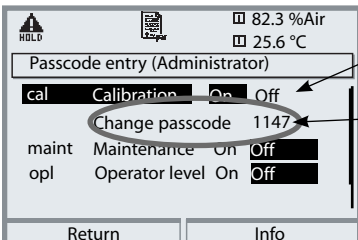| Menu	Display	System control: Passcode entry
	⚠ HOLD □ 82.3 %Air □ 25.6 °C Passcode entry (Administrator) cal — Calibration — On — Off ma If you lose the adm passcode, system access will be locked! op Close ↵	**Changing a passcode** **"Passcode entry" menu** When this menu is opened, the analyzer displays a warning (Fig.). Passcodes (factory settings): Calibration 1147 Maintenance 2958 Operator level 1246 Administrator level 1989 **If you lose the passcode** for the Administrator level, system access will be locked! Please consult our technical support!
	⚠ HOLD □ 82.3 %Air □ 25.6 °C Passcode entry (Administrator) cal Calibration On Off Change passcode 1147 maint Maintenance On Off opl Operator level On Off Return Info	**To change a passcode** Select "On" using arrow keys, confirm with **enter**. Select the position using the **left/right** keys, then edit the number using the **up/down** keys. When all numbers have been entered, confirm with **enter**.

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Configuring the Measurement Display

Select menu: Parameter setting/Module FRONT/Measurement display

Pressing **meas** (1) returns the analyzer to the measuring mode from any function.
All process variables coming from the modules can be displayed. The table on the next page describes how to configure the measurement display.
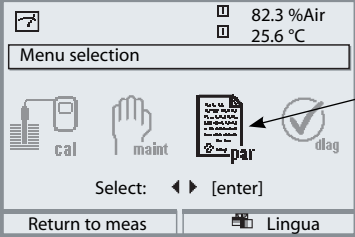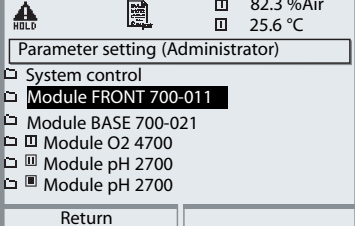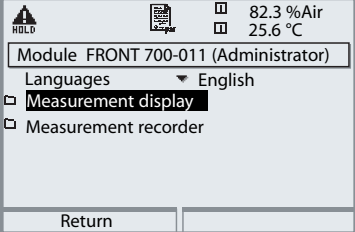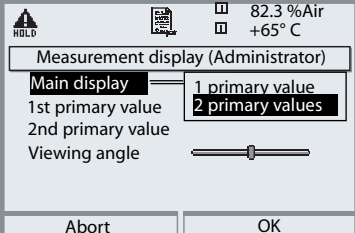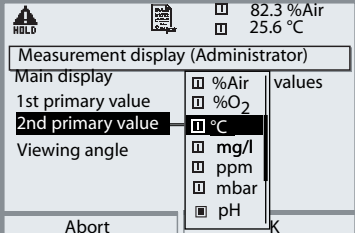
Measurement display
Typical measurement display

Secondary displays
Additional values, also date and time, can be displayed depending on the modules installed.

Softkeys
In measuring mode, the softkeys allow selection of values for the secondary displays or control of functions (user defined).

Menu	Display	Configure measurement display
	⬈ ▯ 82.3 %Air ▯ 25.6 °C Menu selection cal maint par diag Select: ◀ ▶ [enter] Return to meas Lingua	**Configure measurement display** Press **menu** key to Menu selection Select parameter setting using arrow keys, confirm with **enter**. Select: "Administrator level": Passcode 1989 (default setting).
par	⚠ HOLD ▯ 82.3 %Air ▯ 25.6 °C Parameter setting (Administrator) ▢ System control ▢ Module FRONT 700-011 ▢ Module BASE 700-021 ▢ ▯ Module O2 4700 ▢ ▯ Module pH 2700 ▢ ▯ Module pH 2700 Return	Parameter setting: Select "Module FRONT"
	⚠ HOLD ▯ 82.3 %Air ▯ 25.6 °C Module FRONT 700-011 (Administrator) Languages ▾ English ▢ Measurement display ▢ Measurement recorder Return	Front module: Select "Measurement display"
	⚠ HOLD ▯ 82.3 %Air ▯ +65° C Measurement display (Administrator) Main display ⎤ 1 primary value 1st primary value ⎢ 2 primary values 2nd primary value Viewing angle ▭▬▭ Abort OK	Measurement display: Set the number of primary values (large display) to be displayed
	⚠ HOLD ▯ 82.3 %Air ▯ 25.6 °C Measurement display (Administrator) Main display ⎤ ▯ %Air ⎢values 1st primary value ⎢ ▯ %O2 2nd primary value ⎢ ▯ °C Viewing angle ⎢ ▯ mg/l ⎢ ▯ ppm ⎢ ▯ mbar ⎣ ▯ pH Abort K	Select process variable(s) to be displayed and confirm with **enter**. Note: Automatic range selection ppm <--> % and ppm <--> ppb; only suitable unit can be selected! To return to measurement: **meas**

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Calibration / Adjustment

Note: HOLD mode active for the currently calibrated module
Current outputs and relay contacts behave as configured

- **Calibration:** Detecting deviations without readjustment
- **Adjustment:** Detecting deviations with readjustment

Attention:
Without adjustment every dissolved oxygen meter delivers an imprecise or
wrong output value! After replacing the sensor, the electrolyte, or the sensor
membrane, you must perform a calibration.
The resulting values must be taken over by an adjustment for calculating the
measured variables (measured value display, output signals)!

Procedure
Every dissolved oxygen sensor has its individual slope and zero point. Both
values are altered, for example, by aging. For sufficiently high accuracy of
oxygen measurement, the meter must be regularly adjusted for the sensor
data (calibration + adjustment).

Sensor Replacement (First Calibration)
After replacement of the sensor, electrolyte or sensor membrane, a "First
Calibration" should be performed. During First Calibration, the sensor data
are stored as reference values for the statistics.
The "Statistics" menu of Diagnostics shows the deviations of zero, slope,
calibration temperature, calibration pressure, and response time of the last
three calibrations with respect to the reference values of the First Calibration.
This allows evaluation of the drift behavior and aging of the sensor.

Calibration/Adjustment Methods
- Automatic calibration in water/air
- Product calibration (saturation/concentration)
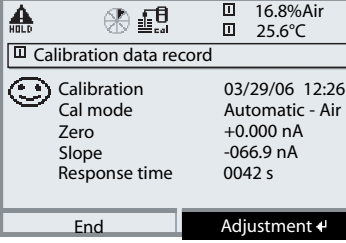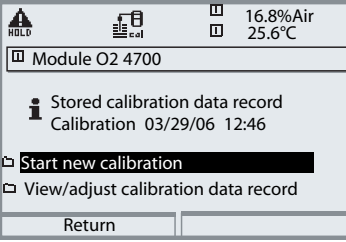- Data entry
- Zero correction

Adjustment

Adjustment means that the values determined by a calibration are taken over. The values determined for zero and slope are entered in the calibration record. (Cal record can be called up in the Diagnostics menu for the module.)
These values are only effective for calculating the measured variables when the calibration has been terminated with an adjustment.
A passcode ensures that an adjustment can only be performed by an authorized person (Administrator).
The Operator can check the current sensor data by a calibration and inform the Administrator when there are deviations.
You can use the additional function SW 700-107 for granting access rights (passcodes) and for Audit Trail (continuous data recording and backup according to FDA 21 CFR Part 11).

Menu	Display	Adjustment after calibration
	HOLD 16.8%Air 25.6°C Calibration data record Calibration 03/29/06 12:26 Cal mode Automatic - Air Zero +0.000 nA Slope -066.9 nA Response time 0042 s End Adjustment ↵	**Administrator** With the corresponding access rights, the device can immediately be adjusted after calibration. The calibration values are taken over for calculating the measured variables.
	HOLD 16.8%Air 25.6°C Module O2 4700 Stored calibration data record Calibration 03/29/06 12:46 Start new calibration View/adjust calibration data record Return	**Operator** (without administrator rights) After calibration, change to measuring mode. Inform Administrator. When opening the menu (Calibration, respective module), the Administrator sees all data of the last calibration and can take over the values or perform a new calibration.

Adjustment

Recommendations for Calibration

It is always recommended to calibrate in air. Compared to water, air is a calibration medium which is easy to handle, stable, and thus safe. In the most cases, however, the sensor must be dismounted for a calibration in air. In certain processes the sensor cannot be removed for calibration. Here, calibration must be performed directly in the process medium (e.g. with aeration). For applications where concentration is measured, calibration in air has proved to be useful.

Common Combination: Process Variable / Calibration Mode

Measurement	Calibration
Saturation	Water
Concentration	Air

If there is a temperature difference between the calibration medium and the measured medium, the sensor must be kept in the respective medium for several minutes before and after calibration in order to deliver stable measured values. The type of calibration pressure detection is preset during parameter setting.
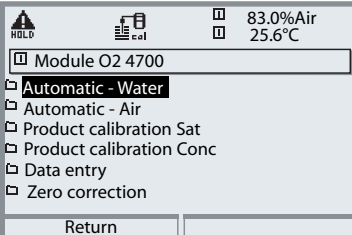
Calibration / Adjustment

Selecting a Calibration Method
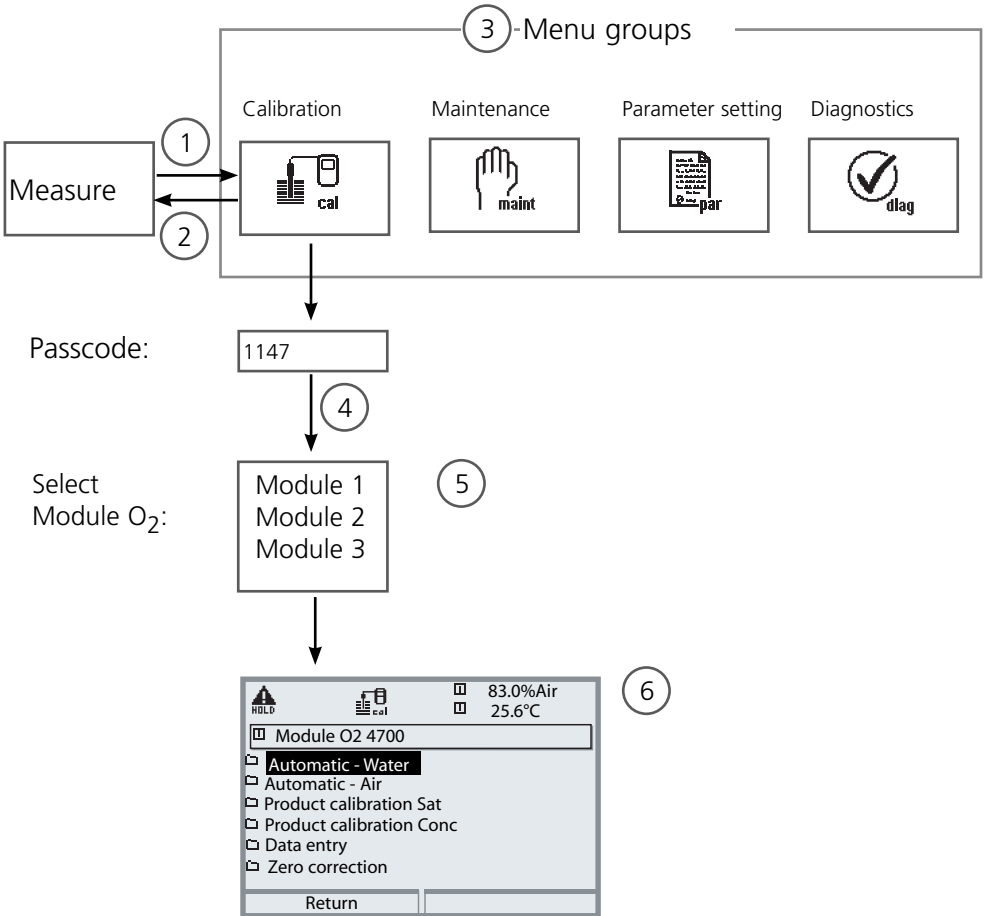
O_2 module calibration: Select a calibration method
(1) Press **menu** key to access menu selection
(2) Pressing the **meas** key returns to measurement
(3) Select Calibration menu group using the arrow keys
(4) Press **enter** to confirm, enter passcode
(5) Select O_2 module, confirm with **enter**.
(6) Select calibration method

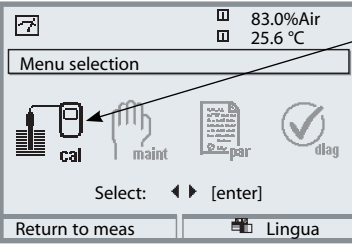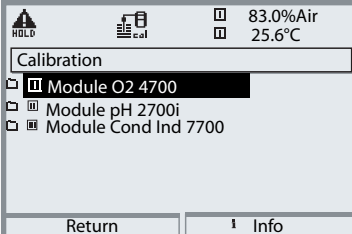| Menu	Display	Select a calibration method
	83.0%Air **25.6 °C** Menu selection cal maint par diag Select: ◀ ▶ [enter] Return to meas Lingua	**Call up calibration** Press **menu** key to select menu. Select calibration using arrow keys, confirm with **enter**, passcode 1147 (To change passcode, select: Parameter setting / System control / Passcode entry). After passcode entry, the module is in HOLD mode: Current outputs and relay contacts of the currently calibrated module behave as configured (BASE) until the Calibration menu is exited.
cal	**HOLD** **cal** **83.0%Air** **25.6°C** Calibration Module O2 4700 Module pH 2700i Module Cond Ind 7700 Return ¹ Info	Calibration: Select "Module O$_2$"
	HOLD **cal** **83.0%Air** **25.6°C** Module O2 4700 Automatic - Water Automatic - Air Product calibration Sat Product calibration Conc Data entry Zero correction Return	Select a calibration method: • Automatic - Water • Automatic - Air • Product calibration: Saturation • Product calibration: Concentration • Data entry • Zero correction When you call up calibration, the analyzer automatically proposes the previous calibration method. If you do not want to calibrate, "Return" with the left softkey.

33

Calibration / Adjustment

Automatic Calibration in Water

Automatic Calibration in Water
The slope is corrected using the saturation value (100 %) related to
air saturation.
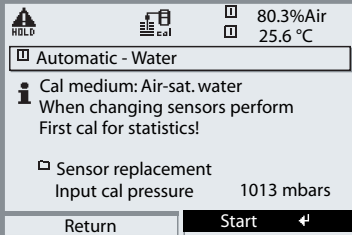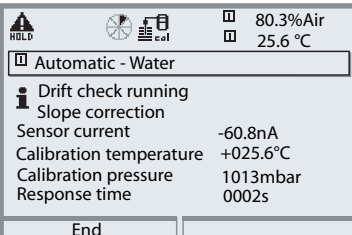
During calibration the module is in HOLD mode.
Current outputs and relay contacts of the module behave as configured
(BASE module).

Caution!
Ensure sufficient medium flow to the sensor (see Specifications of dissolved
oxygen sensors)! The calibration medium must be in equilibrium with air.
Oxygen exchange between water and air is very slow. Therefore, it takes a
relatively long time until water is saturated with atmospheric oxygen. If there
is a temperature difference between calibration medium and measured medi-
um, the sensor must be kept in the respective medium for several minutes
before and after calibration.

Menu	Display	Select calibration mode
	HOLD — 80.3%Air — 25.6°C Calibration Module O2 4700 Module pH 2700i Module Cond Ind 7700 Return — i Info	**Select module:** O_2 4700 The module is in HOLD mode. Current outputs and relay contacts of the currently calibrated module behave as configured (BASE). Confirm with **enter**
	HOLD — 80.3%Air — 25.6°C Module O2 4700 Automatic - Water Automatic - Air Product calibration Sat Product calibration Conc Data entry Zero correction Return	Select "Automatic - Water" calibration method Remove sensor and immerse it in cal medium (air-saturated water), ensure sufficient medium flow to the sensor. Confirm with **enter**

Menu	Display	Automatic calibration in water
⬛📏 cal	🔺 HOLD ⬛📏cal · ▦ 80.3%Air · ▦ 25.6 °C ▦ Automatic - Water ℹ Cal medium: Air-sat. water When changing sensors perform First cal for statistics! ▢ Sensor replacement Input cal pressure 1013 mbars Return Start ↵	Display of selected calibration medium (Air-sat. water) Enter cal pressure if "manual" has been configured. Start with softkey or **enter**
	🔺 HOLD ✳▦cal · ▦ 80.3%Air · ▦ 25.6 °C ▦ Automatic - Water ℹ Drift check running Slope correction Sensor current -60.8nA Calibration temperature +025.6°C Calibration pressure 1013mbar Response time 0002s End	Drift check. Display during calibration • Sensor current • Calibration temperature • Calibration pressure • Response time Waiting time can be reduced by pressing **enter** (without drift check: reduced accuracy of calibration values!). From the response time, you see how long it takes the sensor to deliver a stable signal. If the signal or the measured temperature fluctuate greatly, the calibration procedure is aborted after 2 min. Calibration must be re-started. If successful, place sensor in process, end calibration with softkey or **enter**
	🔺 HOLD ✳▦cal · ▦ 80.3%Air · ▦ 25.6 °C ▦ Calibration data record ☺ Calibration 06/12/06 15:20 Cal mode Automatic - Water Zero +0.030 nA Slope +059.3 nA Response time 0070 sec End Adjustment ↵	**Adjustment** Press "Adjust" to take over the values determined during calibration for calculating the measured variables.

35

Calibration / Adjustment

Automatic Calibration in Air
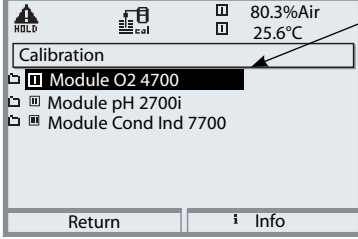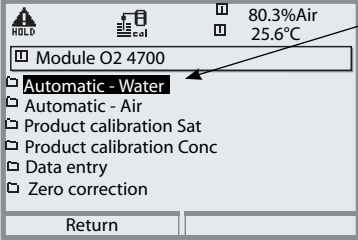
Automatic Calibration in Air
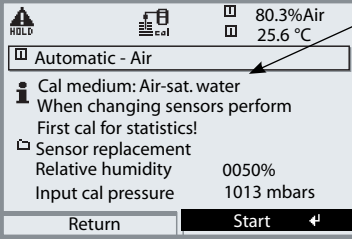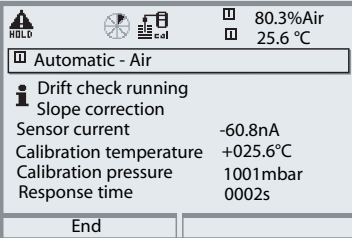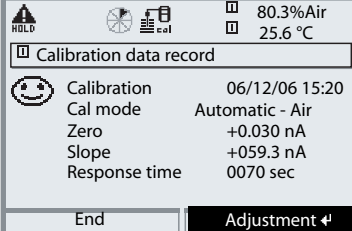
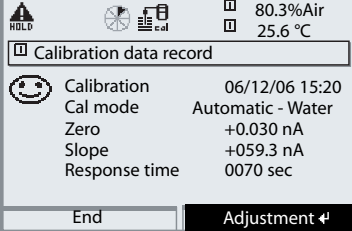The slope is corrected using the saturation value (100 %), similar to air saturation of water. Since this analogy only applies to water-vapor saturated air (100 % relative humidity) and often the calibration air is less humid, the relative humidity of the calibration air must also be specified. If you do not know the exact value of the relative humidity of the calibration air, you can take the following reference values for a sufficiently precise calibration:

• Ambient air: 50 % rel. humidity (average)
• Bottled gas (synthetic air): 0 % rel. humidity

Caution!

The sensor membrane must be dry. Be sure to keep temperature and pressure constant during calibration. If there is a temperature difference between calibration medium and measured medium, the sensor must be kept in the respective medium for several minutes before and after calibration.

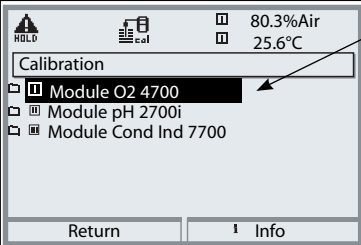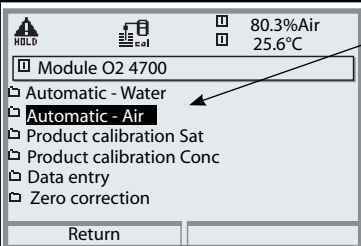| Menu	Display	Select calibration mode
	HOLD — 80.3%Air — 25.6°C — Calibration — Module O2 4700 — Module pH 2700i — Module Cond Ind 7700 — Return — Info	**Select module:** O_2 4700 The module is in HOLD mode. Current outputs and relay contacts of the currently calibrated module behave as configured (BASE). Confirm with **enter**
	HOLD — 80.3%Air — 25.6°C — Module O2 4700 — Automatic - Water — Automatic - Air — Product calibration Sat — Product calibration Conc — Data entry — Zero correction — Return	Select "Automatic - Air" calibration method Remove sensor and place it in air. Confirm with **enter**.

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Menu	Display	Automatic calibration in air

Menu	Display	Automatic calibration in air
▮▮▮▯ cal	**HOLD** ▮▮▮ 🖩cal ⊞ 80.3%Air ⊞ 25.6 °C ⊞ Automatic - Air ⓘ Cal medium: Air-sat. water When changing sensors perform First cal for statistics! 🗁 Sensor replacement Relative humidity 0050% Input cal pressure 1013 mbars Return **Start** ↵	Cal medium: Air Select: First calibration Enter relative humidity, e.g.: • Ambient air: 50 % • Bottled gas: 0 % Enter cal pressure if "manual" has been configured. Start with softkey or **enter**
	HOLD ✺ 🖩cal ⊞ 80.3%Air ⊞ 25.6 °C ⊞ Automatic - Air ⓘ Drift check running Slope correction Sensor current -60.8nA Calibration temperature +025.6°C Calibration pressure 1001mbar Response time 0002s End	Drift check. Display during calibration • Sensor current, calibration temp, cal pressure and response time. Waiting time can be reduced by pressing "End" (without drift check: reduced accuracy of calibration values!). From the response time, you see how long it takes the sensor to deliver a stable signal. If the signal or the measured temperature fluctuate greatly, the calibration procedure is aborted after about 2 min. Calibration must be re-started. If successful, replace sensor in the process. End calibration with softkey or **enter**
	HOLD ✺ 🖩cal ⊞ 80.3%Air ⊞ 25.6 °C ⊞ Calibration data record ☺ Calibration 06/12/06 15:20 Cal mode Automatic - Air Zero +0.030 nA Slope +059.3 nA Response time 0070 sec End **Adjustment** ↵	**Adjustment** Press "Adjust" to take over the values determined during calibration for calculating the measured variables.

Calibration / Adjustment

Product Calibration: Saturation

Product Calibration: Saturation
(Calibration with Sampling)

When the sensor cannot be removed – e.g. for sterility reasons – its slope can be determined with "sampling". To do so, the currently measured saturation value of the process is stored by the M 700. Directly afterwards, a reference value is determined using a portable meter, for example. The reference value is entered into the measuring system. From the difference between measured value and reference value, the M 700 calculates the sensor slope. With low saturation values, the M 700 corrects the zero point, with high values the slope.
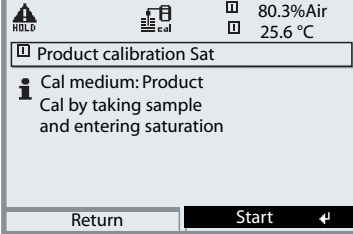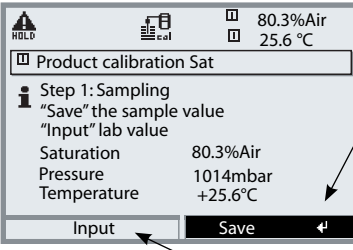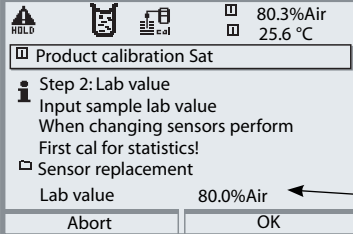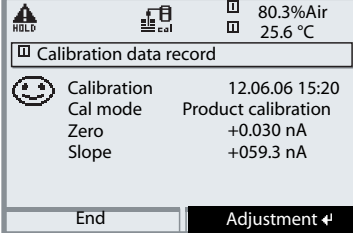
During calibration the module is in HOLD mode.

Current outputs and relay contacts of the module behave as configured (BASE module).

Caution!

The reference value must be measured at temperature and pressure conditions similar to those of the process.

Menu	Display	Product calibration: Saturation
	80.3%Air 25.6°C Calibration ▢ Module O2 4700 ▢ Module pH 2700i ▢ Module Cond Ind 7700 Return · Info	**Select module:** O_2 4700 The module is in HOLD mode. Current outputs and relay contacts of the currently calibrated module behave as configured (BASE). Confirm with **enter**
	80.3%Air 25.6°C ▢ Module O2 4700 Automatic - Water Automatic - Air Product calibration Sat Product calibration Conc Data entry Zero correction Return	Select "Product calibration Sat" calibration method Confirm with **enter**.

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Menu	Display	Product calibration: Saturation

Menu: (icons)

Display:

```
⚠        📶     [I] 80.3%Air
HOLD            [I] 25.6 °C
[I] Product calibration Sat
ℹ Cal medium: Product
  Cal by taking sample
  and entering saturation


      Return          Start    ↵
```

```
⚠        📶     [I] 80.3%Air
HOLD            [I] 25.6 °C
[I] Product calibration Sat
ℹ Step 1: Sampling
  "Save" the sample value
  "Input" lab value
  Saturation      80.3%Air
  Pressure        1014mbar
  Temperature     +25.6°C
      Input           Save     ↵
```

```
⚠    📛   📶    [I] 80.3%Air
HOLD            [I] 25.6 °C
[I] Product calibration Sat
ℹ Step 2: Lab value
  Input sample lab value
  When changing sensors perform
  First cal for statistics!
  ▢ Sensor replacement
  Lab value       80.0%Air
      Abort            OK
```

```
⚠        📶    [I] 80.3%Air
HOLD           [I] 25.6 °C
[I] Calibration data record
☺ Calibration    12.06.06 15:20
  Cal mode       Product calibration
  Zero           +0.030 nA
  Slope          +059.3 nA

      End          Adjustment ↵
```

Product calibration: Saturation

Product calibration Sat
Product calibration is performed in
2 steps.
Prepare reference measurement (e.g.
with portable meter), start with soft-
key or **enter**

Step 1
Take sample.
Store measured value and tem-
perature at the moment of sampling
("Save" softkey or **enter**)
Press **meas** to return to measure-
ment.

Exception:
Sample value can be measured on
the site and be entered immediately.
To do so, press "Input" softkey.

Step 2
Lab value has been measured.
When you open the Product calibra-
tion menu again, the display shown
on the left appears:
Enter reference value ("Lab value").
Confirm with "OK".

Adjustment
Press "Adjust" to take over the
values determined during calibra-
tion for calculating the measured
variables.

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Calibration / Adjustment

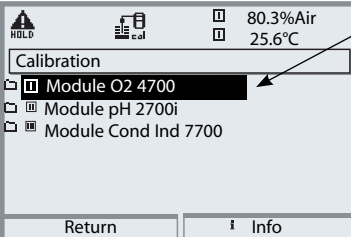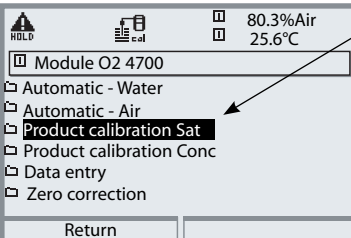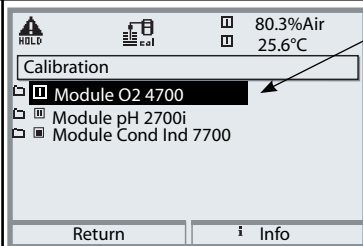## Product Calibration: Concentration (Calibration with Sampling)
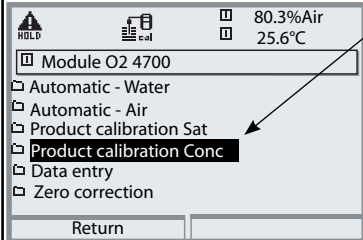
When the sensor cannot be removed – e.g. for sterility reasons – its slope can be determined with "sampling". To do so, the currently measured concentration value of the process is stored by the M 700. Directly afterwards, a reference value is determined using a portable meter, for example. The reference value is entered into the measuring system. From the difference between measured value and reference value, the M 700 calculates the sensor slope. With low concentration values, the M 700 corrects the zero point, with high concentrations the slope.

During calibration the module is in HOLD mode.

Current outputs and relay contacts of the module behave as configured (BASE module).

Caution!

The reference value must be measured at temperature and pressure conditions similar to those of the process.

Menu	Display	Product calibration: Concentration
cal	80.3%Air 25.6°C Calibration Module O2 4700 Module pH 2700i Module Cond Ind 7700 Return i Info	**Select module:** O_2 4700 The module is in HOLD mode. Current outputs and relay contacts of the currently calibrated module behave as configured (BASE). Confirm with **enter**
	80.3%Air 25.6°C Module O2 4700 Automatic - Water Automatic - Air Product calibration Sat Product calibration Conc Data entry Zero correction Return	Select "Product calibration Conc" calibration method Confirm with **enter**

Menu	Display	Product calibration: Concentration

Product calibration Conc
Product calibration is performed in 2 steps.
Prepare reference measurement (e.g. with portable meter), start with softkey or **enter**

Display (first screen):
| ⚠ HOLD   ▯ 80.3%Air / ▯ 25.6 °C |
| ▯ Product calibration Conc |
| ℹ Cal medium: Product Calibration by sampling and entering concentration |
| Return | Start ↵ |

Step 1
Take sample.
Store measured value and temperature at the moment of sampling ("Save" softkey or **enter**)
Press **meas** to return to measurement.

Display (second screen):
| ⚠ HOLD   ▯ 80.3%Air / ▯ 25.6 °C |
| ▯ Product calibration Conc |
| ℹ Step 1: Sampling 'Save' the sample value 'Input' lab value |
| Concentration 8500 µg/l |
| Pressure 1013 mbars |
| Temperature +25.6° C |
| Input | Save ↵ |

Exception:
Sample value can be measured on the site and be entered immediately. To do so, press "Input" softkey.

Step 2
Enter reference value ("Lab value"). When you open the Product calibration menu again, the display shown on the left appears:
Enter reference value ("Lab value"). Confirm with "OK".

Display (third screen):
| ⚠ HOLD   ▯ 80.3%Air / ▯ 25.6 °C |
| ▯ Product calibration Conc |
| ℹ Step 2: Lab value Input sample lab value When changing sensors perform First cal for statistics! |
| ⌂ Sensor replacement |
| Lab value 0017µg/l |
| Return | OK |

Adjustment
Press "Adjust" to take over the values determined during calibration for calculating the measured variables.

Display (fourth screen):
| ⚠ HOLD   ▯ 80.3%Air / ▯ 25.6 °C |
| ▯ Calibration data record |
| ☺ Calibration 12.06.06 15:20 |
| Cal mode Product calibration |
| Zero +0.030 nA |
| Slope +059.3 nA |
| End | Adjustment ↵ |

Calibration / Adjustment

Data Entry of Premeasured Sensors
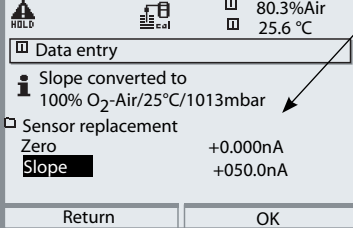
Data Entry of Premeasured Sensors
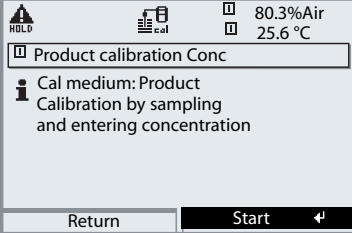Entry of values for slope and zero point of a sensor, related to 25°C, 1013 mbars.

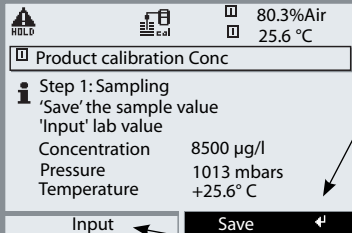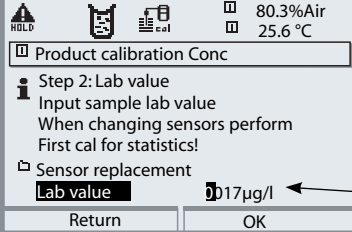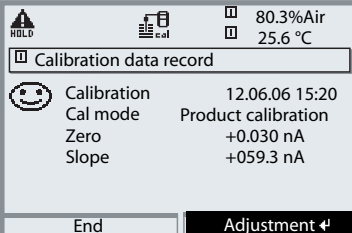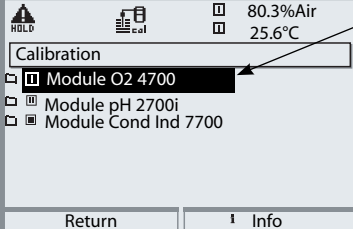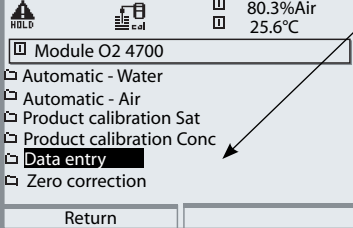## During calibration the module is in HOLD mode.
Current outputs and relay contacts of the module behave as configured (BASE module).

Slope = Sensor current at 100 % atmospheric oxygen, 25 °C, 1013 mbars

Menu	Display	Data entry of premeasured sensors
	HOLD cal 80.3%Air 25.6°C Calibration □ Module O2 4700 □ Module pH 2700i □ Module Cond Ind 7700 Return Info	**Select module:** O_2 4700 The module is in HOLD mode. Current outputs and relay contacts of the currently calibrated module behave as configured (BASE). Confirm with **enter**
	HOLD cal 80.3%Air 25.6°C □ Module O2 4700 Automatic - Water Automatic - Air Product calibration Sat Product calibration Conc Data entry Zero correction Return	Select "Data entry" calibration method Confirm with **enter**
	HOLD cal 80.3%Air 25.6 °C □ Data entry i Slope converted to 100% O_2-Air/25°C/1013mbar Sensor replacement Zero +0.000nA Slope +050.0nA Return OK	Enter the values for • Slope • Zero of premeasured sensor Confirm with "OK".
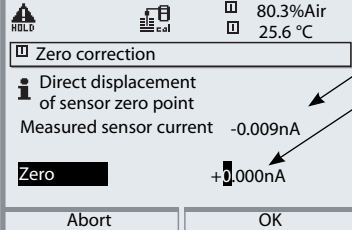
Calibration / Adjustment
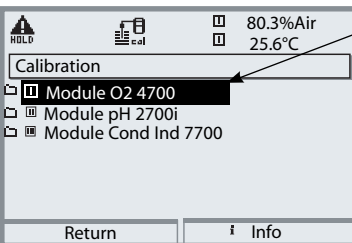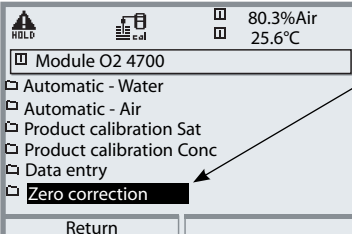
Zero Correction

Zero Correction

The series InPro 6xxx sensors have a very low zero current. For trace measurements below 500 ppb, the zero point should be calibrated.
If a zero correction is performed, the sensor should remain for at least 10 to 60 minutes in the calibration medium (media cotaining CO_2 at least 120 min) to obtain stable, non-drifting values. During zero correction, a drift check is not performed.
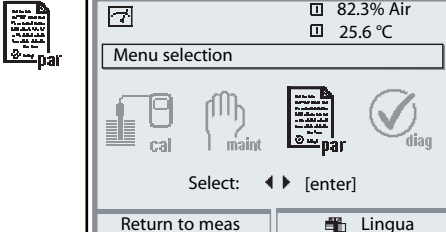
Menu	Display	Zero correction
 cal	**HOLD** cal 80.3%Air 25.6°C Calibration ▸ Module O2 4700 ▸ Module pH 2700i ▸ Module Cond Ind 7700 Return i Info	**Select module:** O_2 4700 The module is in HOLD mode. Current outputs and relay contacts of the currently calibrated module behave as configured (BASE). Confirm with **enter**
	HOLD cal 80.3%Air 25.6°C Module O2 4700 ▸ Automatic - Water ▸ Automatic - Air ▸ Product calibration Sat ▸ Product calibration Conc ▸ Data entry ▸ Zero correction Return	Select "Zero correction" calibration method Confirm with **enter**

	HOLD cal 80.3%Air 25.6 °C
	Zero correction
	i Direct displacement
	  of sensor zero point
	Measured sensor current -0.009nA
	
	Zero +0.000nA
	Abort OK
		Zero correction:
		Display of measured sensor current.
		• Enter input current
		  for zero point
		Confirm with "OK".

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Parameter Setting: Operating Levels
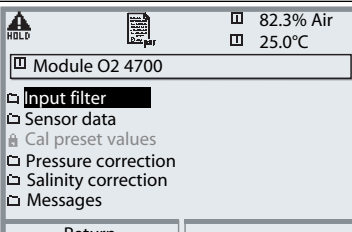
Viewing level, Operator level, Administrator level
Note: HOLD mode (Setting: BASE module)

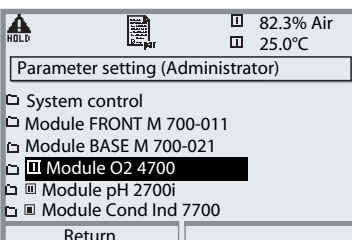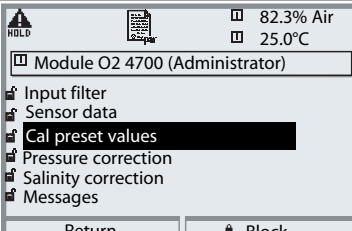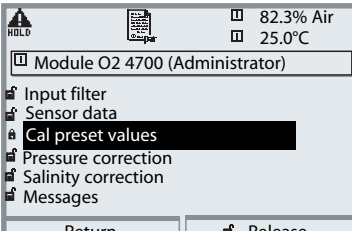| Menu	Display	Viewing level, Operator level, Administrator level
	▱ 82.3% Air 25.6 °C Menu selection cal maint par diag Select: ◀ ▶ [enter] Return to meas Lingua	**Call up parameter setting** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, confirm with **enter**.
	▱ 82.3% Air 25.6 °C Parameter setting ▱ Viewing level (All Data) view 🔒 Operator level (Operation Data) opl 🔒 Administrator level (All Data) adm Return	**Administrator level** Access to all functions, also passcode setting. Releasing or blocking a function for access from the Operator level.
	⚠ HOLD 82.3% Air 25.6 °C Module FRONT (Administrator) Languages ▼ English 🔒 Measurement display Measurement recorder KI recorder Return 🔒 Release	Functions which can be blocked for the Operator level are marked with the "lock" symbol. The functions are released or blocked using the softkey.
	⚠ HOLD 82.3% Air 25.6 °C Module FRONT Languages ▼ English 🔒 Measurement display ▱ Measurement recorder ▱ KI recorder Return	**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!

Parameter Setting: Lock Functions
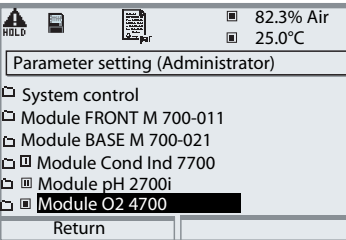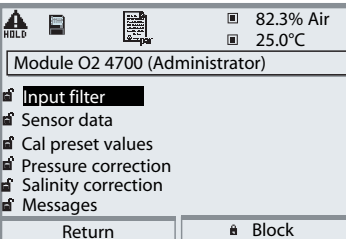
Administrator level: Enable / lock functions for Operator level
Note: HOLD mode (Setting: BASE module)

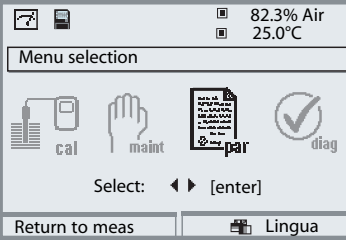| Menu	Display	Administrator level: Enable / lock functions
par	⚠ HOLD 📄par 🗔 82.3% Air 🗔 25.0°C Parameter setting (Administrator) 📂 System control 📂 Module FRONT M 700-011 📂 Module BASE M 700-021 📂 🗔 Module O2 4700 📂 🗔 Module pH 2700i 📂 🗔 Module Cond Ind 7700 Return	**Example:** Blocking access to the calibration adjustments from the Operator level **Call up parameter setting** Select Administrator level. Enter passcode (1989). Select "Module O$_2$" (e.g.) using arrow keys, confirm with **enter**.
	⚠ HOLD 📄par 🗔 82.3% Air 🗔 25.0°C 🗔 Module O2 4700 (Administrator) 🔓 Input filter 🔓 Sensor data 🔓 Cal preset values 🔓 Pressure correction 🔓 Salinity correction 🔓 Messages Return 🔒 Block	Select "Cal preset values" using arrow keys. "Block" with softkey.
	⚠ HOLD 📄par 🗔 82.3% Air 🗔 25.0°C 🗔 Module O2 4700 (Administrator) 🔓 Input filter 🔓 Sensor data 🔒 Cal preset values 🔓 Pressure correction 🔓 Salinity correction 🔓 Messages Return 🔓 Release	Now, the "Cal preset values" line is marked with the "lock" icon. This function cannot be accessed from the Operator level any more. The softkey function changes to "Release".
par	⚠ HOLD 📄par 🗔 82.3% Air 🗔 25.0°C 🗔 Module O2 4700 📂 Input filter 📂 Sensor data 🔒 Cal preset values 📂 Pressure correction 📂 Salinity correction 📂 Messages Return	**Call up parameter setting** Select Operator level, passcode (1246). Select "Module O$_2$". Now, the locked function is displayed in gray and marked with the "lock" icon.

Activating Parameter Setting

Call up parameter setting

Menu	Display	Parameter setting
par	□ ▣ 82.3% Air ▣ 25.0°C Menu selection cal maint par diag Select: ◀ ▶ [enter] Return to meas 🔲 Lingua	**Call up parameter setting** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, confirm with **enter**. Passcode as delivered: 1989
	⚠ ▣ ▣ 82.3% Air HOLD par ▣ 25.0°C Parameter setting (Administrator) ▢ System control ▢ Module FRONT M 700-011 ▢ Module BASE M 700-021 ▢ ▣ Module Cond Ind 7700 ▢ ▣ Module pH 2700i ▢ ▣ Module O2 4700 Return	Select module, confirm with **enter**. (In the Figure, the "O_2" module is selected, for example.)
	⚠ ▣ ▣ 82.3% Air HOLD par ▣ 25.0°C Module O2 4700 (Administrator) 🔒 Input filter 🔒 Sensor data 🔒 Cal preset values 🔒 Pressure correction 🔒 Salinity correction 🔒 Messages Return 🔒 Block	Select parameter using arrow keys, confirm with **enter**.

During parameter setting the analyzer is in HOLD mode:
Current outputs and relay contacts behave as configured (BASE module).

Documenting Parameter Setting

You must reproducibly document all parameter settings in the device to achieve a high level of system and device security according to GLP. For that purpose, an Excel file is provided (on the CD-ROM shipped with the basic device or as download at www.mt.com/pro) to enter the parameter settings.

The Excel file provides one worksheet for each module with columns for the following parameters: Factory settings, parameter set A, parameter set B. Enter your settings as parameter set A or B.
The gray cells in the parameter set B column cannot be modified since they contain sensor-specific values which cannot be changed by parameter set switchover. Here, the values listed under parameter set A apply.

Documenting Parameter Setting

	A	B	C	D	E	F
1						
2	1.	**Meßstelle:**				Zugriff über Menüpunkt:
3		**M 700**				
4	1.1.	parametriert am / von:				
5						
6						
7	2.	Gerätebeschreibung	Hardware	Software	Seriennummer	Diagnose / Gerätebeschreibung
8	2.1.	Bedienfront 700-011 :				Diagnose / Gerätebeschreibung / Front
9	2.2.	M 700 Base 700-021:				Diagnose / Gerätebeschreibung / Base
10	2.3.	Modul Steckplatz [I] :				Diagnose / Gerätebeschreibung / I
11	2.4.	Modul Steckplatz [II] :				Diagnose / Gerätebeschreibung / II
12	2.5.	Modul Steckplatz [III] :				Diagnose / Gerätebeschreibung / III
13						
14						
15		**M 700 Front**				
16	3.	M 700 Front Einstellungen	Werkseinstellung	Parametersatz A	Parametersatz B	
17	3.1.	Sprache:	Deutsch			Parametrierung (Spezialist) / Modul Front ...
18						
19	3.1.1	Meßwertanzeige:				
20		Hauptanzeige	2 Hauptmeßwerte			Parametrierung (Spezialist) / Modul Front ... / Meß
21		1. Hauptmeßwert (Modul/Wert):	modulabhängig			
22		2. Hauptmeßwert (Modul/Wert):	modulabhängig			
23		Anzeigeformat (pH)	xx.xx pH			
24		Blickwinkel	Mitte			
25						
26	3.3.	Nebenanzeige				Einstellung erfolgt über Softkeys, wenn in Matrixfu
27		Anzeigewert, links	-			
28		Anzeigewert, rechts	-			
29						
30	3.4	Meßwertrecorder:	Option SW700-103			Parametrierung (Spezialist) / Modul Front ... / Meß
31		Zeitbasis (t / Pixel)	1 min			
32		Zeitlupe (10x)	Aus			
33		Min / Max anzeigen	Ein			
34	3.4.1	Kanal 1: Meßgröße	modulabhängig			
35		Anfang	0.00			
36		Ende	14.00			
37	3.4.2	Kanal 2: Meßgröße	modulabhängig			
38		Anfang	-50.0			
39		Ende	150.0			

From the application window of the Excel file, select the worksheet for the module the parameter settings of which you want to document.
Set the parameters of the respective module and enter the selected values in the corresponding cells of the module worksheet.
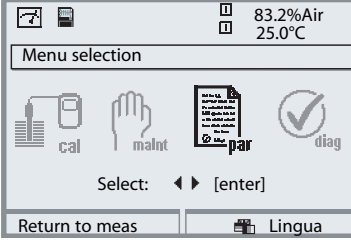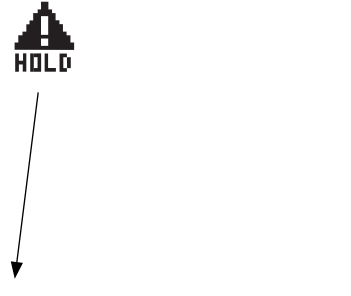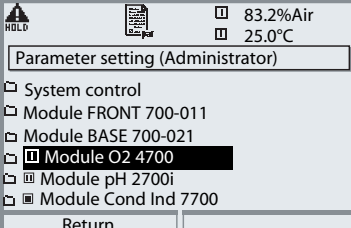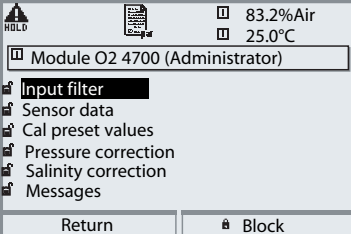
Caution!

Display	During parameter setting the "HOLD" mode is active.
	HOLD. The NAMUR "function check" contact is active (factory setting: Module BASE, Contact K2, N/O contact). Current output response is user-defined: • Current meas.: The currently measured value appears at the current output • Last usable value: The last measured value is held at the current output • Fixed 22 mA: The output current is at 22 mA

Module Configuration: Operating Mode
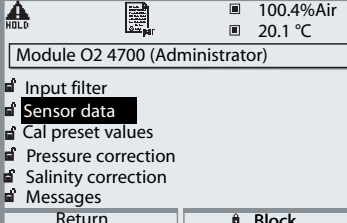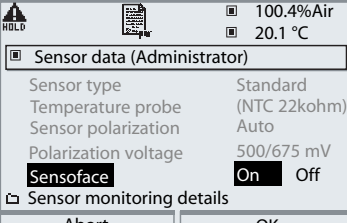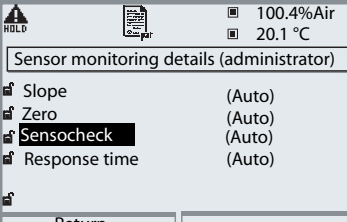
Call up parameter setting
Note: HOLD mode
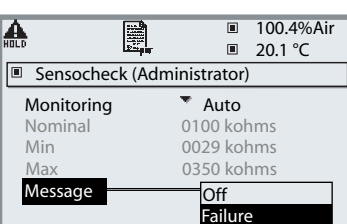
Menu	Display	Parameter setting
	⊞ ▤ 83.2%Air 25.0°C Menu selection cal maint **par** diag Select: ◀ ▶ [enter] Return to meas 🏳 Lingua	**Call up parameter setting** From the measuring mode: Press **menu** key to select menu. Select parameter setting using arrow keys, confirm with **enter**. Passcode 1989 (To change passcode: Parameter setting/System control/ Passcode entry).
	⚠ HOLD	**HOLD** During parameter setting the analyzer is in "HOLD" mode. Current outputs and relay contacts behave as configured.
	⚠ HOLD 🗎 83.2%Air 25.0°C Parameter setting (Administrator) ⊡ System control ⊡ Module FRONT 700-011 ⊡ Module BASE 700-021 ⊡ Module O2 4700 ⊡ Module pH 2700i ⊡ Module Cond Ind 7700 Return	Select "Module O_2 4700". Confirm with **enter**
	⚠ HOLD 🗎 83.2%Air 25.0°C Module O2 4700 (Administrator) Input filter Sensor data Cal preset values Pressure correction Salinity correction Messages Return 🔒 Block	Select "Operating mode" using arrow keys, confirm with **enter.**

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Setting the Sensor Data Parameters

Sensor data: Sensor monitoring details
Note: HOLD mode active

Menu	Display	Parameter selection
	HOLD ▲ 100.4%Air 20.1 °C Module O2 4700 (Administrator) ▪ Input filter ▪ Sensor data ▪ Cal preset values ▪ Pressure correction ▪ Salinity correction ▪ Messages Return 🔒 Block	**Sensor data** (see following page) Sensor data are preset depending on the sensor type. Gray display lines cannot be edited.
	HOLD ▲ 100.4%Air 20.1 °C ▪ Sensor data (Administrator) Sensor type Standard Temperature probe (NTC 22kohm) Sensor polarization Auto Polarization voltage 500/675 mV Sensoface On Off ☐ Sensor monitoring details Abort OK	**Sensoface** provides information on the sensor condition (evaluating the sensor data). Great deviations are signaled. Sensoface can be switched off.
	HOLD ▲ 100.4%Air 20.1 °C Sensor monitoring details (administrator) ▪ Slope (Auto) ▪ Zero (Auto) ▪ Sensocheck (Auto) ▪ Response time (Auto) ▪ Return	**Sensor monitoring details** The following parameters are monitored: zero, slope, response time. For "Auto", the tolerance limits are displayed in gray. For "Individual", the settings can be specified by the user.
	HOLD ▲ 100.4%Air 20.1 °C ▪ Sensocheck (Administrator) Monitoring ▼ Auto Nominal 0100 kohms Min 0029 kohms Max 0350 kohms Message Off / Failure Abort Maint. request	**Message** Sensocheck can generate a message for failure or maintenance request. It can be seen in the Message list of the Diagnostics menu.

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Parameter	Default	Selection / Range
Input filter • Pulse suppression	Off	Off, On
Sensor data • Measure in • Sensor type • Temperature probe ** • Sensor ** • Reference electrode ** • Polarization voltage • Sensocheck	Liquids A Standard NTC 22 kohms Without guard Off 0675 mV Off	Liquids, Gases (Vol%), Gases (ppm) A Standard, B Trace Sensor (with guard) *, C Trace sensor (without guard), Other NTC 30 kohms, NTC 22 kohms With guard, Without guard On, Off xxxx mV (entry) Off, failure, maintenance request
Cal preset values • Cal saturation • Cal concentration • Cal timer	%AIR mg/l 0000 h	%Air µg/l, mg/l, ppb, ppm xxxx h (entry)
Pressure correction • Pressure during meas • Pressure during cal	Auto Auto	Auto, Manual (default value 1013 mbars) Auto, Manual (default value 1013 mbars)
Salinity correction • Input	Salinity	Salinity, Chlorinity, Conductivity (00.00 g/kg or 0.000 µS/cm, depending on selection)

*   Sensocheck not possible for trace sensor with guard, therefore disabled
** Can only be set with "Sensor type Others" selected

Sensoface ☺

Sensoface is a graphic indication of the sensor condition.
Prerequisite: Sensocheck must have been activated during parameter setting.
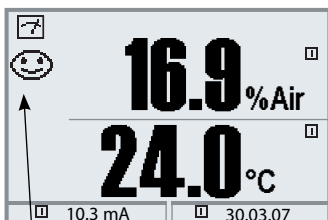
Sensocheck:
Automatic monitoring of membrane and
electrolyte

The "smileys" provide information on wear and required maintenance of the
sensor ("friendly" - "neutral" - "sad").

Sensoface Criteria (adjustable - see Sensor monitoring)

Parameter	Critical range	
	Sensor Type A	Sensor Type B
Slope*	< 30 nA or > 110 nA	< 225 nA or > 525 nA
Zero	< -0.6 nA or > 0.6 nA	< -1 nA or > 1 nA
Sensocheck (Ref. impedance)	0.3*R or > 3.5*R however always R < 20 kohms or > 4 Mohms, resp.	
Response time	> 600 sec	
Calibration timer	when 80 % expired	

* "Slope": Sensor current value with oxygen saturation (referred to air),
25°C, and 1013 mbars normal pressure (nA /100 %) The display only indi-
cates the "nA" symbol. From the technical point of view, it is no "slope"
but a calibration point. This value shall allow comparing the sensor with the
specifications in the datasheet.

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Calculation Blocks

Select menu: Parameter setting/System control/Calculation Blocks
Calculation of new variables from measured 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 difference between the existing values is calculated: These output variables are then available in the system and can be assigned to the outputs (current, limit values, display ...)

Functionality of Measuring Module

Inputs:
Sensors, terminals

Outputs
Measured values / Status

Oxy

Measuring module

Temp

Module [I]

e.g.:
O_2 measuring module

%Air
%O_2
ppm
°C
g/l
mbar
nA
°F
Vol%
I input
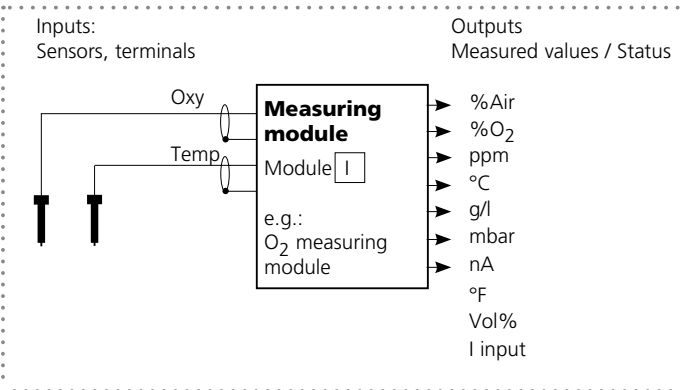
Functionality of Calculation Block
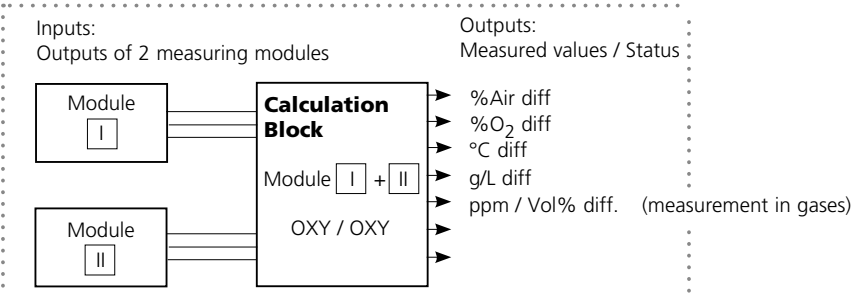
Inputs:
Outputs of 2 measuring modules

Outputs:
Measured values / Status

Module [I]

Calculation Block

Module [I] + [II]

OXY / OXY

Module [II]

%Air diff
%O_2 diff
°C diff
g/L diff
ppm / Vol% diff.   (measurement in gases)

Activating Calculation Blocks

Select menu: Parameter setting/System control/Calculation Blocks
Combining measuring modules to Calculation Blocks
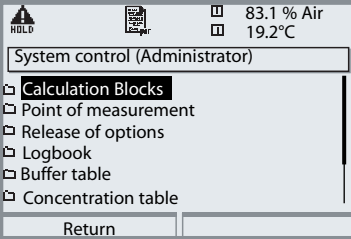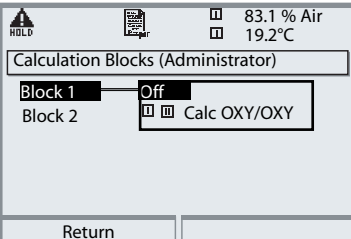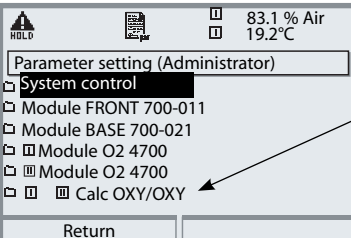
Combining Measuring Modules
With three measuring modules the following Calculation Block combinations are possible: Ⅰ + Ⅱ ,   Ⅰ + Ⅲ ,   Ⅱ + Ⅲ

Up to two Calculation Blocks can be activated.
All current outputs can be set to output the new process variables formed by the Calculation Blocks.
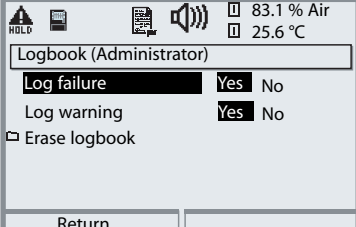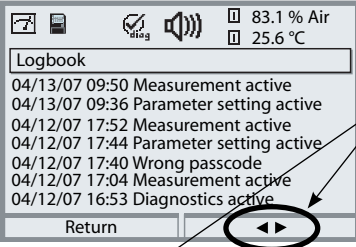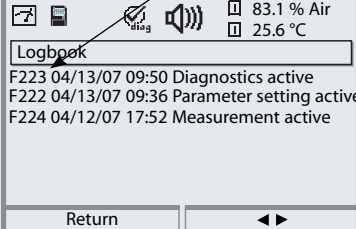All new process variables can be displayed as primary or as secondary value.
Controller functions are not supported.
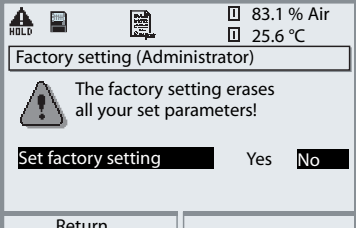
Menu	Display	Activating Calculation Blocks
par	HOLD 83.1 % Air 19.2°C System control (Administrator) Calculation Blocks Point of measurement Release of options Logbook Buffer table Concentration table Return	**Calculation Blocks** • Call up parameter setting • System control • Select "Calculation Blocks"
	HOLD 83.1 % Air 19.2°C Calculation Blocks (Administrator) Block 1 Off Block 2 Ⅱ Ⅲ Calc OXY/OXY Return	Depending on the modules installed, the possible combinations for Calculation Blocks are offered.
	HOLD 83.1 % Air 19.2°C Parameter setting (Administrator) System control Module FRONT 700-011 Module BASE 700-021 Ⅱ Module O2 4700 Ⅲ Module O2 4700 Ⅱ Ⅲ Calc OXY/OXY Return	During parameter setting the Calculation Blocks are displayed like modules.

Logbook, Factory Setting

Parameter setting/System control/Logbook
Note: HOLD mode

Menu	Display	Logbook, factory setting
par	**⚠ 📋 📋 ◀))) 🗓 83.1 % Air / 25.6 °C** Logbook (Administrator) Log failure .... Yes No Log warning .... Yes No 🗁 Erase logbook Return	**Logbook** Select which messages are to be logged in the logbook. The last 50 events are recorded with date and time. This permits quality management documentation to ISO 9000 et seq.
	📄 📋 ✓diag ◀))) 🗓 83.1 % Air / 25.6 °C Logbook 04/13/07 09:50 Measurement active 04/13/07 09:36 Parameter setting active 04/12/07 17:52 Measurement active 04/12/07 17:44 Parameter setting active 04/12/07 17:40 Wrong passcode 04/12/07 17:04 Measurement active 04/12/07 16:53 Diagnostics active Return ◀▶	The logbook can be called up from the diagnostics menu (Fig.). Pressing the right softkey displays the message identifier.
	📄 📋 ✓diag ◀))) 🗓 83.1 % Air / 25.6 °C Logbook F223 04/13/07 09:50 Diagnostics active F222 04/13/07 09:36 Parameter setting active F224 04/12/07 17:52 Measurement active Return ◀▶	Additional function SW 700-104: Extended logbook for recording data on SmartMedia card (TAN).
	⚠ 📋 📋 🗓 83.1 % Air / 25.6 °C Factory setting (Administrator) ⚠ The factory setting erases all your set parameters! Set factory setting Yes No Return	**Factory setting** Allows resetting the parameters to their factory setting. When this menu is opened, the analyzer displays a warning (Fig.).

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Parameter Setting

Messages: Default settings and selection range
Note: HOLD mode (Setting: BASE module)

Parameter	Default	Selection / Range
Messages Gas • Concentration • Partial pressure • Air pressure	 Off Off Off	 Off, variable limits* Off, variable limits* Off, device limits max., variable limits*
Messages Liquid • Saturation %Air • %O2 saturation • Concentration • Partial pressure • Air pressure	 Off Off Off Off Off	 Off, variable limits* Off, variable limits* Off, variable limits* Off, variable limits* Off, device limits max., variable limits*

		* With "Variable limits" selected,
		the following parameters can be edited:
		   • Failure Limit Lo
		   • Warning Limit Lo
		   • Warning Limit Hi
		   • Failure Limit Hi

Device limits
• Device limits max.   Maximum measurement range of device
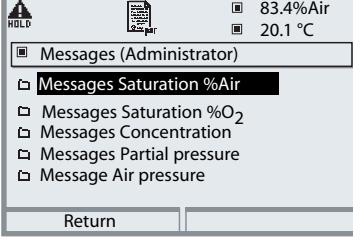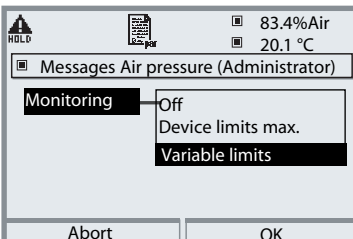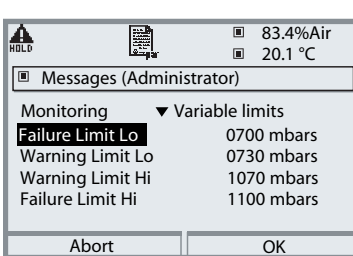• Variable limits: Range limits specified

Device limits max.

Variable limits
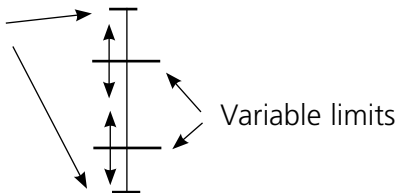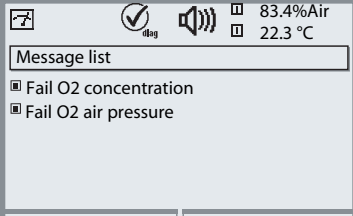
Setting the Message Parameters

Messages
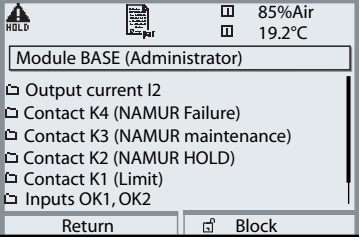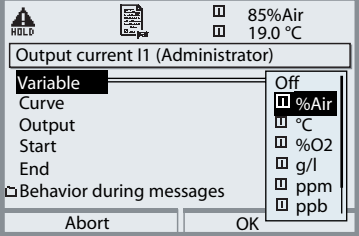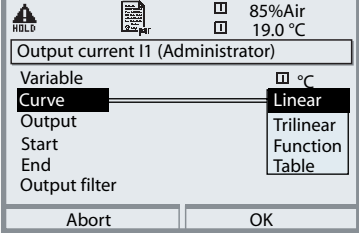**Note:** HOLD mode (setting: BASE module)

| Menu	Display	Messages
par	**83.4%Air** **20.1 °C** ▣ Messages (Administrator) ▱ Messages Saturation %Air ▱ Messages Saturation %O$_2$ ▱ Messages Concentration ▱ Messages Partial pressure ▱ Message Air pressure Return	**Messages** All parameters determined by the measuring module can generate messages. • **Device limits max:** Messages are generated when the process variable (e.g. air pressure) is outside the measurement 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).
	83.4%Air **20.1 °C** ▣ Messages Air pressure (Administrator) Monitoring — Off Device limits max. Variable limits Abort OK	• **Variable limits:** For the "failure" and "warning" messages you can define upper and lower limits for message generation. • **Message icons:** 🔊 Failure (Failure limit HiHi/LoLo) 🛠 Maintenance (Warning limit Hi/Lo)
	83.4%Air **20.1 °C** ▣ Messages (Administrator) Monitoring ▼ Variable limits Failure Limit Lo 0700 mbars Warning Limit Lo 0730 mbars Warning Limit Hi 1070 mbars Failure Limit Hi 1100 mbars Abort OK	
diag	**83.4%Air** **22.3 °C** Message list ▣ Fail O2 concentration ▣ Fail O2 air pressure Abort	**Diagnostics menu** When the "Maintenance" or "Failure" icons are flashing in the display, you should call up the Diagnostics menu. The messages are displayed in the "Message list".

Current Outputs, Contacts, OK Inputs

Select menu: Parameter setting/Module BASE
Note: HOLD mode (Setting: BASE module)

| Menu	Display	Parameter setting BASE module
	HOLD ⚠ 📄 🄀 85%Air 🄀 19.2°C Module BASE (Administrator) ▫ Output current I2 ▫ Contact K4 (NAMUR Failure) ▫ Contact K3 (NAMUR maintenance) ▫ Contact K2 (NAMUR HOLD) ▫ Contact K1 (Limit) ▫ Inputs OK1, OK2 Return ▫ Block	To configure current output • Call up parameter setting • Enter passcode • Select "Module BASE" • Select "Output current ..."
	HOLD ⚠ 📄 🄀 85%Air 🄀 19.0 °C Output current I1 (Administrator) Variable ⎸ Off Curve ⎸ 🄀 %Air Output ⎸ 🄀 °C Start ⎸ 🄀 %O2 End ⎸ 🄀 g/l ▫ Behavior during messages ⎸ 🄀 ppm ⎸ 🄀 ppb Abort OK	• Select process variable Gas measurement in %/ppm (Liquids: ppm/ppb) Start and end of current output can be set to the other process variable because also the measured value switches automatically. The decimal point can be moved using the arrow keys.
	HOLD ⚠ 📄 🄀 85%Air 🄀 19.0 °C Output current I1 (Administrator) Variable 🄀 °C Curve ⎸ Linear Output ⎸ Trilinear Start ⎸ Function End ⎸ Table Output filter Abort OK	• Select Curve, e.g. "linear": The measured variable is represented by a linear output current curve. The desired range of the measured variable is specified by the values for "Start" and "End".

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

Example 1: Range %Air 50 ... 100
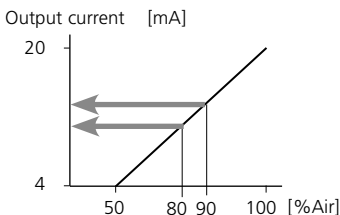
Example 2: Range %Air 80 ... 90
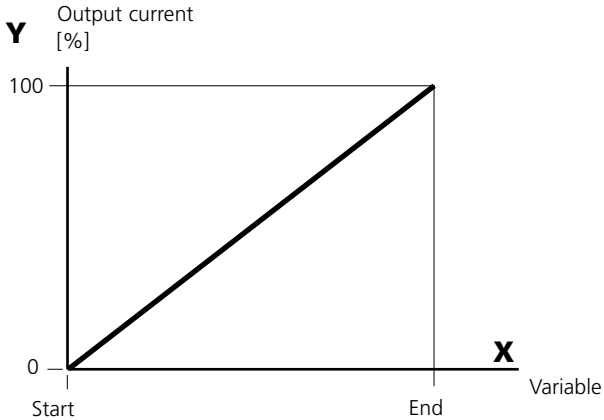Advantage: Higher resolution in range of interest
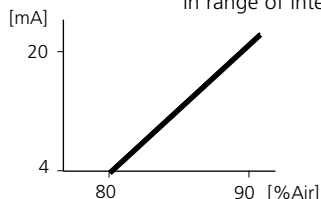
Output current [mA]

Current Outputs: Characteristics
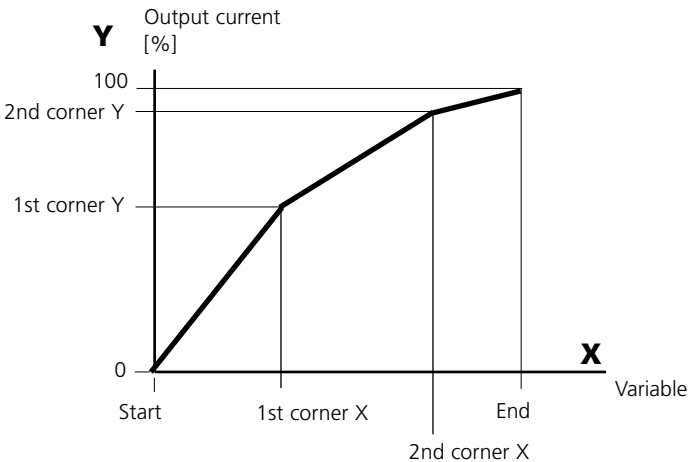
Select menu: Parameter setting/Module BASE

• Linear characteristic
The measured variable is represented by a linear output current curve.

Output current [%]

100

0

Y

X

Start

End

Variable

• Trilinear characteristic
Two additional corner points must be entered:

Output current [%]

100

2nd corner Y

1st corner Y

0

Y

X

Start

1st corner X

End

2nd corner X

Variable

• Note: Bilinear characteristic
For a bilinear characteristic, identical parameters are entered for the two corner points (1st corner, 2nd corner).

• Function characteristic

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.
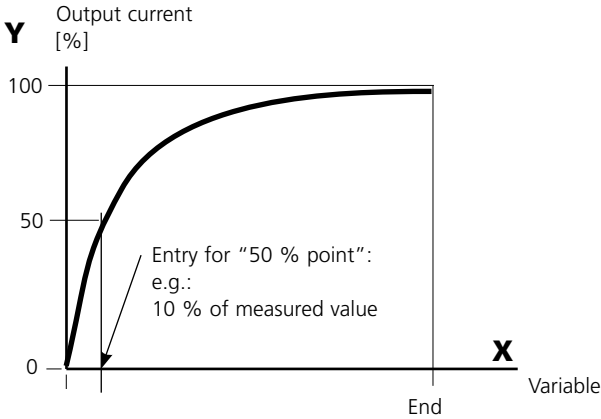
Equation

Output current (4 ... 20 mA) = $\dfrac{(1+K)x}{1+Kx}$ 16 mA + 4 mA

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

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 value
X50%:   31.6 % of maximum value
E: Maximum value

Logarithmic output curve over two decades:
S: 1 % of maximum value
X50%:   10 % of maximum value
E: Maximum value

Output Filter

Time Constant

Time Constant of Output Filter

To smoothen the current output, a low-pass filter with adjustable time constant can be switched on. When there is a jump at the input (100 %), the output level is at 63 % after the time constant has been reached.

The time constant can be set from 0 to 120 sec. If the time constant is set to 0 sec, the current output follows the input.
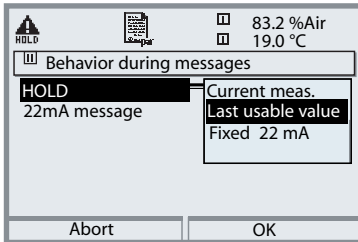
Notice:

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 constant 0 to 120 sec
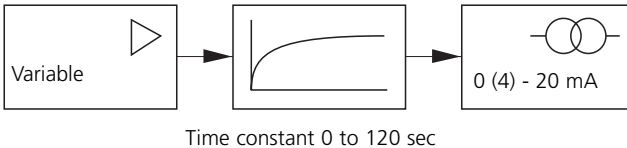
NAMUR Signals: Current Outputs

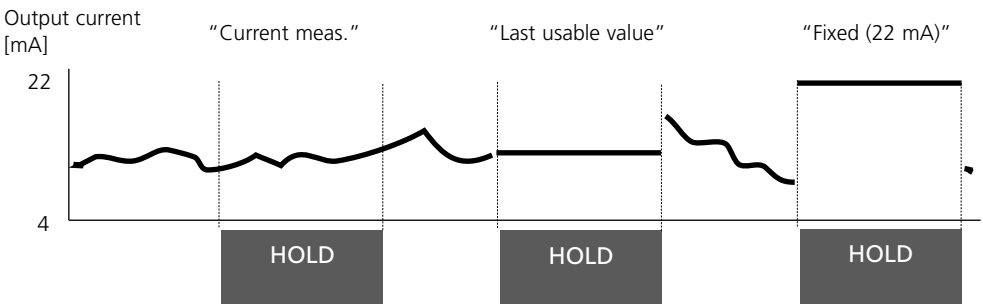Behavior during messages: HOLD, 22 mA signal

Behavior During Messages

Depending on the parameter setting ("Messages") the current outputs switch to:

- Currently measured value
- Last measured value (HOLD function)
- Fixed value (22 mA)

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" (Warn) 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 ...

Enter the same values for the failure limits as for the current output:
Parameter setting - Module BASE - Output current - Variable Start / End.

NAMUR Signals: Relay Contacts

Failure, Maintenance Request, HOLD (Function Check)

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

Failure	Contact K4, normally closed (signaling current failure)
Maint. request	Contact K3, normally open contact
HOLD	Contact K2, normally open contact
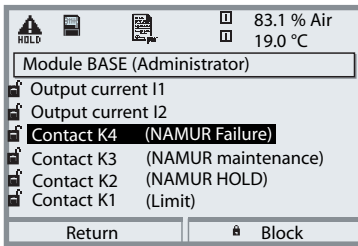
NAMUR signals: Factory setting of contacts
• Select parameter setting:
• Administrator level
• Select "Module BASE" (Fig.)
  You can define a delay time for "Maintenance request" and "Failure", resp. If an alarm message is released, the contact will only be activated after expiry of this delay time.

Failure is active

when a value has exceeded (or fallen below, resp.) 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. Failure is disabled during "HOLD" (Function check).

Maintenance request is active

when a value has exceeded (or fallen below, resp.) a preset "Warning Limit Hi" or "Warning Limit Lo", or when other warning messages have been activated. That means that the equipment is still operating properly but should be serviced, or that process parameters have reached a value requiring intervention.
Failure is disabled during "HOLD" (function check).

HOLD is active:
• during calibration
• during maintenance (current source, meas. point maintenance)
• during parameter setting at the Operator level and the Administrator level
• during an automatic rinsing cycle.

Relay Contacts: Protective Wiring

Protective Wiring of Relay Contacts

Relay contacts are subjected 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.
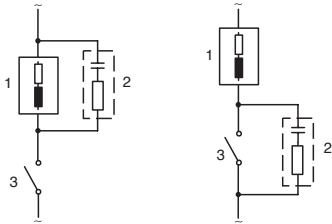
Typical AC applications with inductive load

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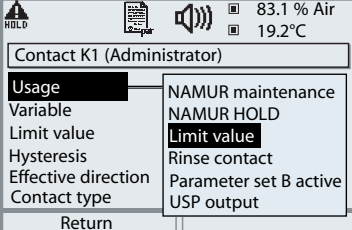   Resistor 100 ohms / 1 W
3 Contact

Caution!

Make sure that the maximum ratings of the relay contacts are not exceeded even during switching!
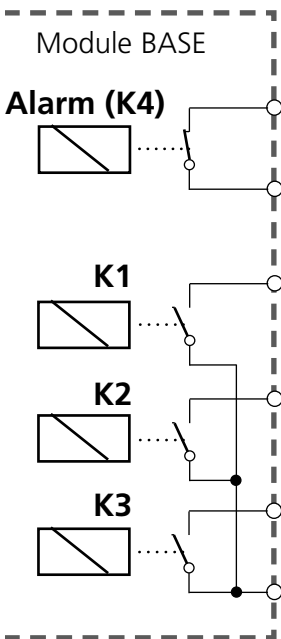
Information Concerning Relay Contacts

As delivered, the relay contacts are suitable for low signal currents (down to approx. 1mA). 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/Module BASE/Relay contacts

Menu	Display	Setting the relay contacts
	⚠ HOLD 📄 🔊))) ▣ 83.1 % Air ▣ 19.2°C Contact K1 (Administrator) **Usage** NAMUR maintenance Variable NAMUR HOLD Limit value **Limit value** Hysteresis Rinse contact Effective direction Parameter set B active Contact type USP output Return	**Relay contacts, usage** • Call up parameter setting • Enter passcode • Select "Module BASE" • Select "Contact ..." • "Usage" (Fig.)

Module BASE

Alarm (K4)

K1

K2

K3

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.
**Default settings of the user-definable
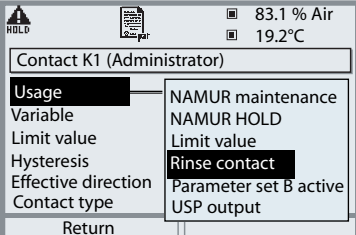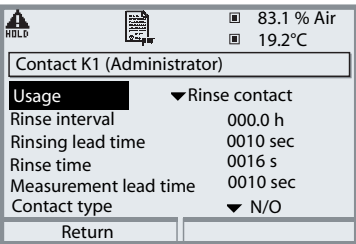relay contacts of the BASE module:**
K3:   NAMUR maintenance request
K2:   NAMUR HOLD (function check)
K1:   Limit

K1-K3 are user definable ("Usage"):
• NAMUR maintenance
• NAMUR HOLD
• Limit value
• Rinse contact
• Parameter set B active
• USP output (Cond module only)
• KI rec. active
• Sensoface
• Controller alarm

Rinse Contact

Parameter setting/Module BASE/Relay contacts/Usage/Rinse contact

Menu	Display	Configuring the rinse contact
🗎 par	⚠ HOLD ▣ 83.1 % Air ▣ 19.2°C Contact K1 (Administrator) **Usage** NAMUR maintenance Variable NAMUR HOLD Limit value Limit value Hysteresis **Rinse contact** Effective direction Parameter set B active Contact type USP output Return	**Relay contacts, usage** • Call up parameter setting • Enter passcode • Select "Module BASE" • Select contact e.g. K1) • "Rinse contact" (Fig.)
	⚠ HOLD ▣ 83.1 % Air ▣ 19.2°C Contact K1 (Administrator) **Usage** ▼Rinse contact Rinse interval 000.0 h Rinsing lead time 0010 sec Rinse time 0016 s Measurement lead time 0010 sec Contact type ▼ N/O Return	**Configuring the rinse contact** • Set rinse interval • Set rinse duration • During the defined "lead time" the "HOLD" mode is active. • Select contact type (e.g. "N/O")

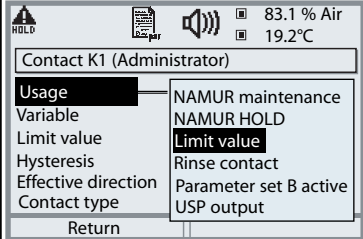## Please note when configuring the "Rinse contact" function
- "HOLD" mode (e.g. during parameter setting) delays the execution of the "Rinse contact" function.
- Up to 3 rinse functions (contacts K1 ... K3) can be configured independently.
- The individual rinse functions are not synchronized with each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

Time Response

HOLD	� timing diagram
Contact Kx	
Lead time	
Rinse time	
Shut-off delay	
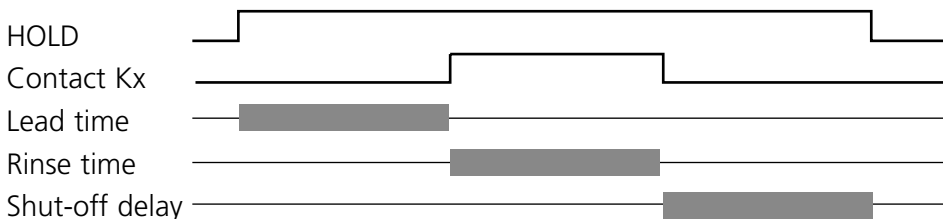
Limit Value, Hysteresis, Contact Type

Parameter setting/Module BASE/Relay contacts/Usage

Menu	Display	Usage as limit value
	Contact K1 (Administrator) — Usage / Variable / Limit value / Hysteresis / Effective direction / Contact type — NAMUR maintenance / NAMUR HOLD / Limit value / Rinse contact / Parameter set B active / USP output — Return — 83.1 % Air / 19.2°C	**Relay output: Limit** • Call up parameter setting • Enter passcode • Select "Module BASE" • Select "Contact ..." • "Usage: Limit" (Fig.)

Limit Value ⊻
Effective direction min
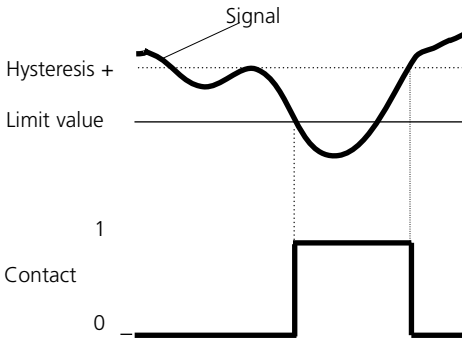
Limit Value ⊼
Effective direction max
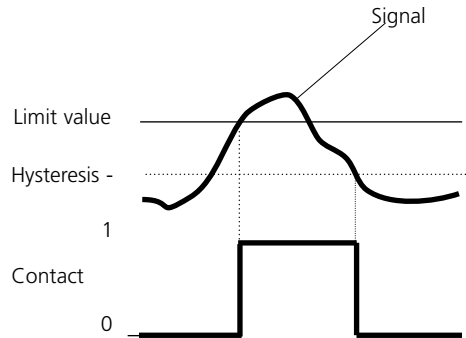
Icons in the measurement display:
Measured value exceeds limit: ⊼   Measured value falls below limit: ⊻

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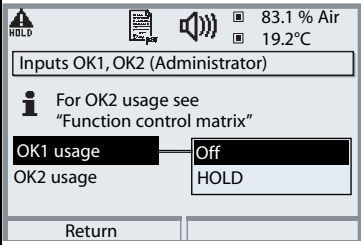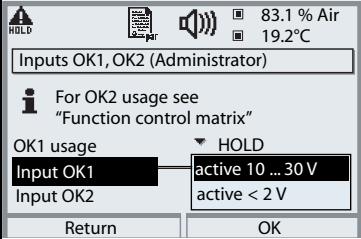
Contact Type
Specifies whether the active contact is closed (N/O) or open (N/C).

OK1, OK2 Inputs: Specify Level

Parameter setting/Module BASE/Inputs OK1, OK2
Note: HOLD mode (setting: BASE module)

Menu	Display	Setting the OK inputs
	▲ HOLD 🗒 🔊 ◼ 83.1 % Air ◼ 19.2°C — Inputs OK1, OK2 (Administrator) — ℹ For OK2 usage see "Function control matrix" — OK1 usage / Off — OK2 usage / HOLD — Return	**OK1 usage** • Call up parameter setting • Enter passcode • Select "Module BASE" • Select "Inputs OK1/OK2" • Select "OK1 usage"
	▲ HOLD 🗒 🔊 ◼ 83.1 % Air ◼ 19.2°C — Inputs OK1, OK2 (Administrator) — ℹ For OK2 usage see "Function control matrix" — OK1 usage / ▼ HOLD — Input OK1 / active 10 ... 30 V — Input OK2 / active < 2 V — Return / OK	**OK1/OK2 switching level** • Call up parameter setting • Enter passcode • Select "Module BASE" • Select "Inputs OK1/OK2" • Specify active switching level

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

• OK1: "Off" or "HOLD" (Function check)
• OK2: Select: System control / Function control matrix ("Off", "Parameter set A/B", "Start KI recorder")

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

BASE module

OK1

OK1

OK2

OK2

OK
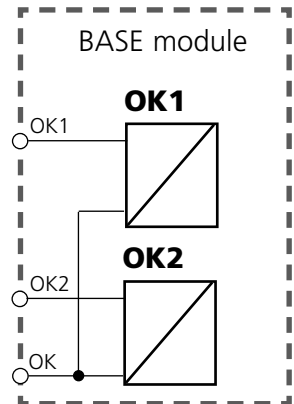
Switching Parameter Sets via OK2

Parameter setting / System control / Function control matrix
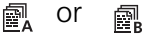**Note:** HOLD mode (setting: BASE module)
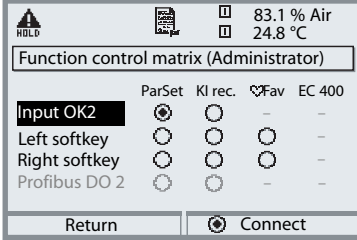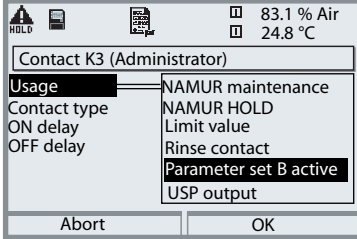
Parameter sets

2 complete parameter sets (A, B) can be stored in the analyzer.
You can switch between the parameter sets using the OK2 input.
The currently activated set can be signaled by a relay contact.
An icon in the measurement display shows which parameter set is active:

📖A   or   📖B

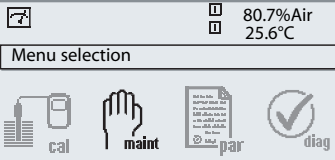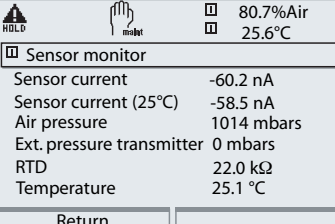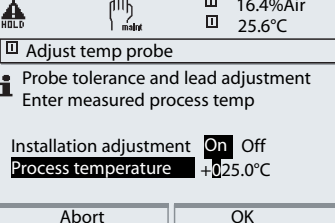| Menu	Display	Parameter sets
▤ par	⚠ HOLD 📖 🔲 83.1 % Air 🔲 24.8 °C Function control matrix (Administrator) ParSet KI rec. ❤Fav EC 400 **Input OK2** ◉ ○ – – Left softkey ○ ○ ○ – Right softkey ○ ○ ○ – Profibus DO 2 ○ ○ – – Return ◉ Connect	**Selecting parameter set (A, B) via OK2 input** • Call up parameter setting • System control • Function control matrix • Select "OK2" • Connect "Parameter set A/B"
	⚠ HOLD 📄 📖 🔲 83.1 % Air 🔲 24.8 °C Contact K3 (Administrator) **Usage** ——— NAMUR maintenance Contact type NAMUR HOLD ON delay Limit value OFF delay Rinse contact **Parameter set B active** USP output Abort OK	**Signaling active parameter set via relay contact** • Call up parameter setting • BASE module • Select contact • Usage: "Parameter set ...".

Notice

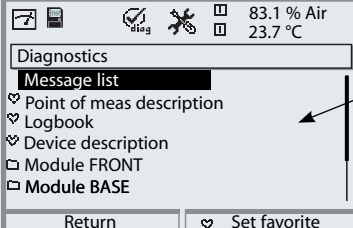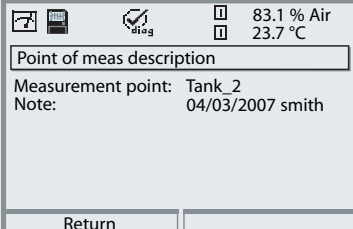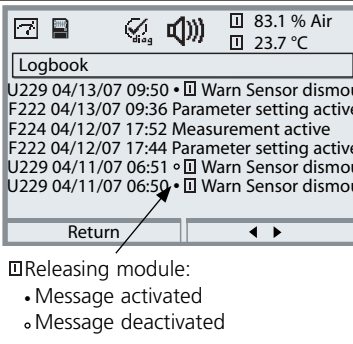The selection has no effect when working on SmartMedia card with
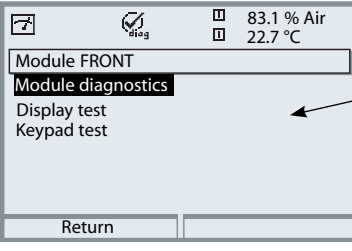SW 700-102.

Maintenance
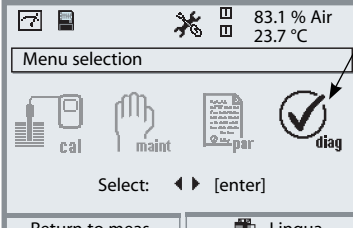
Sensor monitor / Temp probe adjustment
Note: HOLD mode (setting: BASE module)
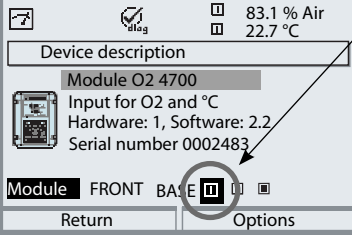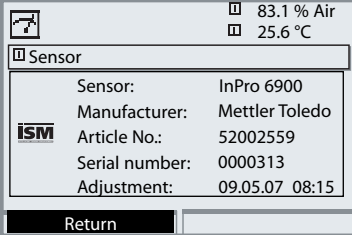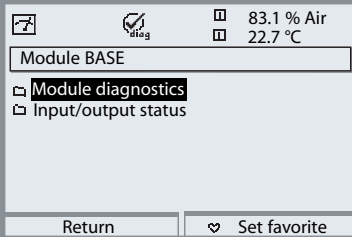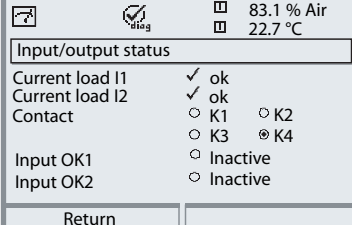
Menu	Display	Maintenance
🖐 maint	**80.7%Air 25.6°C** Menu selection cal maint par diag Select: ◀ ▶ [enter] Return to meas Lingua ⚠ HOLD 🖐 maint **80.7%Air 25.6°C** Sensor monitor Sensor current -60.2 nA Sensor current (25°C) -58.5 nA Air pressure 1014 mbars Ext. pressure transmitter 0 mbars RTD 22.0 kΩ Temperature 25.1 °C Return ⚠ HOLD 🖐 maint **16.4%Air 25.6°C** Adjust temp probe ℹ Probe tolerance and lead adjustment Enter measured process temp Installation adjustment On Off Process temperature +025.0°C Abort OK	**Call up Maintenance** From the measuring mode: Press **menu** key to select menu. Select maintenance using arrow keys, confirm with **enter**. Passcode 2958 (To change passcode: Parameter setting/System control/ Passcode entry). Then select "Module O_2". **Sensor monitor** During maintenance, the sensor monitor allows validation of the sensor by immersing it in a known solution, for example, and checking the values measured. **Temp probe adjustment** This function allows you to compensated for the individual temperature probe tolerance and the influence of the lead resistances to increase accuracy of temperature measurement. Adjustment may only be carried out when the process temperature is precisely measured using a calibrated reference thermometer! The measurement error of the reference thermometer should be less than 0.1 °C. Adjustment without precise measurement might result in considerable deviations of the measured value display!

Diagnostics Functions

General status information of the measuring system
Select menu: Diagnostics

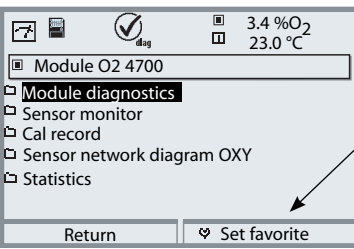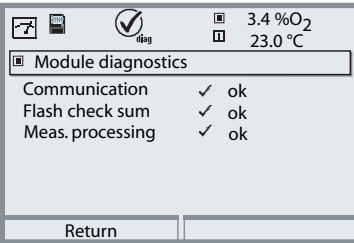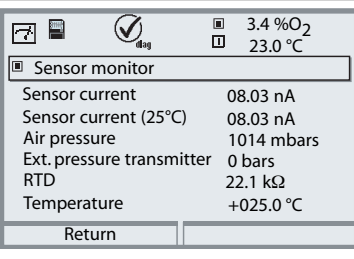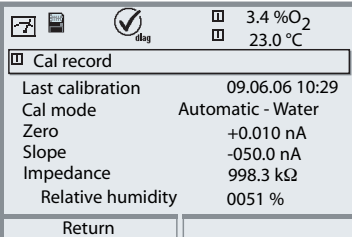| Menu	Display	Diagnostics functions
      ✓ diag	**Menu selection** — 83.1 % Air / 23.7 °C cal maint par **diag** Select: ◀ ▶ [enter] Return to meas Lingua	**Call up diagnostics** From the measuring mode: Press **menu** key to select menu. Select diagnostics using arrow keys, confirm with **enter**.
	Diagnostics — 83.1 % Air / 23.7 °C Message list ♥ Point of meas description ♥ Logbook ♥ Device description ▭ Module FRONT ▭ **Module BASE** Return ♥ Set favorite	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.
	Point of meas description — 83.1 % Air / 23.7 °C Measurement point: Tank_2 Note: 04/03/2007 smith Return	**Point of meas description** Allows entering a tag number and a note. Select position: left/right arrow key, select character: up/down arrow key. Confirm the entry with **enter**.
	Logbook — 83.1 % Air / 23.7 °C U229 04/13/07 09:50 • Ⅱ Warn Sensor dismou F222 04/13/07 09:36 Parameter setting active F224 04/12/07 17:52 Measurement active F222 04/12/07 17:44 Parameter setting active U229 04/11/07 06:51 ∘ Ⅱ Warn Sensor dismou U229 04/11/07 06:50 • Ⅱ Warn Sensor dismou Return ◀ ▶ Ⅱ Releasing module: • Message activated ∘ Message deactivated	**Logbook** Shows the last 50 events with message identifier, date, time, module concerned, and plaintext of the message. This permits quality management documentation to ISO 9000 et seq. Extended logbook: SmartMedia card (SW 700-104)

Menu	Display	Diagnostics functions
$\bigotimes_{diag}$	⟲ ⟋diag 🔲 83.1 % Air / 🔲 22.7 °C **Device description** Module O2 4700 Input for O2 and °C Hardware: 1, Software: 2.2 Serial number 0002483 Module FRONT BASE 🔲 🔲 ▣ Return Options	**Device description** Select module using arrow keys: Provides information about all modules installed: Function, serial number, hardware and software version, and device options.
	⟲ ⟋diag 🔲 83.1 % Air / 🔲 22.7 °C Module FRONT **Module diagnostics** Display test Keypad test Return	**FRONT module** The module contains the display and keypad control. Test possibilities: • Module diagnostics • Display test • Keypad test
	⟲ 🔲 83.1 % Air / 🔲 25.6 °C 🔲 Sensor Sensor: InPro 6900 Manufacturer: Mettler Toledo **iSM** Article No.: 52002559 Serial number: 0000313 Adjustment: 09.05.07 08:15 Return	**ISM sensor description*** Information on sensor type, manufacturer, article no., serial number, date of last adjustment * Menu is only displayed for ISM modules when a valid ISM sensor is connected.
	⟲ ⟋diag 🔲 83.1 % Air / 🔲 22.7 °C Module BASE **Module diagnostics** Input/output status Return ♥ Set favorite	**BASE module** The module generates the standard output signals. Test possibilities: • Module diagnostics • Input/output status
	⟲ ⟋diag 🔲 83.1 % Air / 🔲 22.7 °C Input/output status Current load I1 ✓ ok Current load I2 ✓ ok Contact ○ K1 ○ K2 ○ K3 ◉ K4 Input OK1 ○ Inactive Input OK2 ○ Inactive Return	Example: Module BASE, input/output status.

Module Diagnostics

Module diagnostics/Sensor monitor/Cal record/Sensor network diagram/
Statistics

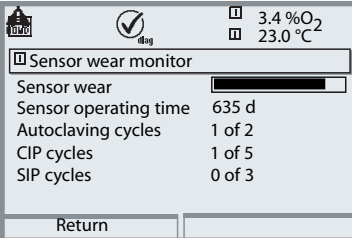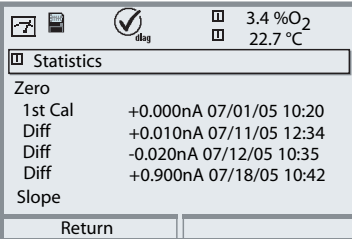| Menu	Display	Module diagnostics / Sensor monitor
	Menu selection — cal / maint / par / diag — Select: ◀ ▶ [enter] — Return to meas — Lingua — 3.4 %O_2 / 23.0 °C	**Call up diagnostics** From the measuring mode: Press **menu** key to select menu. Select diagnostics using arrow keys, confirm with **enter**. Then select "Module O_2".
	Module O2 4700 — Module diagnostics — Sensor monitor — Cal record — Sensor network diagram OXY — Statistics — Return — Set favorite — 3.4 %O_2 / 23.0 °C	The Diagnostics menu gives an overview of all diagnostics functions available. Messages set as "Favorite" can be called up directly from the measuring mode using a softkey. Select: Parameter setting / System control / Function control matrix.
	Module diagnostics — Communication ✓ ok — Flash check sum ✓ ok — Meas. processing ✓ ok — Return — 3.4 %O_2 / 23.0 °C	**Module diagnostics** Function test of internal components: - Internal device communication - Check of firmware (module) - Factory settings, measured value processing
	Sensor monitor — Sensor current 08.03 nA — Sensor current (25°C) 08.03 nA — Air pressure 1014 mbars — Ext. pressure transmitter 0 bars — RTD 22.1 kΩ — Temperature +025.0 °C — Return — 3.4 %O_2 / 23.0 °C	**Sensor monitor** Shows the current directly measured by the sensor, the barometric pressure, and temperature. Important function for diagnostics and validation!

Menu	Display	Cal record / Sensor network diagram / Statistics
diag	⊞ ▣ ✓**diag** ▣ 3.4 %O_2 ▣ 23.0 °C ⊡ Cal record Last calibration 09.06.06 10:29 Cal mode Automatic - Water Zero +0.010 nA Slope -050.0 nA Impedance 998.3 kΩ Relative humidity 0051 % Return	**Cal record** Data of last calibration, suitable for documentation to ISO 9000 and GLP (Date, time, calibration method, sensor zero and slope, rel. humidity for calibration in air)
	⊞ ✓**diag** ▣ 3.4 %O_2 ▣ 23.0 °C ⊡ Sensor network diagram 1 - Slope 2 - Zero point 3 - Sensocheck 4 - Not in use 5 - Response time 6 - Cal timer 7 - Sensor wear Return Info "Outer circle" Value within tolerance Critical range – "inner circle" Value out of tolerance The tolerance can be modified as required!	**Sensor network diagram** The measured values are continuously monitored during the measurement process. The sensor network diagram provides at-a-glance information about critical parameters. If a tolerance limit has been exceeded, the respective parameter is flashing. Values in gray: Monitoring switched off.
	✓**diag** ▣ 3.4 %O_2 ▣ 23.0 °C ⊡ Sensor wear monitor Sensor wear ▮▮▮▮▮▮▯ Sensor operating time 635 d Autoclaving cycles 1 of 2 CIP cycles 1 of 5 SIP cycles 0 of 3 Return	**Sensor wear monitor (ISM)** In addition to the current sensor wear, the sensor operating time as well as the number of executed autoclaving, CIP, or SIP cycles can be seen at a glance. * Menu is only displayed for ISM modules when a valid ISM sensor is connected.
	⊞ ▣ ✓**diag** ▣ 3.4 %O_2 ▣ 22.7 °C ⊡ Statistics Zero 1st Cal +0.000nA 07/01/05 10:20 Diff +0.010nA 07/11/05 12:34 Diff -0.020nA 07/12/05 10:35 Diff +0.900nA 07/18/05 10:42 Slope Return	**Statistics** Indication of sensor data for the First Calibration and the last 3 calibrations. (Date and time of First Calibration, sensor zero and slope, temperature, pressure, response time)

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Setting Diagnostics Messages as Favorite

Select menu: Parameter setting/System control/Function control matrix

Secondary Displays (1)

Here, additional values are displayed in the measuring mode according to the factory setting. When the respective softkey (2) is pressed, the process variables measured by the modules plus date or time are displayed. In addition, you can use the **softkeys (2)** to control functions.

To assign a function to a softkey, select

Parameter setting/System control/ Function control matrix

Function which can be controlled by softkeys:
- Parameter set selection
- KI recorder Start/Stop
- Favorites
- EC 400 (fully automated probe controller)

Favorites

Selected Diagnostics functions can be called up directly from the measuring mode using a softkey.

The table on the next page explains how to select favorites.

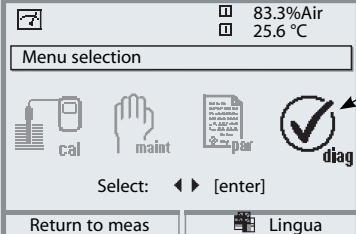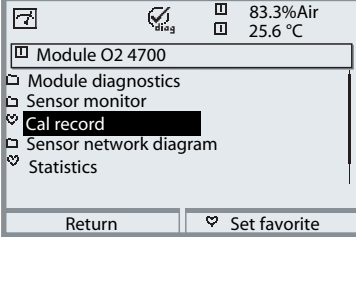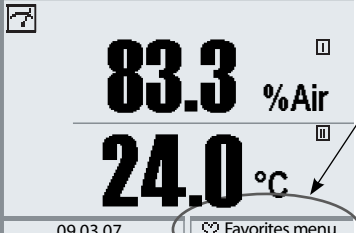|		☐ 83.3%Air	
⚠ HOLD		☐ 25.6 °C	
Function control matrix (Administrator)			
	ParSet	KI rec.	♡Fav EC 400
Input OK2	○	○	–
Left softkey	○	○	○ –
Right softkey	○	○	◉ –
Profibus DO 2	○	○	– –
Return		◉ Connect	
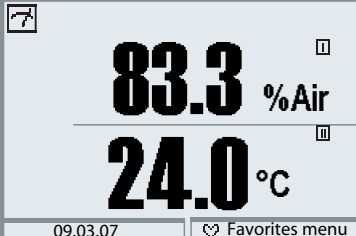
Example:
"Favorites" to be selected with "Right softkey"

To select a softkey function:
Select desired function
using arrow keys,
press "Connect" softkey
and confirm with **enter**.

To deselect a function:
Press "Disconnect" softkey,
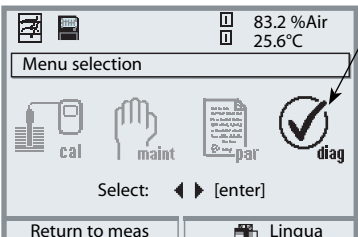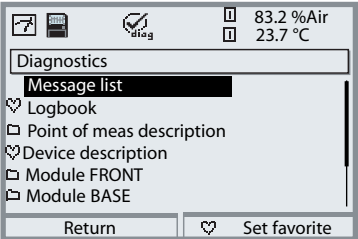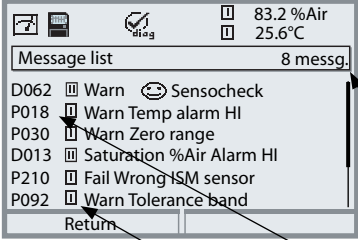confirm with **enter**.

Menu	Display	Select favorites
	83.3 %Air **24.0** °C 09.03.07 ♡ Favorites menu	**Favorites menu** Diagnostics functions can be called up directly from the measuring mode using a softkey. The "Favorites" are selected in the Diagnostics menu.
✓diag	83.3%Air 25.6 °C Menu selection cal maint par ✓diag Select: ◀ ▶ [enter] Return to meas Lingua	**Select favorites** Press **menu** key to Menu selection Select diagnostics using arrow keys, confirm with **enter**. Then select module and confirm with **enter**.
	83.3%Air 25.6 °C Module O2 4700 Module diagnostics Sensor monitor Cal record Sensor network diagram Statistics Return ♡ Set favorite	Set/delete favorite: "Set favorite" allows activation of the selected diagnostic function directly from the measuring mode via softkey. The menu line is marked with a heart icon.
	83.3 %Air **24.0** °C 09.03.07 ♡ Favorites menu	Pressing the **meas** key returns to measurement. When the softkey has been assigned to "Favorites", "Favorites menu" is read in the secondary display (see "Function control matrix").

Notice:

When one of the softkeys has been assigned to the "Favorites menu" function, diagnostic functions which have been set as "Favorite" can be directly called up from the measuring mode.

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Diagnostics Functions

General status information of the measuring system
Select menu: Diagnostics - Message list

Menu	Display	Diagnostics functions

	▣ ▦ 83.2 %Air
	        25.6°C
	
	Menu selection
	
	📟 ✋ 📄 ✓diag
	  cal maint par diag
	
	Select: ◀ ▶ [enter]
	Return to meas 🔲 Lingua
		Call up diagnostics
		From the measuring mode:
		Press **menu** key to select menu.
		Select diagnostics using arrow keys,
		confirm with **enter**.

✓diag	▣ ▦ ✓diag 83.2 %Air 23.7 °C Diagnostics Message list ♡ Logbook ▫ Point of meas description ♡ Device description ▫ Module FRONT ▫ Module BASE Return ♡ Set favorite	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.
	▣ ▦ ✓diag 83.2 %Air 25.6°C Message list 8 messg. D062 ▥ Warn ☺ Sensocheck P018 ▥ Warn Temp alarm HI P030 ▥ Warn Zero range D013 ▥ Saturation %Air Alarm HI P210 ▥ Fail Wrong ISM sensor P092 ▥ Warn Tolerance band Return	**Message list** Shows the currently activated warn- ing or failure messages in plain text. **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.

Messages

O$_2$ 4700(X) Module

No.	O$_2$ Messages	Message type
D008	Meas. processing (factory settings)	FAIL
D009	Module failure (Firmware Flash check sum)	FAIL
D010	Saturation %Air Range	FAIL
D011	Saturation %Air Alarm LO_LO	FAIL
D012	Saturation %Air Alarm LO	WARN
D013	Saturation %Air Alarm HI	WARN
D014	Saturation %Air Alarm HI_HI	FAIL
D015	Temperature range	FAIL
D016	Temperature Alarm LO_LO	FAIL
D017	Temperature Alarm LO	WARN
D018	Temperature Alarm HI	WARN
D019	Temperature Alarm HI_HI	FAIL
D020	Concentration range	FAIL
D021	Concentration Alarm LO_LO	FAIL
D022	Concentration Alarm LO	WARN
D023	Concentration Alarm HI	WARN
D024	Concentration Alarm HI_HI	FAIL
D025	Part. press. range	FAIL
D026	Part. press. Alarm LO_LO	FAIL
D027	Part. press. Alarm LO	WARN
D028	Part. press. Alarm HI	WARN
D029	Part. press. Alarm HI_HI	FAIL
D030	Zero range	WARN
D035	Slope range	WARN
D040	Air pressure range	WARN

Messages

No.	O$_2$ Messages	Message type
D041	Air pressure Alarm LO_LO	FAIL
D042	Air pressure Alarm LO	WARN
D043	Air pressure Alarm HI	WARN
D044	Air pressure Alarm HI_HI	FAIL
D045	Saturation %O2 Range	FAIL
D046	Saturation %O2 Alarm LO_LO	FAIL
D047	Saturation %O2 Alarm LO	WARN
D048	Saturation %O2 Alarm HI	WARN
D049	Saturation %O2 Alarm HI_HI	FAIL
D050	Air pressure Manual range	WARN
D060	SAD SENSOFACE: Slope	WARN
D061	SAD SENSOFACE: Zero	WARN
D062	SAD SENSOFACE: Sensocheck	User-defined
D063	SAD SENSOFACE: Response time	WARN
D064	Calibration timer	WARN
D070	SAD SENSOFACE: Sensor wear	User-defined
D080	Range (sensor current)	WARN
D090	Vol% range (measurement in gases)	WARN
D091	Vol% Alarm LO_LO (measurement in gases)	FAIL
D092	Vol% Alarm LO (measurement in gases)	WARN
D093	Vol% Alarm HI (measurement in gases)	WARN
D094	Vol% Alarm HI_HI (measurement in gases)	FAIL
D095	ppm range (measurement in gases)	FAIL
D096	ppm Alarm LO_LO (measurement in gases)	FAIL
D097	ppm Alarm LO (measurement in gases)	WARN
D098	ppm Alarm HI (measurement in gases)	WARN
D099	ppm Alarm HI_HI (measurement in gases)	FAIL
D110	CIP counter	User-defined
D111	SIP counter	User-defined
D112	Autoclaving counter	User-defined

Messages

No.	O$_2$ Messages	Message type
D113	Sensor operating time (duration of use)	User-defined
D114	Membrane body changes	User-defined
D115	Inner body changes	User-defined
D120	Wrong ISM sensor	FAIL
D121	ISM sensor (error in factory settings/characteristics)	FAIL
D122	ISM sensor memory (error in cal data records)	WARN
D123	New sensor, adjustment required	WARN
D130	SIP cycle counted	Text
D131	CIP cycle counted	Text
D200	Temp O2 conc/SAT	WARN
D201	Cal temp	Text
D203	Cal: Identical media	Text
D204	Cal: Media interchanged	Text
D205	Cal: Sensor unstable	Text
D254	Module reset	Text

No.	Messages Calculation Blocks O$_2$ / O$_2$	Message type
H010	%AIR-Diff Range	FAIL
H011	%AIR-Diff Alarm LO_LO	FAIL
H012	%AIR-Diff Alarm LO	WARN
H013	%AIR-Diff Alarm HI	WARN
H014	%AIR-Diff Alarm HI_HI	FAIL
H015	Temperature-Diff Range	FAIL
H016	Temperature-Diff Alarm LO_LO	FAIL
H017	Temperature-Diff Alarm LO	WARN
H018	Temperature-Diff Alarm HI	WARN
H019	Temperature-Diff Alarm HI_HI	FAIL
H020	Concentration-Diff Range	FAIL
H021	Concentration-Diff Alarm LO_LO	FAIL

Messages

No.	Messages Calculation Blocks O_2 / O_2	Message type
H022	Concentration-Diff Alarm LO	WARN
H023	Concentration-Diff Alarm HI	WARN
H024	Concentration-Diff Alarm HI_HI	FAIL
H045	%O_2 Diff Range	FAIL
H046	%O_2 Diff Alarm LO_LO	FAIL
H047	%O_2 Diff Alarm LO	WARN
H048	%O_2 Diff Alarm HI	WARN
H049	%O_2 Diff Alarm HI_HI	FAIL
H090	Vol%-Diff range (measurement in gases)	WARN
H091	Vol%-Diff Alarm LO_LO (measurement in gases)	FAIL
H092	Vol%-Diff Alarm LO (measurement in gases)	WARN
H093	Vol%-Diff Alarm HI (measurement in gases)	WARN
H094	Vol%-Diff Alarm HI_HI (measurement in gases)	FAIL
H095	ppm-Diff range (measurement in gases)	FAIL
H096	ppm-Diff Alarm LO_LO (measurement in gases)	FAIL
H097	ppm-Diff Alarm LO (measurement in gases)	WARN
H098	ppm-Diff Alarm HI (measurement in gases)	WARN
H099	ppm-Diff Alarm HI_HI (measurement in gases)	FAIL

Specifications

Specifications O$_2$ 4700(X) Module

Oxy input	Standard applications with the Mettler-Toledo InPro 6800
(EEx ia IIC)	Series sensors
Measuring current	0 ... 1800 nA, resolution 30 pA
Saturation (-10 ... 80 °C)	0.0 ... 199.9 / 200 ... 600 % Air
	0.0 ... 29.9 / 30 ... 120 % O$_2$
Measurement error**	< 0.5 % meas.val. + 0.05 mg/l or 0.05 ppm
Concentration (-10 ... 80 °C)	0000 ... 9999 µg/l
	(overrange during calibration up to 19.99 mg/l)
	0000 ... 9999 ppb
	(overrange during calibration up to 19.99 ppm)
	0.00 ... 200.00 mg/l
	0.00 ... 200.00 ppm
Measurement error**	< 0.5 % meas.val. +0.05 mg/l or 0.05 ppm
Polarization voltage	0 ... −1000 mV, default −675 mV, Ri approx. 3 kohms
Partial pressure	0 ... 2000 mbars
Air pressure	700 ... 1100 mbars
Manual	0 ... 9999 mbars
Salinity correction	0.0 ... 45.0 g/kg
Adm. guard current	≤ 20 µA
Ref voltage	± 500 mV (voltage across ref connection and anode)

Measurement in gases	0 ... 2000 mbars
	0 ... 9999 ppm
	0.00 ... 29.9 / 30.0 .... 120.0%vol (display only)
	(1%vol = 10,000 ppm)
Current start / end	As desired within range
Calibration methods	Automatic - Air
	- with the following default settings:
	rH = 50 %, p 0 measured barometric pressure,
	calibration medium air (dry air = 20.95 %vol)

Specifications

(Calibration methods)	Product calibration (select ppm or Vol%) Data entry Zero correction

Sensor monitoring *	Sensocheck Monitoring of membrane and electrolyte

Sensoface	Provides information on the sensor condition
Sensor network diagram	Zero, slope, response time, calibration interval, Sensocheck, wear (ISM)

Sensor monitor	Direct display of measured values from sensor for validation of sensor current / barometric pressure / temperature / I input

Sensor standardization *	Operating modes - Automatic calibration in air-saturated water - Automatic calibration in air - Product calibration: Saturation - Product calibration: Concentration - Data entry zero/slope - Zero correction
Calibration record/statistics	Recording of: Zero, slope, response time, calibration method, with date and time of the last three calibrations and the First Calibration

Temperature input (EEx ia IIC)	
Temperature probe *	NTC 22 kΩ / NTC 30 kΩ, 2-wire connection, adjustable
Measurement range (MR)	-20 ... +150 °C (-4 ... 302 °F)
Resolution	0.1 °C
Measurement error [**]	0.2 % meas.val. + 0.5 K

[*] User-defined
[**] To IEC 746 Part 1, at nominal operating conditions, ± 1 count, plus sensor error

Specifications

General Data

Explosion protection (IS module only)	ATEX:	See rating plate: KEMA 03 ATEX 2056 II 2 (1) GD EEx ib [ia] IIC T4 T 70 °C
	FM:	NI, Class I, Div 2, GP A, B, C, D T4 with IS circuits extending into Division 1 Class I, Zone 2, AEx nA, Group IIC, T4 Class I, Zone 1, AEx me ib [ia] IIC, T4
	CSA:	NI, Class I, Div 2, Group A, B, C, D with IS circuits extending into Division 1 AIS, Class I, Zone 1, Ex ib [ia] IIC, T4 NI, Class I, Zone 2, Ex nA [ia] IIC

EMC	NAMUR NE 21 and EN 61326 VDE 0843 Part 20 /01.98 EN 61326/A1 VDE 0843 Part 20/A1 /05.99
Emitted interference Immunity to interference	Class B Industry

Lightning protection	EN 61000-4-5, Installation Class 2

Nominal operating conditions	Ambient temperature: –20 ... +55 °C (Ex: max. +50 °C) Rel. humidity: 10 ... 95 % not condensing

Transport/Storage temperature	–20 ... +70 °C

Screw clamp connector	Single wires and flexible leads up to 2.5 mm²

Appendix:

Minimum Spans for Current Outputs

The O_2 4700(X) module is a measuring module. It does not provide current outputs. Current outputs are provided by the BASE module (basic device) or by communication modules (e.g. Out, PID). The corresponding parameters must be set there.

The minimum current span shall prevent that the resolution limit of the measurement technology (± 1 count) is seen in the current.

O_2 4700(X) Module

%Air	10.0
%O_2	2.0
°C	10.0
mbar	20.0 (barometric pressure)
nA	10 % min. 1.00 nA
mg/l	10 % min. 20.0 µg/l
ppm	10 % min. 20.0 ppb
mbar	20.0 (partial pressure)
Vol%	2.0
ppm	1000
°F	10.0

Calculation Block OXY/OXY

Diff %Air	10.0
Diff-%O_2	2.0
Diff mg/l	10 % min. 2.0 µg/l
Diff ppm	10 % min. 2.0 ppb
Diff °C	10.0
Diff Vol%	2.0
Diff ppm	1000

Dissolved Oxygen Measurement in Carbonated Beverages (SW 700-011)

Application-specific additional function for breweries

Recommended only for InPro 6900 series sensors!

This additional function simplifies parameter setting since all steps not required for dissolved oxygen measurement in carbonated beverages are omitted. It simultaneously acts on all installed O_2 modules (module software version 2.2 and higher).

Function principle:
The following processes are automated by the additional function, i.e. all parameters required for the respective program step are set automatically.

During the filling process, for example, it must be ensured that as little oxygen as possible is dissolved in the beer to extent its shelf life.
During oxygen trace measurement the sensor is operated with a very low polarization voltage (-500 mV). This results in low cross-sensitivity to CO_2.

For a calibration in air, this polarization voltage is too low.
It must be set to -675 mV and afterwards be reduced again to -500 mV for measuring in the trace range.
Be sure to wait long enough for the sensor to stabilize.

Opening and closing of valves causes pressure variations in the beer pipes which momentarily falsify the O_2 signal. Therefore the input signal must be attenuated correspondingly to suppress transient interferences.

Overview of Parameter Setting
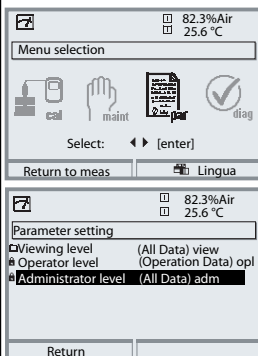
Parameter setting

Activated from measuring mode: Press **menu** key to select menu.

Select parameter setting using arrow keys, confirm with **enter**.

Administrator level

Access to all functions, also passcode setting.

Releasing or blocking a function 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 (Option) • Record logbook • Register recorder • Decimal separator • Card full • Format	Menu only appears with SmartMedia Card inserted. Make sure that it is a <u>memory card</u>, not an <u>update card</u>. Commercially available SmartMedia cards must be formatted before they can be used as memory card.
Copy configuration	The complete configuration of an analyzer can be written on a SmartMedia card. This allows transferring all device settings to other devices with identical equipment (exception: options and passcodes).
Parameter sets • Load • Save	2 parameter sets (A,B) are available in the analyzer. The currently active parameter set is read on 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 SmartMedia card (Option) is used.
Function control matrix • Input OK2 • Left softkey • Right softkey	Selecting the control element for the following functions: - Parameter set selection - KI recorder (Start/Stop) - Favorites menu (selected diagnostics functions) - EC 400 (fully automated probe controller)
Time/date	Selecting the display format, entry
Point of meas description	Can be called up in the diagnostics menu.
Release of options	A TAN is required to release an Option.
Software update	Software update from SmartMedia card (update card)
Logbook	Selecting events to be recorded
Buffer table	Entering own buffer set for automatic calibration
Factory setting	Resetting all parameters to factory setting
Passcode entry	Editing the passcodes

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Parameter Setting Menu

Display Settings: FRONT Module

Languages

Measurement display • Main display • Display format • Viewing angle	Representation of measured values on the display: - Selecting the number of primary values displayed (one or two) - Decimal places
Measurement recorder • Time base • Zoom function • Min/Max display	Option: 2-channel, selection of process variable, start and end
KI recorder	Option: See more detailed "Options" manual

Signal Outputs and Inputs, Contacts: BASE Module

Output current I1, I2
• Variable
• Curve
• Output (0/4 - 20 mA)
• Output filter
• Behavior during messages
   - HOLD
   --- Current meas.
   --- Last meas. value
   --- Fixed 22 mA
   - 22 mA message

2 current outputs, separately adjustable

Behavior during messages

Output current [mA]

"Current meas."   "Last usable value"   "Fixed (22 mA)"

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4

HOLD   HOLD   HOLD

Contact K4 • Contact type • ON delay • OFF delay	NAMUR Failure
Contacts K3, K2, K1 • Usage - Maintenance request - HOLD (function check) - Limit value (adjustable) - Rinse contact (adjustable) - Parameter set B active - USP output - KI recorder active - Sensoface • Conoller alarm (alarm output EC 400) • Contact type / ON/OFF delay	Factory setting: K3: Maintenance request, K2: HOLD, K1: Limit - Variable, limit value, hysteresis, effective direction, ... - Rinsing interval, lead times, rinse duration, logbook entry, ...
Inputs OK1, OK2 • OK1 usage - Signal level	Optocoupler - signal inputs Off, HOLD (function check) active level switchable from 10 to 30 V or < 2 V, resp. For OK2 see System control/Function control matrix

Parameter Setting Menu

O$_2$ 4700(X) Module

Input filter

Sensor data
- Sensor type
- Temperature probe
- Sensor
- Reference electrode
- Sensor polarization
- Polarization voltage
- Sensoface
- Details
    - Slope
    - Zero point
    - Sensocheck
    - Response time

Representation of measured values on the display:
- Select
- Selection for Measurement / Calibration

Cal preset values
- Cal saturation
- Cal concentration
    - mg/l
    - µg/l
    - ppm
    - ppb
- Calibration timer

Pressure correction
- Pressure during meas
- Pressure during cal

Salinity correction
- Entry
    - Salinity
    - Chlorinity
    - Conductivity
- Salinity

Messages
- Saturation %Air
- Saturation %O$_2$
- Concentration
- Partial pressure
- Temperature
- Air pressure

Calibration Menu

O$_2$ 4700(X) Module

Automatic - Water
Automatic - Air
Product calibration Sat
Product calibration Conc
Data entry
Zero correction

Maintenance Menu

BASE Module

Current source	Output current definable 0 ... 22 mA

O$_2$ 4700(X) Module

Sensor monitor	Sensor current, air pressure, RTD, temperature, impedance
Temp probe adjustment	Compensating for lead length

Diagnostics Menu

Message list	List of all warning and failure messages
Point of meas description	
Logbook	
Device description	Hardware version, Serial no., (Module) Firmware, Options

FRONT Module

Module diagnostics
Display test
Keypad test

BASE Module

Module diagnostics
Input/output status

O$_2$ 4700(X) Module

Module diagnostics	Internal function test
Sensor monitor	Shows the values currently measured by the sensor
Cal record	Data of last adjustment / calibration
Sensor network diagram Oxy	Graphical representation of the sensor parameters
Statistics	Displays first calibration and deviations of last 3 calibrations

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Icon	Explanation of Icons Important for this Module
⤢	The device is in measuring mode.
⚙cal ⚠HOLD	The device is in calibration mode. HOLD mode active for currently calibrated module.
✋maint ⚠HOLD	The device is in maintenance mode. HOLD mode active.
📋par ⚠HOLD	The device is in parameter setting mode. HOLD mode active.
☑dia	The device is in diagnostics mode.
NAMUR signals ⚠HOLD ◁)) ✖	HOLD. The NAMUR "function check" contact is active (factory setting: Module BASE, Contact K2, N/O contact). Current outputs as configured: • Current meas.: The currently measured value appears at the current output • Last usable value: The last measured value is held at the current output • Fixed 22 mA: The output current is at 22 mA Failure. The NAMUR "failure" contact is active (factory setting: Module BASE, Contact K4, N/C contact). To view error message, call up: Diagnostics menu/Message list Maintenance request. The NAMUR contact is active (factory setting: Module BASE, Contact K2, N/O contact). To view error message, call up: Diagnostics menu/Message list
▼ ▲	Limit indication: Lower / upper range limit exceeded
🌡 man	Temperature detection by manual input
✳	Calibration is performed
📟	Calibration - Step 1 of product calibration has been executed. The analyzer is waiting for the sample values.
🗁	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.
⊞	Designates the module slot (1, 2 or 3), allowing the clear assignment of measured-value/parameter displays in the case of identical module types.
📑B	Indicates the active parameter set .(The analyzer provides two parameter sets A and B. Up to 5 sets can be added using additional functions and SmartMedia card.)

Menu Selection O₂ 4700(X) Module