pH Transmitter 2500

Your Consultant:

01/99
20 606 1159

Mettler-Toledo GmbH, Process, Postfach, 8902 Urdorf, Switzerland
Phone +41 (01) 736 22 11, Fax +41 (01) 736 26 36

CE

Warranty

Defects occurring within 3 years from delivery date shall be remedied free of charge at our works (carriage and insurance paid by sender).
Accessories and display backlighting: 1 year

Changes for Software Release 6

No logbook recording of error messages during maintenance, calibration, and parameter setting

During maintenance work, such as cleaning the sensor or during calibration, often a great number of error messages is generated. These messages are completely meaningless for the measurement because the unit is in functional check mode and the current is frozen. Therefore, they are not recorded in the logbook any more.

Logbook entry after input of wrong passcode

The attempt to activate a function using a wrong passcode is recorded in the logbook.

Manual selection of temperature probe

Automatic Pt 100/Pt 1000 recognition and selection is omitted.

Functional check also during sample calibration

During calibration, after passcode input, the “functional check” NAMUR signal is generally set, i.e. the output current is frozen. Up to now, this signal has not been set during sample calibration.

Safety Information

Be sure to read and observe the following requirements!

Before connecting the apparatus to mains, make sure that the mains voltage corresponds to the voltage rating given on the rating plate.

Opening the apparatus exposes live parts. Therefore, the apparatus shall not be opened. If repair should be required, return the apparatus to our factory.

If opening the apparatus is inevitable, it shall first be disconnected from all voltage sources.
Make sure that the mains supply has been disconnected.

Repair or adjustment of an opened apparatus under voltage shall be carried out only by a skilled person who is aware of the hazard involved.

Remember that the voltage across accessible parts of the open apparatus may be dangerous to life.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and secured against any unintended operation.
The protection is likely to be impaired if, for example:

- the apparatus shows visible damage
- the apparatus fails to perform the intended measurements
- after prolonged storage at temperatures above 70 °C
- after severe transport stresses

Before recommissioning the apparatus, a professional routine test according to EN 61010-1 shall be performed. This test should be carried out at our factory.

Installation and Start-Up

Installation of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual and per applicable local and national codes. Make sure that the technical specifications and input ratings are observed.

For information on installation, refer to chapter 10.

Start-up of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual and per applicable local and national codes.
Before first start-up, a *complete parameter setting* procedure must be performed by a system specialist.

If you operate an instrument with option 298 at a grounded 24 Vac power supply and the process medium is also grounded, compensating currents (via internal EMC wiring) can lead to measurement errors.

Therefore, connect terminal 4 with the process medium (conductive tank wall) as shown in fig. 9–3.

At ambient temperatures below 0 °C, LC display readability might be restricted. This does *not* affect instrument function.

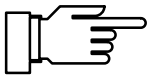
Real-time clock, logbook, cal record and sensor statistics are battery backed for approx. 1 year. After longer power outages these data can be lost. In that case the transmitter displays ”Warn Time/ Date” and the date is reset to 01–01–1990. Time and date must be updated.

Information on Electromagnetic Compatibility

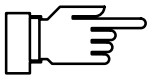
Compliance with Interference Immunity Requirements

All inputs and outputs of the pH Transmitter 2500 are electrically isolated to each other. The isolation voltages are limited to approx. 50 V by gas-filled surge arresters (to meet EMC requirements to NAMUR).

Option 351 (Interface)



For connecting the RS 485 interface, twisted and/or shielded cable must be used.



To meet the radio interference limits at the RS 485 interface, terminal 15 (shield) must be grounded. Do not use the protective conductor for grounding!

CE

The pH Transmitter 2500 meets the following generic standards:

Electromagnetic Emission
EN 50081-1 Domestic, Commercial and Light Industry

Immunity to Interference
EN 50082-2 Industry

and can therefore be used on residential, commercial and light industrial premises and in industry.

Package Contents and Unpacking

Unpack the instrument carefully.
Check the shipment for transport damages and for completeness.
The package should contain:

- pH Transmitter 2500
- this instruction manual
- the accessories you have ordered
  (for available accessories, see chapter 13)

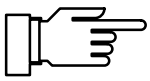
Description of this Manual

This manual describes

- what you can do with the pH Transmitter 2500
- how to operate the pH Transmitter 2500
- what you have to know for installation and mounting

Warning

Warning means that ignoring the given instructions may lead to malfunction or damage of the instrument or other equipment and to personal injury.



Note

Notes call your attention to important information.

Remarks on Representation

The keys of the pH Transmitter 2500 are represented as follows:

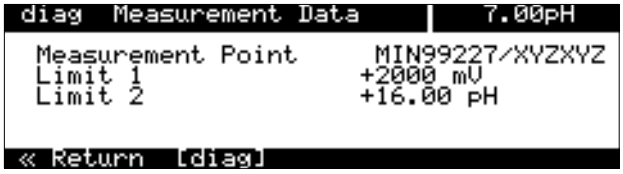
meas , **cal** , **maint** , **par** , **diag**

◄ , ► , ▲ , ▼ , **enter**

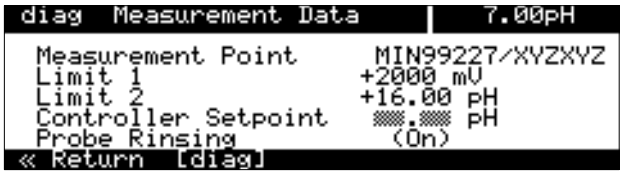
A term printed in **bold-faced text** is explained in chapter 17: ”Technical Terms”.

Italics are used to emphasize certain information.

The representation of a menu in this manual can slightly differ from the display of your pH Transmitter 2500 . This depends on the options your instrument is equipped with.



Example:
Diagnostics menu ”Measurement Data”
for a standard instrument.



Example:
Diagnostics menu ”Measurement Data”
for an instrument with option 352 (probe rinsing) and option 353 (digital controller function).

Structure of this Manual

Like the operation of the pH Transmitter 2500 , this manual is divided into three levels:

Viewing Level: You can view all information on instrument state and sensor as well as the settings.

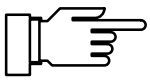
Refer to chapters 1, 2, 4 and 6

Operator Level: You can edit selected parameters and calibrate the electrode.

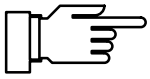
Refer to chapters 1 through 7

Administrator Level You can set all parameters of the pH Transmitter 2500 and make use of special functions (such as interface operation).

Refer to chapters 1 through 10



If you are looking for information on a topic that is not listed in the table of contents, the index at the end of this manual will help you.



If the behavior of your instrument differs from the description in this manual, check if the manual corresponds to the software version of your instrument: see page 4–6.

Overview of the pH Transmitter 2500	Chapter **1** gives you an overview of the performance of the pH Transmitter 2500 .
Operating the pH Transmitter 2500	Chapter **2** introduces you to the user interface and describes the keypad assignments. Selection of menu items and input of numerals is explained.
Calibration	Chapter **3** shows how to select the calibration sequence and how to perform a calibration.
The Diagnostics Menu	Chapter **4** describes how the Diagnostics menu provides you with information on the state of electrode and instrument.
The Maintenance Menu	Chapter **5** explains how the installation can be maintained.
Display of Settings	Chapter **6** explains how to read out instrument settings.
Parameter Setting on the Operator Level	Chapter **7** explains how to set instrument parameters on the Operator level.
Parameter Setting on the Administrator Level	Chapter **8** describes complete instrument parameter setting.
Capabilities of the pH Transmitter 2500	Chapter **9** gives a detailed description of the transmitter's capabilities and applications and provides useful information on operation.
Information on Mounting, Installation and Maintenance	Chapter **10** contains all required terminal assignments, dimension drawings and installation instructions as well as information on maintenance and cleaning of the instrument.
Error Messages	Chapter **11** alphabetically lists all error messages that might appear during operation.
Interface Commands	Chapter **12** provides a summary of all commands for controlling the pH Transmitter 2500 via RS 485 interface.
Product Line and Accessories	Chapter **13** lists the accessories and options available for expanding the instrument functions.
Specifications	Chapter **14** contains the complete technical specifications.
Buffer Charts	Chapter **15** provides the temperature charts for the buffers stored for Calimatic®.
Appendix	Chapter **16** shows how to replace the EPROM.
Technical Terms	Chapter **17** explains technical terms.
Index	Chapter **18** helps you find information in this manual.

Contents

1 Overview of the pH Transmitter 2500

Installation of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual and per applicable local and national codes.
Before first start-up, a *complete parameter setting* procedure must be performed by a system specialist.

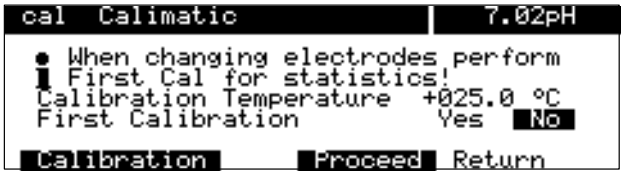
Instrument Concept

Since we have largely followed **NAMUR** recommendations and customer demands – especially concerning safety, reliability and functional variety – this instrument provides state of the art technology showing a new standard for process instruments.

User Interface

The display interface consists of a backlit high-resolution graphical display (240 x 64 pixels) and a keypad.
Each key has only one function and is definitely assigned to a **menu** or an input function.

In **measuring mode** the graphical display allows simultaneous readout of the currently measured value via large numerals (25 mm) and of two further values on secondary displays, as well as display of **status messages** (to NAMUR) such as **warning** (maintenance required) and **failure,** and limit messages.
Depending on your application, the displays can be assigned to different variables and output values: pH/mV value, ORP (oxidation-reduction potential), rH value, measured and manually entered temperature, time, date, output current values 1 and 2, input current in %, controller output, elapsed time since last calibration, or glass and reference electrode impedances (electrode monitoring).



Operator guidance is supported by a 7-line plain-text display with information texts. During operation, the currently measured value and active status messages remain visible.

The keypad includes the keys **meas** (measurement), **cal** (calibration), **maint** (maintenance), **par** (parameter setting), **diag** (diagnostics), a cursor pad for selecting menu items or entering alphanumeric characters and **enter** for confirming your entry.

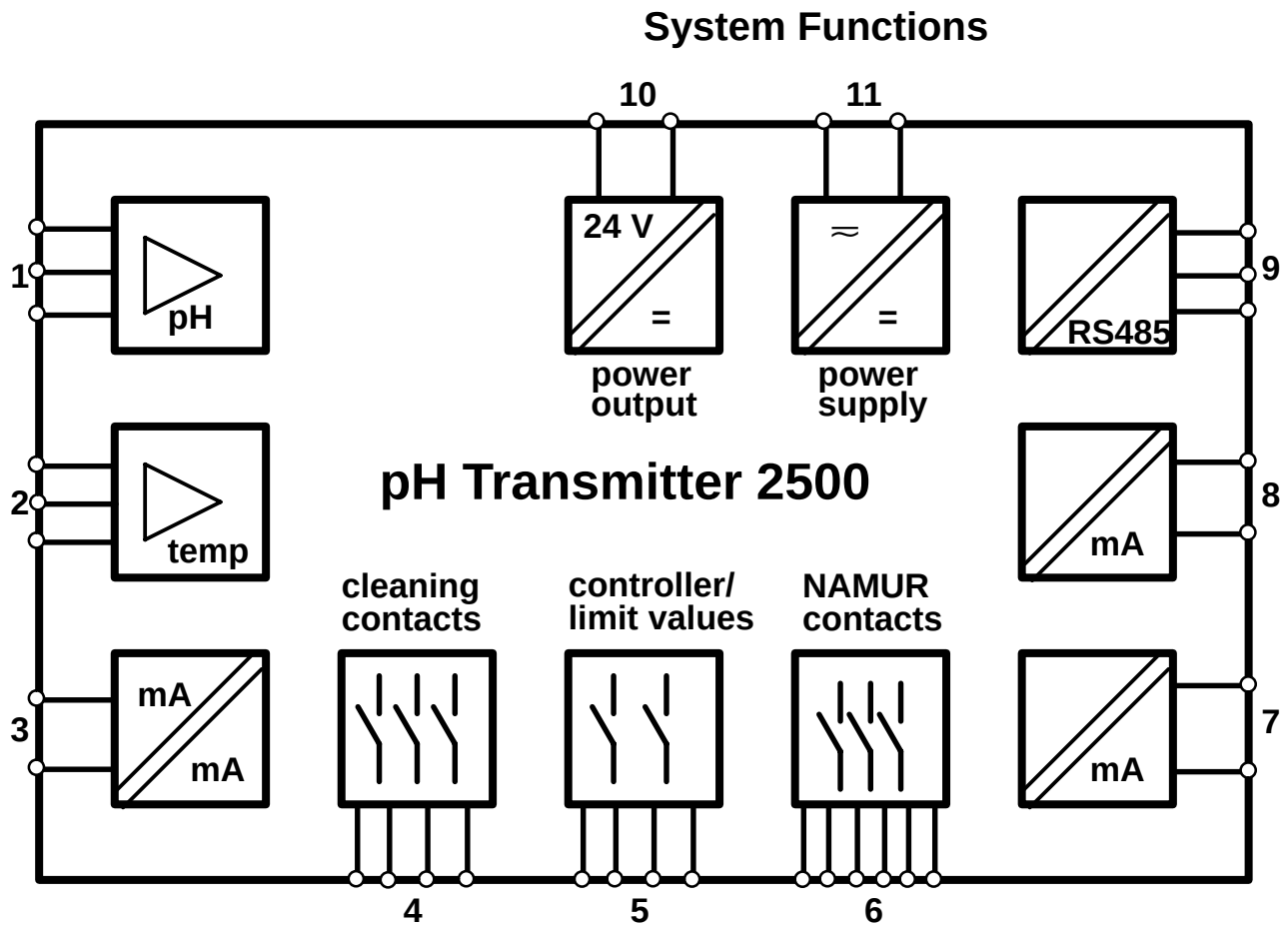


Fig. 1–1 System Functions pH Transmitter 2500

Fig. 1–1 shows the versatile system functions. In addition to the obligatory inputs for sensing and reference electrode (1) and temperature probe (2), an **equipotential bonding electrode** can be connected, which at the same time serves as **auxiliary electrode** for electrode monitoring.
When a suitable electrode – such as platinum – is connected, pH value and **oxidation-reduction potential (ORP)** can be measured simultaneously. As a result, also the pH-compensated ORP – the so-called **rH value** – can be calculated and displayed.

The instrument provides two galvanically isolated *standard current outputs* (0(4) to 20 mA) (7 and 8), which can each be assigned to pH, mV, ORP, rH or temperature. As an option current output 2 (7) can also be used as an analog controller output.
A *standard current input* (0(4) to 20 mA) (3) (galvanic isolation optional) allows limit monitoring of a pressure sensor signal, for example. In addition, the *power output* (10) can be used to create complete 2-wire loops, e.g. for flow or level meters. The determined values can be read out or assigned to limit contacts and messages.

A serial RS 485 interface (9) permits complete remote control and readout of all measurement data and status messages – even over long distances. In addition to ”point-to-point” connection, up to 31 devices can be connected by bus.

The NAMUR contacts (6) allow direct on-site control of signalling units for functional check, warning (maintenance required) and failure. The limit/controller contacts (5) alert to out-of-limit conditions or actuate valves or pumps for control purposes (integrated control function). The cleaning contacts (4) allow actuation of suitable probes for rinsing and cleaning the electrode or of the InClean retractable probe.

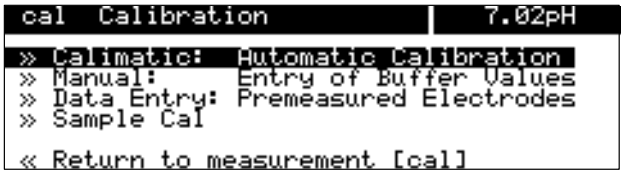
Menu Structure

From the menu structure (Fig. 2–1, page 2–4) you see how operation is strictly organized according to the different menu groups, providing outstanding ease of use in spite of the great functional variety.

A menu is activated by pressing the corresponding key. At any time, also from a lower menu level, you can return to measuring mode by pressing **meas**.

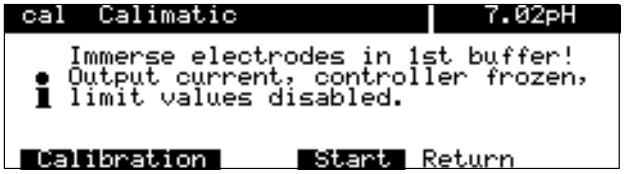
Operation is self-explaining by operator prompting in plaintext dialog. Even for the Administrator level, you neither require the instruction manual nor an additional device (terminal, laptop).

Individual Menus

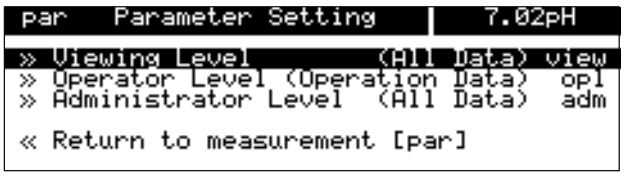


Here you have the **Calibration menu** as an example for operator prompting using information texts. You can choose between four different calibration sequences.

Access can be blocked by a passcode (can also be disabled).

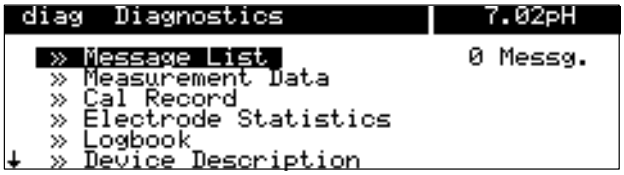


During the **calibration sequence** you get instructions for each step. At the end, the determined electrode data are displayed and stored.



The **Parameter Setting menu** is divided into Viewing, Operator and Administrator level according to the operator's specialization.
On the **Viewing level,** the parameters can only be displayed but not edited.
On the **Operator level,** only marked menu items are enabled for parameter setting.
On the **Administrator level,** all parameter setting functions are accessible. In addition, each item can be marked to configure an optimum menu for the Operator level.
Operator and Administrator level are protected against unauthorized access by **passcodes.** For the Operator level, the passcodes can also be disabled, if required.

The Maintenance menu contains functions for measurement point maintenance (rinsing and cleaning) and for temperature probe adjustment. It also provides a current source function for manual adjustment of the output currents, for example in order to set controller parameters or test external devices (recorder, indicator).
Access can also be passcode protected if required.



The Diagnostics menu provides information on sensor and pH Transmitter.
Activated warning and failure messages are listed in plaintext in the **message list**. Furthermore, you can retrieve the latest electrode data and compare them with the data of the previous or the First Calibration (statistics).

Messages and function activations are automatically stored with date and time in a **logbook** with a storage capacity of 200 entries. This allows tracing back and QM documentation of events according to ISO 9000. Comprehensive instrument testing (memory, display and keypad) can be performed on site using the diagnostics function.

2 Operating the pH Transmitter 2500

Start-up of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual.
Before first start-up, a *complete parameter setting* procedure must be performed by a system administrator.

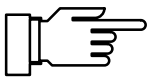
pH Transmitter 2500 in Measuring Mode

In measuring mode, the **main display** reads the measured value.
Below the main display there are two **secondary displays**.

The symbol ▲▼ indicates that the secondary display can be edited using the scrolling keys.

Pressing the scrolling keys ▲ and ▼ selects the measured variable read on the left secondary display.

Press cursor key ▶ to access the right secondary display.
Then use the scrolling keys ▲ and ▼ to select the displayed variable.
Pressing cursor key ◀ returns you to the left secondary display.



At ambient temperatures below 0 °C, LC display readability can be restricted. This does *not* affect instrument functions.

The following variables can be read out on the secondary displays:

- pH value
- mV value
- ORP value
- rH value

Pt	measured temperature (°C)
MAN	manual temperature (°C)
I- IN	input current
OUTP1	output current 1
OUTP2	output current 2 (only with option 350)
X_w	controller setpoint (only with option 353 or 483)
CTL-Y	controller output (only with option 353 or 483)
TIME	time
DATE	date
CTIME	calibration timer
REF	reference electrode impedance
GLASS	glass electrode impedance

Alarm Messages

If the user defined limits (e.g. of the pH value) are exceeded for **warning message** (”maintenance required”) or **failure message**, ”WARN” or ”FAIL” will appear in the lower left corner of the display.

The measurement display flashes.

The corresponding NAMUR contacts are active.

Active messages are listed in the message list of the **Diagnostics menu**. (See page 4–2.)
For setting the warning and failure message limits, refer to chapter 9, page 9–22.

Limit Contacts Active

If the defined **limit values** are exceeded, e.g. for the pH value, ”L1” and/or ”L2” will appear in the upper right corner of the display.

Limit contacts L1 and/or L2 are active.

During a sample calibration, the ”L1/L2” display is covered by ”Sample”!
In remote status during interface operation, the ”L1/L2” display is covered by ”Remote”!

The limit value settings are listed under ”Measurement Data” in the **Diagnostics menu.** (See page 4–2.)
For setting the limit values, refer to chapter 9, page 9–25.

Control Elements

Pressing menu key **cal**, **diag**, **maint** or **par** accesses the corresponding menu.

Pressing **cursor keys** ◀ or ▶ selects the entry position on the display.

Pressing **scrolling keys** ▲ or ▼ selects a display line. When entering numeric parameters, they are used to scroll the numerals 0 through 9 and change the sign. The keys provide a repeat function.

All entries are accepted by pressing **enter**.

Pressing **meas** returns you to measuring mode, regardless of which menu or submenu you are in.

Pressing **cal** , **diag** , **maint** or **par** activates the corresponding menu.

In the *upper left corner* you read the menu (”adm”) and the menu level (e.g. ”Current Input”) where you are at the moment.

In the *upper right corner* you read the measured value (as on the large measurement display). Active warning or failure messages are indicated by ”$_{W}$” and/or ”^{F}” at the left of the measured value.

To exit the menu and return to measuring mode,

- press the menu key once more (repeatedly, if required) or
- press **meas**.

Menu Structure

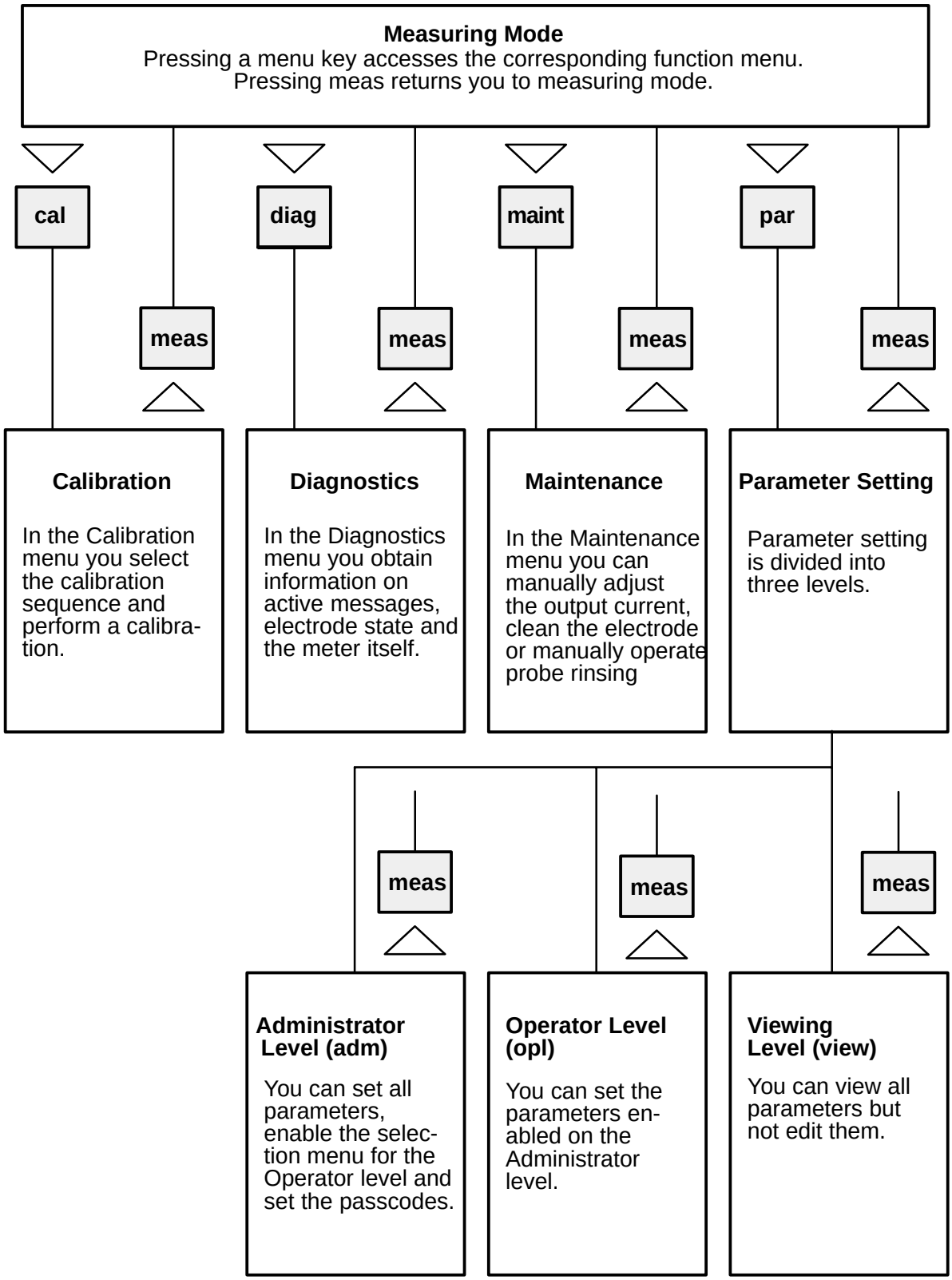


Fig. 2–1 Menu Structure

Information on operation is indicated by **i**.

How to select a menu item

Press **scrolling key** ▲ or ▼ to select a display line. The selected line is marked by a dark bar (reverse video).

The scrolling keys provide a repeat function:
When the key is held down, the lines are scrolled through.

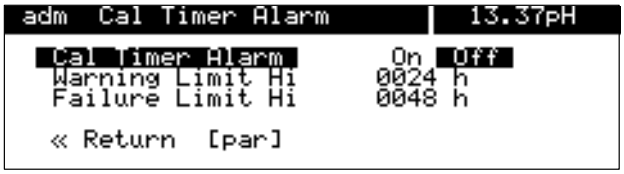
The arrows "↑" and "↓" indicate that more lines can be accessed by scrolling.

The symbols ≪ and ≫ at the beginning of the display line indicate that you can access another menu level by pressing cursor key ◄ or ►:

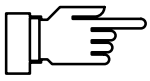
≫ Pressing ► or **enter** accesses the next (lower) menu level.

≪ Pressing ◄ or the corresponding menu key accesses the previous (higher) menu level.

How to change a setting



Pressing ◄ or ► changes the parameter setting. The selected position is marked by a dark bar and flashes.



A flashing entry position means:
The setting has been changed but not yet accepted.

How to store the edited value

Pressing **enter** stores the new parameter (e.g. "On"). Flashing stops.

How to keep the old setting

Pressing the menu key (e.g. **par**) instead of **enter** restores the old setting ("undo" function).

How to enter numeric values

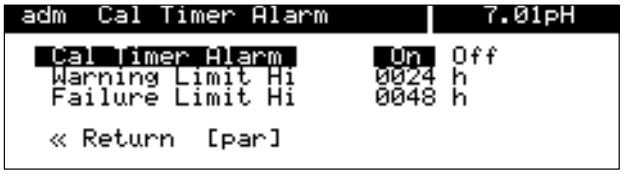
Press ▶ to access the number you want to edit. The flashing cursor is on the first digit.

Select the entry position using **cursor keys** ◀ or ▶.

Press the **scrolling keys** ▲ or ▼ to scroll from 0 through 9 and change the sign.

How to change a sign

If the entry value has a sign, the flashing cursor can be placed on it using ◀.
Pressing ▲ or ▼ switches between ”+” and ”–”.



In this *example* we want to change the cal timer alarm ”Warning Limit Hi” from 24 to 30 h.

Press ▶ three times until the flashing cursor is on digit ”2”.

Press ▲ once (”3”).
Press ▶ once: The flashing cursor is on digit ”4”.
Press ▼ four times (”0”).

How to keep the old setting

Pressing menu key **par** restores the old setting.

Pressing **enter** stores the new value.

3 Calibration

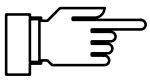
Why do you have to calibrate?

Every **pH electrode** has its individual **zero point** and its individual **slope**. Both values are altered by aging and wear. For sufficiently high accuracy of pH measurement, the instrument must be regularly adjusted for the electrode data (calibration). The pH Transmitter 2500 corrects the voltage delivered by the electrode according to electrode zero and slope and displays it as pH value.

For calibration, the electrode is immersed in (one or two) **buffer solutions** whose pH value is exactly known. The pH Transmitter 2500 measures the voltages from the electrode and the buffer solution temperature and automatically calculates electrode zero and slope.

Without calibration every pH meter delivers an imprecise or wrong output value!
Especially after replacing the electrode you *must* perform a calibration!

Monitoring Functions for Calibration



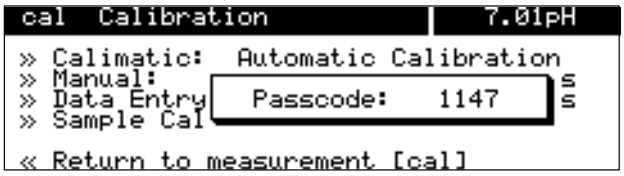
The pH Transmitter 2500 provides comprehensive functions for monitoring correct calibration performance and electrode state. This allows documentation for quality management to ISO 9000 and GLP/GMP.

- Sensocheck® monitors the electrode state by measuring **glass and reference electrode impedances.** (See page 9–14.)
- Regular calibration can be monitored by a **cal timer**. (See page 9–6.)
- The **calibration record** (GLP/GMP) provides all relevant data of the last calibration. (See page 4–3.)
- The **electrode statistics** show the behavior of the electrode parameters during the last three calibrations compared to the **First Calibration**. (See page 4–4.)
- The **logbook** provides time and date stamped records of calibrations performed within the last 200 events. (See page 4–5.)
- For zero point, electrode slope, glass and reference electrode impedance, you can define limits for a **warning** and a **failure message** each. (See page 9–22.) This permits automatic monitoring of electrode state and aging using the calibration data.

How to access the Calibration menu

Pressing **cal** activates the Calibration menu.

Pressing **meas** exits the Calibration menu.



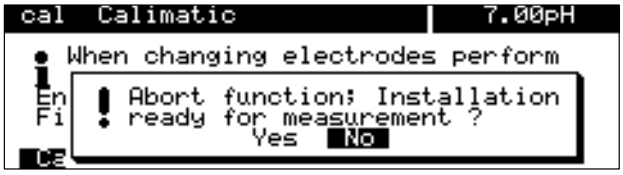
When you are prompted for passcode entry, you must know the **calibration passcode**:

Enter the calibration passcode using scrolling keys ▲ / ▼ and cursor keys ◀ / ▶ (see page 2–6) and confirm your entry with **enter**.

After passcode entry, the output current (1 and 2) is frozen at its last value.

On the Administrator level you can set a new calibration passcode or disable it. (See page 8–4).

Opening the Calibration menu (by pressing **cal** and entering the calibration passcode) activates NAMUR contact ”functional check”. It is deactivated when you exit the menu.
When you select a calibration sequence (Calimatic®, Manual or Data Entry), contact ”probe” will be active for the duration of the calibration (only with option 352 probe rinsing, see page 9–48).
During **cal**, probe rinsing is locked, a rinsing cycle is not started. *Calibration is locked as long as a timer controlled rinsing cycle is running.*



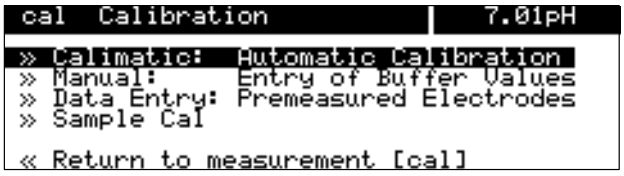
If you press **meas** before calibrating with the first buffer, you are prompted to confirm your decision to abort calibration. If you really want to, press ◀ to select ”Yes” and confirm with **enter**.

The old calibration data remain valid.

If you press **meas** *after* having calibrated with the first buffer, you are prompted again to confirm your decision to abort calibration. If you really want to, press ◀ to select ”Yes” and confirm with **enter**.

The *new zero point* is stored, but the *old slope* value remains valid.

How to select a calibration sequence



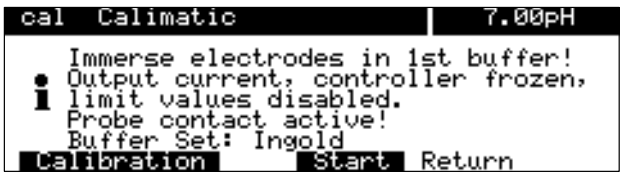
You can choose between four different calibration sequences:

- automatic buffer recognition by Calimatic®
- manual entry of buffer values
- entry of premeasured electrode data
- calibration by sampling

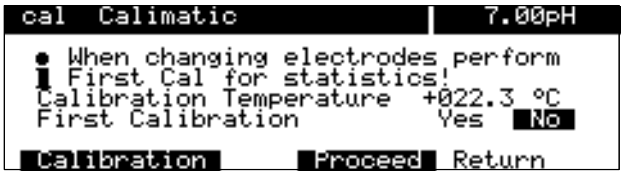
When you press **cal**, the pH Transmitter automatically suggests the previous calibration sequence.

If you do *not* want to calibrate, press **cal** or press ▼ to select ”Return to measurement” and confirm with **enter**.

To start a calibration:
Press ▼ or ▲ to select a calibration sequence and confirm with **enter**.



An **information display** provides information on the state of the pH Transmitter 2500 during calibration and guides you through operation.



What does ”First Calibration” mean?

During a ”First Calibration”, the electrode data are stored as reference values for **electrode statistics**.
The Diagnostics menu ”Electrode Statistics” shows the deviations of zero, slope, and glass and reference electrode impedances of the last three calibrations with respect to the reference values of the First Calibration. This allows to evaluate drift behavior and aging of the electrode.

When do you have to perform a First Calibration?

Each time you replace the electrode you must perform a First Calibration!

How do you perform a First Calibration?

Select a calibration sequence. Then select ”First Calibration Yes” using ▲ and ◀ and confirm with **enter**.

If you *do not* want to perform a First Calibration, press **enter** to proceed to the next step of the calibration sequence.

Temperature Compensation during Calibration

Why Temperature Compensation?

There are two important reasons for determining the buffer solution temperature:

- The slope of the pH electrode is temperature dependent. Therefore the measured voltage must be corrected for the temperature influence (Nernst equation).
- The pH value of the buffer solution is temperature dependent. For calibration, the buffer solution temperature must therefore be known to choose the actual pH value from the buffer chart.

During parameter setting, you define if calibration temperature is automatically measured or must be entered manually (see page 9–9).

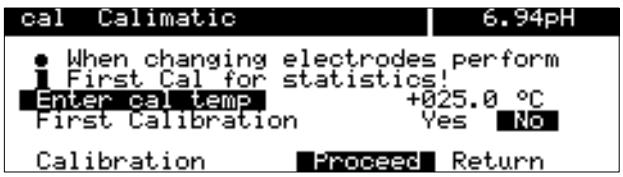
Automatic Temperature Compensation

For automatic cal temp detection, the pH Transmitter 2500 detects the buffer solution temperature using a Pt 100/Pt 1000 temperature probe.

For automatic temperature compensation, there *must* be a temperature probe in the buffer solution. This probe must be connected to the Pt 100/ Pt 1000 input of the pH Transmitter 2500! Otherwise you must select manual entry of calibration temperature.

When ”Cal Temp” has been set to ”Auto”, ”Measured Cal Temp” is read in the menu.
When ”Cal Temp” has been set to ”Manual”, ”Enter cal temp” is read in the menu.

Manual Temperature Compensation



Buffer solution temperature must be entered manually in the Calibration menu:

Measure the buffer solution temperature, e.g. using a glass thermometer.
Select ”Enter cal temp” using ▲ and ▶.
Enter the measured temperature using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Single- or Dual-Point Calibration?

For the calibration sequences

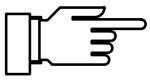
automatic calibration with Calimatic

calibration with manual entry of buffer values

you can choose between single-point calibration and dual-point calibration.

Dual-Point Calibration

The electrode is calibrated with two buffer solutions.
The pH Transmitter 2500 determines zero and slope of the electrode and takes them into account for the measured process value.



Dual-point calibration is required if

the pH value strongly fluctuates,

there is a great difference between measured pH value and electrode zero,

pH measurement must be very accurate, or

the electrode is subjected to strong wear.

Single-Point Calibration

The electrode is only calibrated with one buffer solution.
Only the zero point of the electrode is determined and taken into account by the pH Transmitter 2500.

Single-point calibration is suitable and permissible if the measured values lie near the electrode zero so that slope changes do not have a great effect.

Automatic Calibration with Calimatic®

For automatic calibration with Calimatic®, the electrode is immersed in one or two buffer solutions. From the measured electrode potential and temperature, the pH Transmitter 2500 *automatically* recognizes the nominal buffer value.
The sequence of buffer solutions is irrelevant, however they must belong to the **buffer set** selected during parameter setting (see chapter 9, page 9–7).
Temperature dependence of the nominal buffer value is taken into account by Calimatic®.

All calibration data are related to a reference temperature of 25 °C.
During calibration, output current (1 and 2) and controller output are frozen at their last values; limit contacts are disabled, contact ”probe” is enabled (only with option 352).

Calibration of electrodes with zero point other than pH 7

The Option 356 (integrated as standard in all instruments) allows to define the nominal zero and slope of the electrode (see page 9–7).

Then, also an electrode with zero point at pH = 4.6, for example, can be automatically calibrated using Calimatic®.

Calibration is valid if
zero point deviates by < ±1 pH unit
and slope by < ±5.5 mV/pH
from the nominal value.

What you have to know for calibration

Use only new, undiluted buffer solutions!
The buffer solutions must belong to the selected buffer set (see chapter 9, page 9–7)!

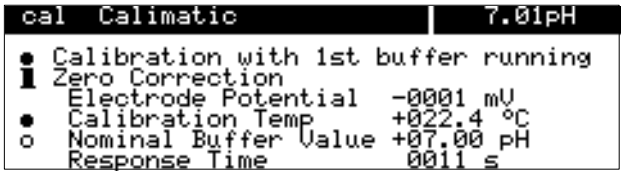
For measurement of reference electrode impedance (jumper removed from terminals 3 and 4), the buffer solution must be electrically connected to terminal 4 during calibration.

To do so, immerse an auxiliary electrode in the buffer solution and connect the auxiliary electrode to terminal 4.

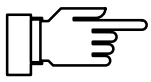
How to perform an automatic calibration

Remove electrode
Select submenu ”Calimatic – Automatic Calibration”
Press enter
Immerse electrodes in first buffer
Press enter

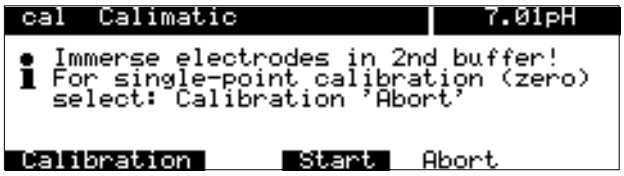
Immerse the electrode in the first buffer solution and confirm ”Calibration Start” with **enter**.



When the pH Transmitter 2500 has recognized the buffer solution, the nominal buffer value is displayed.
Then you can press **cal** to reduce the time needed for the measured voltage to stabilize.
However, this reduces accuracy of calibration values!
From the **response time** you see how long it takes for the measured voltage to stabilize.



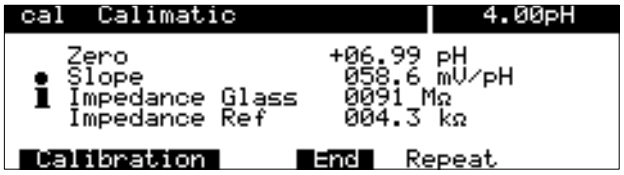
If electrode potential or measured temperature strongly fluctuate, calibration is stopped after 2 min.



Rinse electrode thoroughly!
Immerse electrodes in 2nd buffer
Press enter

For *dual-point calibration,* immerse the electrode in the second buffer solution and confirm with **enter**.
Calibration is performed with the second buffer.

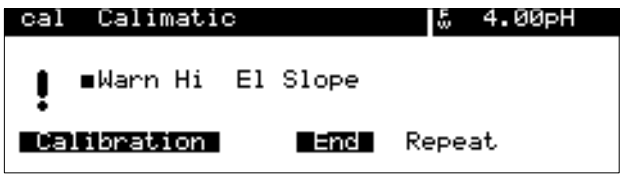
For *single-point calibration,* press ▶ to select ”Abort” and confirm with **enter**.



After a successful calibration, the electrode data are displayed.
Press **enter** or **cal** to return to the Calibration menu, or
press **meas** to activate measuring mode.

Press enter
Rinse electrode thoroughly and reinstall it

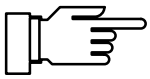
If you want to repeat calibration, press ▶ to select ”Repeat” and confirm with **enter**.



If an error message is displayed, you have to repeat calibration.

Calibration with Manual Entry of Buffer Values

For calibration with manual entry of buffer values, the electrode is immersed in one or two buffer solutions.
The pH Transmitter 2500 displays the measured temperature.
Then you have to enter the *temperature corrected buffer values*. To do so, look at the buffer chart (e.g. on the bottle) and enter the buffer value belonging to the displayed temperature. For intermediate temperature values, you must interpolate.



All calibration data are related to a reference temperature of 25 °C.
During calibration, output current (1 and 2) and controller output are frozen at their last values, limit contacts are disabled, contact ”probe” is enabled (only with option 352).

What you have to know for calibration

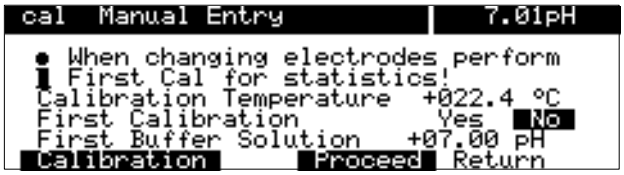
Use only new, undiluted buffer solutions!

For measurement of reference electrode impedance (jumper removed from terminals 3 and 4), the buffer solution must be electrically connected to terminal 4 during calibration.

To do so, immerse an auxiliary electrode in the buffer solution and connect the auxiliary electrode to terminal 4.

How to perform a manual calibration

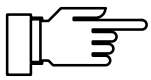
Remove electrode
Select submenu ”Manual Entry of Buffer Values”
Press enter



Press **cal** and **enter** to open the ”Manual Entry” submenu.
The measured calibration temperature is displayed, or calibration temperature can be entered manually.

Enter 1st buffer value

Press ▲ and ▶ to move the cursor to the entry position for the 1st buffer value.
Enter the 1st buffer value using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

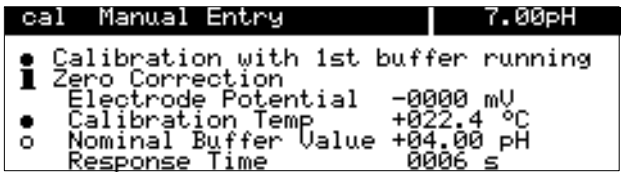


You must enter the temperature corrected buffer value. To do so, look at the buffer chart and enter the buffer value belonging to the displayed calibration temperature.

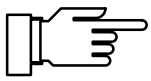
Press **enter** to proceed to the information text.

Immerse electrodes in 1st buffer
Press enter

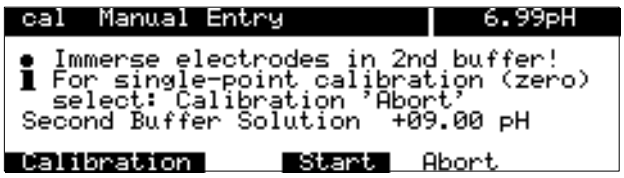
Immerse the electrode in the first buffer solution and press **enter** to confirm ”Calibration Start”.



Then you can press **cal** to reduce the time needed for the measured voltage to stabilize.
However, this reduces accuracy of calibration values!
From the **response time** you see how long the electrode takes until the measured voltage has stabilized.



If electrode potential or measured temperature strongly fluctuate, calibration is stopped after 2 min.



Rinse electrode thoroughly!
Immerse electrodes in 2nd buffer

For *dual-point calibration,* immerse the electrode in the second buffer solution.

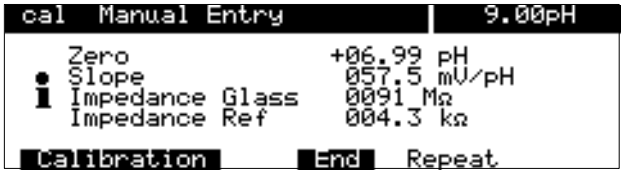
For *single-point calibration,* press ▶ to select "Abort" and confirm with **enter**.

Enter 2nd buffer value

Press ▲ and ▶ to move the cursor to the entry position for the 2nd buffer value.
Enter the 2nd buffer value using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Press enter to start 2nd calibration step

Calibration is performed with the second buffer.



After a successful calibration, the electrode data are displayed.
Press **enter** or **cal** to return to the Calibration menu, or
press **meas** to activate measuring mode.

Press enter
Rinse electrode thoroughly
and reinstall it

If you want to repeat calibration, press ▶ to select "Repeat" and confirm with **enter**.

If an error message is displayed, you have to repeat calibration.

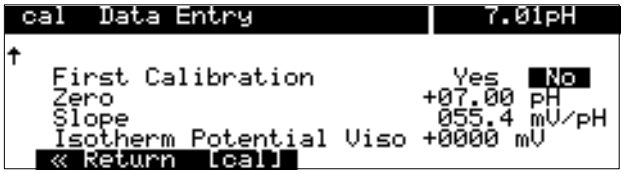
Calibration by Entry of Premeasured Electrode Data

You can directly enter the values for zero, slope and isothermal intersection potential of an electrode. The values must be known, that is, they must have been determined in the laboratory, for example.

When you enter an isothermal intersection potential V_{iso}, this value remains stored for the calibration sequences during Calimatic®, Manual Entry, and Sample Calibration.

During calibration, output current (1 and 2) and controller output are frozen, limit contacts are disabled, contact "probe" is enabled.

How to enter premeasured data



Press **cal** and **enter** to open the "Data Entry" submenu.
Enter the premeasured values using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

Calibration by Sampling

If the electrode cannot be removed (e.g. for reasons of sterility in biotechnical processes) electrode zero can be calibrated by ”sampling”.

To do so, the pH Transmitter 2500 stores the currently measured process value.
Immediately afterwards you take a sample from the process. The pH value of the sample is measured in the laboratory.
The laboratory value is entered into the pH Transmitter 2500 which calculates the electrode zero from the difference between measured value and laboratory value (this method only allows single-point calibration).

During calibration, output current (1 and 2) and controller output are frozen, limit contacts are disabled, contact ”probe” is enabled.

How to perform calibration by sampling

Press **cal** and **enter** to open the ”Sample Cal” submenu.
The measured sample temperature is displayed.

The currently measured pH value of the medium is displayed and stored.
Press **enter** or **cal** to return to the Calibration menu, or
press **meas** to activate measuring mode.

In measuring mode the word ”Sample” in the upper right corner of the display indicates that a sample value has been stored for calibration. The pH Transmitter expects entry of the laboratory value. Until that, it uses the old zero value for measurement.
(If the pH Transmitter is in remote status during interface operation, the display ”Sample” is covered by ”Remote”.)

Take sample

Take a sample from the process and measure the pH value of the sample in the laboratory or using a portable meter directly on site (e.g. Model 1120).

Please note that the pH value of the sample is temperature dependent. Therefore, laboratory measurement should be performed at the sample temperature read on the display.
You should transport the sample in an insulated container (Dewar) to maintain its temperature.
The pH value of the sample can also be altered through escape of volatile substances.

After having determined the pH value of the sample, press **cal** and **enter** to open the ”Sample Cal” submenu.
The measured sample temperature and the stored pH value are displayed.

Enter the measured pH value of the sample (”Lab Value”) using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Pressing **enter** or **cal** returns you to the Calibration menu.

Pressing **meas** activates measuring mode.

Calibration with InClean Retractable Probe

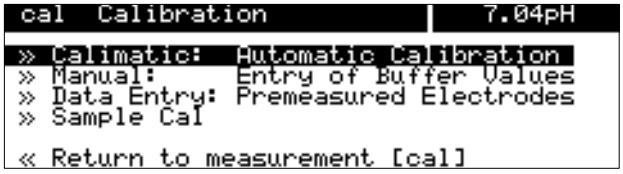
When the instrument is equipped with option 404, you can control a InClean automatic retractable probe (see page 9–39).

For calibration, dismount the electrode and select one of the four calibration sequences.

In the following, an automatic calibration with Calimatic® is used as example for a calibration procedure.

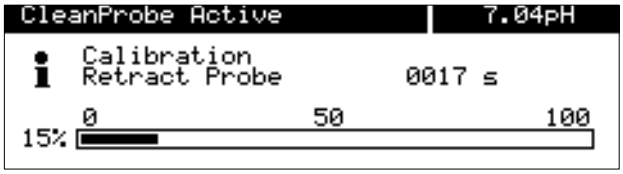
For technical reasons the InClean retractable probe is only called ”CleanProbe” in the menu texts of the pH Transmitter 2500.

Rinsing program selected



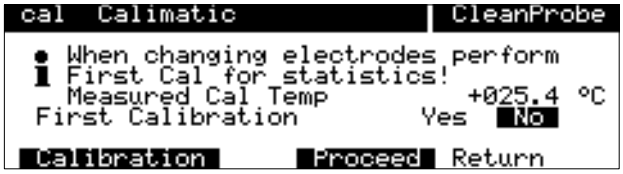
After calling up the Calibration menu with the key **cal** and entering the calibration passcode if necessary, select the desired calibration procedure.

The following description applies to the Calimatic® calibration procedure. During manual calibration and data input the sequence is structured accordingly. The procedure for probe calibration is described separately (see Pg. 3–17).



After the Calimatic® has been called up, the retractable probe first carries out the selected rinsing program up to the wait position. The individual steps are shown on the display in their consecutive order.

When the rinsing program has reached the wait position you will be asked to set the mode selector to the ”Service” position.

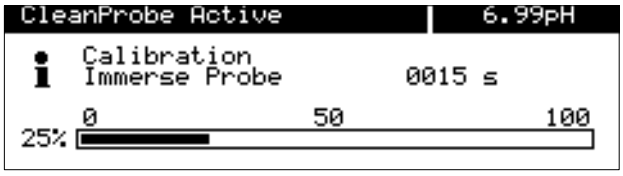


The acknowledgement does not appear on the display until the mode selector is in the ”Service” position. Now the electrode can be removed without danger.

Never remove the electrode before switching the mode selector to ”Service”!

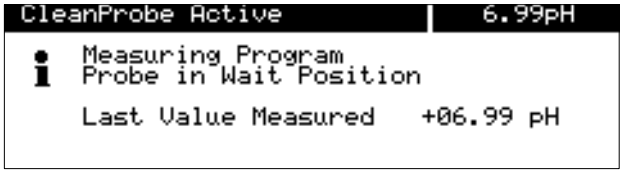
After completing calibration and reinstalling the electrode the pH Transmitter will ask you to set the mode selector to the ”Run” position.
Check again beforehand whether the electrode is properly installed and the retractable probe is ready for operation (compressed air, water, cleaning agent etc.).

Never move the remote cleaning probe into the ”Measuring” position unless the electrode is installed, as otherwise process fluid may escape!

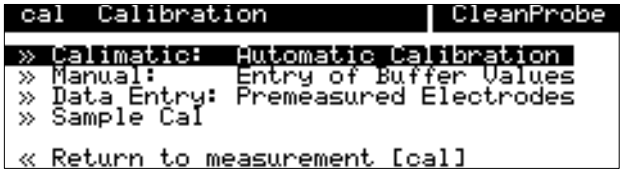


Then set the mode selector to the ”Run” position. This causes the retractable probe to run through the remaining program steps and then move into the ”Measuring” position.

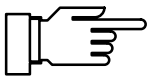
Measuring program selected



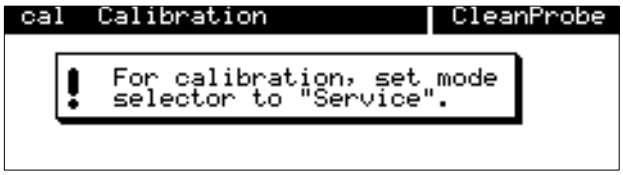
The retractable probe is already in the wait position. The output currents are frozen at the last value, the limit contacts are inactive and the NAMUR contact ”Functional control” is active.



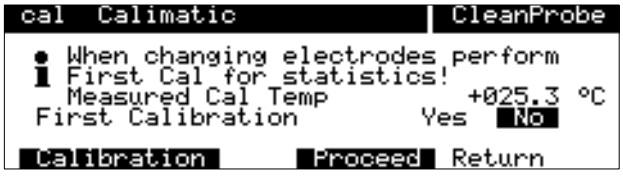
After calling up the Calibration menu with the key **cal** and entering the calibration passcode if necessary, select the desired calibration procedure.



The following description applies to the Calimatic® calibration procedure. During manual calibration and data input the sequence is structured accordingly.
The procedure for probe calibration is described separately (see Pg. 3–17).



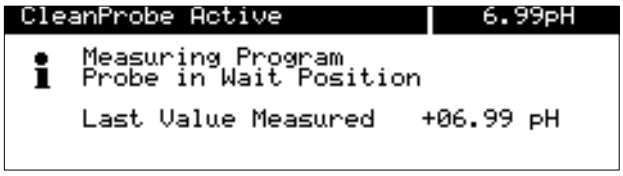
After calling up the Calimatic® you will be asked to set the mode selector to the ”Service” position.



The acknowledgement does not appear on the display until the mode selector is in the ”Service” position. Now the electrode can be removed without danger.

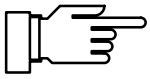
Never remove the electrode before switching the mode selector to ”Service”!

After completing calibration and reinstalling the electrode the pH Transmitter will ask you to set the mode selector to the ”Run” position.
Check again beforehand whether the electrode is properly installed and the retractable probe is ready for operation (compressed air, water, cleaning agent etc.).



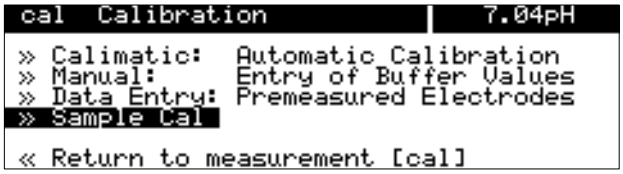
Then set the mode selector to the ”Run” position. The pH Transmitter then indicates that the retractable probe is still in the wait position.

Sample Calibration with InClean Retractable Probe



For detailed description of sample calibration, please refer to page 3–13.

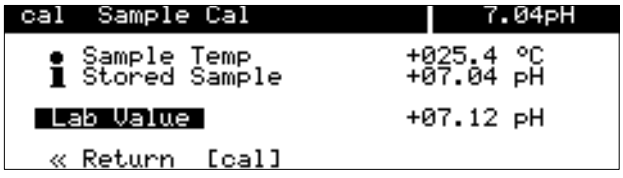
Rinsing program selected



After calling up the Calibration menu with the key **cal** and entering the calibration passcode if necessary, select the desired calibration procedure.

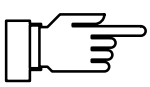
The pH Transmitter 2500 stores the current pH of the measured medium. Now take a sample and return to the measuring mode. You will be asked if you really want to quit the function. Press ▲ to select “Yes” and confirm with **enter**.

In the measuring mode the word ”Sample” appears in the upper right corner, indicating that a sample value has been stored for calibration.



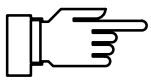
In the lab you determine the pH of the sample and then call up the sample Calibration menu again and enter the lab value. The pH Transmitter 2500 then calculates the new electrode zero point.

End calibration and return to the measuring mode.

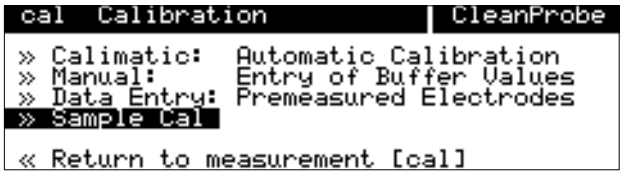


During sample calibration only a new electrode zero point is determined and the old electrode slope is retained.

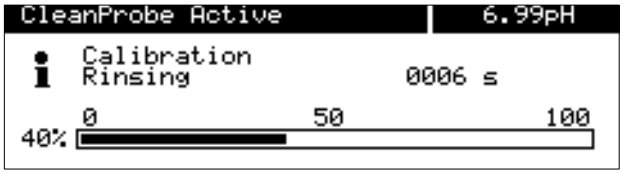
Measuring program selected



When the measuring program has been selected, the InClean first runs through an entire measuring cycle in order to determine the current pH of the measured medium.

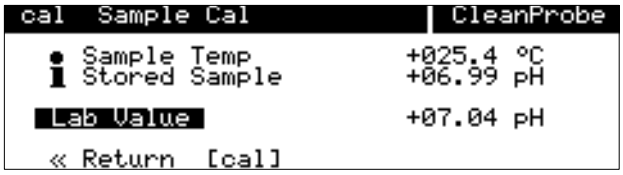


After calling up the Calibration menu with the **cal** key and entering the calibration passcode if necessary, select the desired calibration procedure.

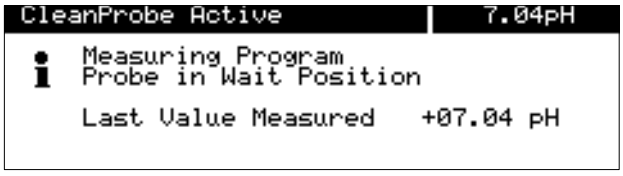


The InClean retractable probe now runs through an entire measuring cycle (as defined): the probe is rinsed and moves into the ”Measuring” position. The pH is measured for the defined measuring time.
Then the probe returns to the ”Rinsing” position again and carries out the remaining program steps up to the wait position.

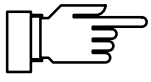
The pH Transmitter 2500 stores the current pH of the measured medium. Now take a sample and return to the measuring mode.



In the lab you determine the pH of the sample and then call up the sample Calibration menu again and enter the lab value. The pH Transmitter 2500 then calculates the new electrode zero point.



After exiting the Calibration menu the probe is in the wait position again.



During sample calibration only a new electrode zero point is determined and the old electrode slope is retained.

4 Diagnostics Menu

What you can do in the Diagnostics menu

The Diagnostics menu provides all relevant information on instrument status.

The message list
shows the number of currently activated messages and the individual warning or failure messages in plaintext.

The measurement data
show the point of measurement (to DIN 19 227/ ISO 3511), the limit values, the controller setpoint (with option 353), and if probe rinsing is activated.

The calibration record
shows all relevant data of the last calibration for documentation according to GLP/GMP.

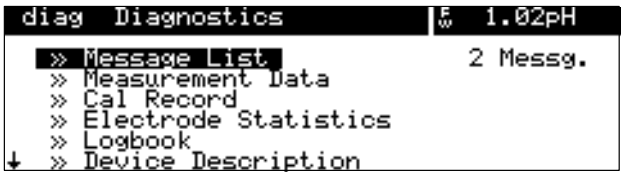
The electrode statistics
shows the electrode data of the last three calibrations and of **First Calibration**.

The logbook
shows the last 200 events with date and time, such as calibrations, warning and failure messages, power failure etc.
This allows quality management documentation to ISO 9000.

The device description
contains information on model designation, serial number and options of the instrument.

The device diagnostics
allows comprehensive tests to check the function of the pH Transmitter 2500.
This allows quality management documentation to ISO 9000.
Instrument settings and parameters are not affected.

How to access the Diagnostics menu



Pressing **diag** opens the Diagnostics menu.

Pressing **meas** or **diag** exits the Diagnostics menu.

Message List

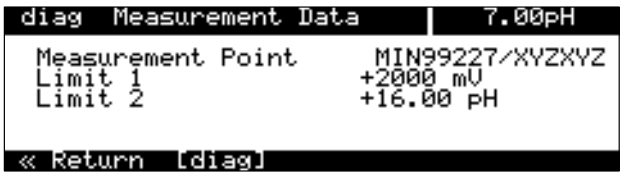
Press ▶ or **enter** to access the ”Message List”.

All currently active failure and warning messages are displayed.

For description of messages, refer to chapter 11.

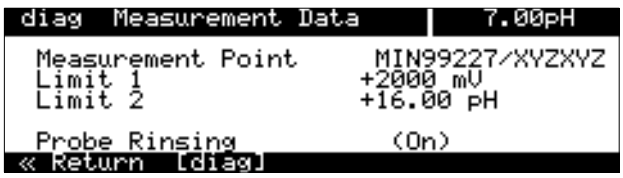
Press **diag** to return to the Diagnostics menu.

Measurement Data

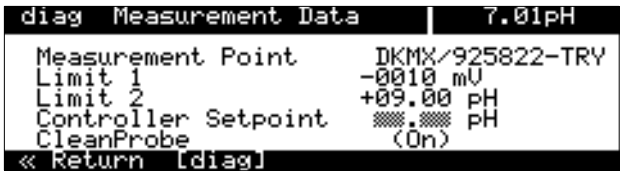


Press ▼ and **enter** to access the ”Measurement Data”.

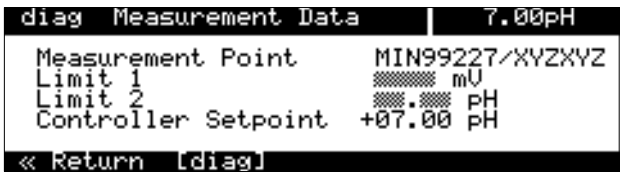
The point of measurement (to DIN 19227/ ISO 3511) is displayed.
Below, you can read which limit values are set.



If the pH Transmitter is equipped with option 352 (probe rinsing), you can see if probe rinsing is activated.



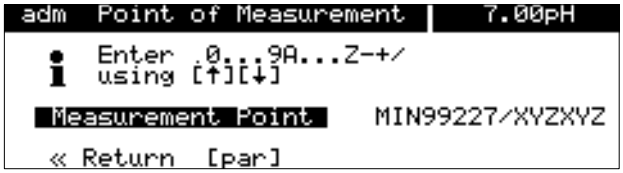
If the pH Transmitter is equipped with option 404 (InClean), you can see if InClean control is activated.



If the pH Transmitter is equipped with option 353 (digital controller) or option 483 (analog controller) *and the controller is activated*, the controller setpoint is displayed.
When the digital controller is active, the limit values are not monitored.

Press **diag** to return to the Diagnostics menu.

How to enter the point of measurement



On the Administrator or Operator level you select menu item ”Point of Measurement”.

You can enter . 0...9 A...Z – + / using the scrolling keys.
Enter the point of measurement using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Calibration Record

Select ”Cal Record” using ▼ and **enter**.

Press **diag** to return to the Diagnostics menu.

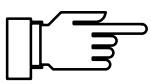
What you can do with the calibration record

The calibration record contains all relevant data of the last calibration required for documentation according to ISO 9000 and GMP.

- date and time of last calibration
- calibration sequence (e.g. Calimatic)
- zero point of electrode
- slope of electrode
- isothermal intersection potential V_{iso}

For the 1st and 2nd Buffer:

- nominal buffer value
- (measured) electrode potential
- calibration temperature
- electrode response time until stabilization of measured voltage



For some calibration sequences, such as Data Entry, not all measured values are available. The relevant positions are covered by a gray bar.

Electrode Statistics

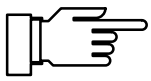
What is the electrode statistics?

When you perform a **First Calibration** (see page 3–5), the following values are stored as **reference values**:

- date and time of First Calibration
- electrode response time of First Calibration
- zero point of electrode
- slope of electrode
- glass electrode impedance
- reference electrode impedance

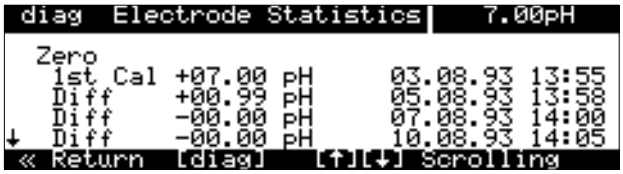
When you then perform ordinary calibrations, the following data will be listed in the electrode statistics for the *last three calibrations:*

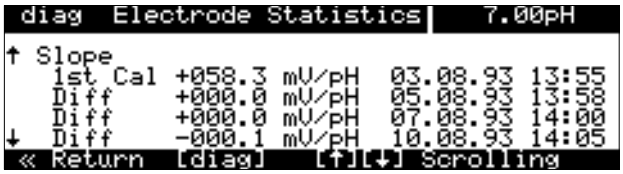
- date and time of calibration
- electrode response time during calibration
- *deviation* of zero point *from First Calibration to calibratio*n
- *deviation* of electrode slope
- *deviation* of glass electrode impedance
- *deviation* of reference electrode impedance



This provides you with important information on electrode state, aging and the time for the next due calibration.
If the time between two calibrations is less than 6 minutes, the pH Transmitter interprets the second calibration as repetition of the first one (e.g. when an error has occurred). It does not store a new record. The last calibration record is overwritten.

How to read out electrode statistics



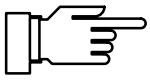


Select ”Electrode Statistics” using ▼ and **enter**.
Press the scrolling keys to read out the statistics data of the First Calibration and the last three calibrations, respectively:

- zero point
- slope
- impedance glass electrode
- impedance reference electrode
- electrode response time

Press **diag** to return to the Diagnostics menu.

Logbook



You can only make use of the logbook if your pH Transmitter is equipped with option 354.
Without this option, the menu reads ”Logbook (Optional)”, and this item cannot be selected.

What is the logbook?

The logbook contains the last 200 events with date and time and displays them. Error messages occurring during parameter setting, calibration or maintenance are not recorded.
The following events are recorded:

- instrument in measuring mode
- instrument turned on/off
- ■: start of warning and failure messages
- □: end of warning and failure messages
- probe rinsing activated
- calibration messages
- parameter setting, calibration, maintenance or diagnostics activated
- entry of wrong passcodes

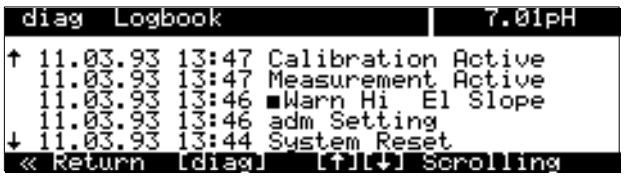
What you can do with the logbook

The logbook entries can be used for quality management documentation to ISO 9000 and GLP/ GMP.

Logbook entries *cannot be edited!*

If the pH Transmitter is equipped with option 351 (remote interface) (refer to page 9–53), the logbook contents can be read out and automatically documented.

How to read out the logbook entries

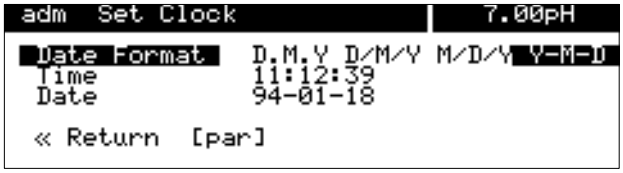


Select ”Logbook” using ▼ and **enter**.

Press the scrolling keys to read out all entries.

Press **diag** to return to the Diagnostics menu.

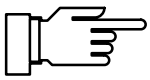
How to set time, date and date format



Select menu item ”Set Clock” on the Operator or Administrator level.

Select date format, time or date using ▼ and **enter**.

Enter time and date using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



On pressing **enter**, the clock starts running at the entered value.
You can read out time and date on the secondary display, time also on the measurement display. (see page 2–1).

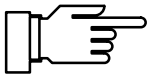
Device Description

Select ”Device Description” using ▼ and **enter**.

You read:

- model designation,
- serial number,
- hardware and software version and instrument options.

Press **diag** to return to the Diagnostics menu.



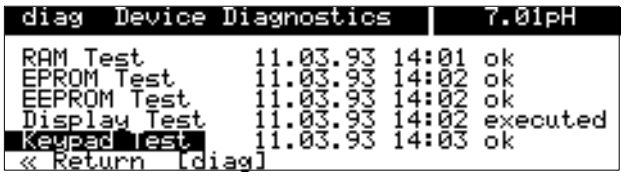
The software version must correspond to the version indicated at the bottom right of the second page of this manual.
The options for *power supply* are *not* displayed. They are indicated on the nameplate (between the Pg cable glands).

Device Diagnostics

What you can do with the device diagnostics

The device diagnostics allows you to perform comprehensive tests to check the function of the pH Transmitter 2500.
This permits quality management documentation to ISO 9000.
Instrument settings and parameters are not affected.

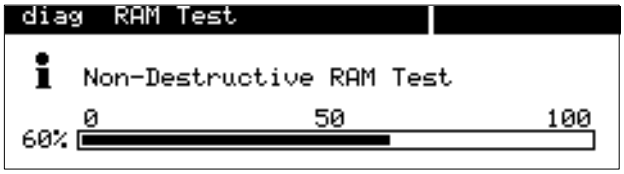
How to perform device diagnostics



Select ”Device Diagnostics” using ▼ and **enter**.

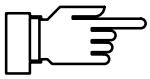
You see when each test was performed and what the result was.

Memory Test



Select ”RAM Test”, ”EPROM Test” or ”EEPROM Test” using ▼ and **enter**.

Press **enter** to start testing.
Test progress is indicated by a bargraph.



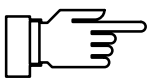
If ”Failure” is read in the menu after testing has been terminated, the pH Transmitter must be returned to the manufacturer for repair.

Display Test

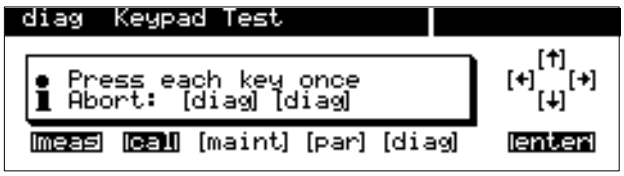
Select ”Display Test” using ▼.

Press **enter** to start testing.

Several test patterns will be displayed allowing you to check if all pixels, lines and columns function perfectly.



If there are disturbances in the test patterns, you should return the instrument to the manufacturer for repair.



Keypad Test

Select ”Keypad Test” using ▼.

Press **enter** to start testing.

You must press each key *once*. Keys that have been pressed are highlighted.

If ”Keypad Test Failure” is read on the display after you have pressed all keys, you must return the pH Transmitter to the manufacturer for repair.

Press **diag** to return to the Diagnostics menu.

5 Maintenance Menu

What you can do in the Maintenance menu

The Maintenance menu provides all functions for sensor maintenance and adjustment of connected instruments.
Access to the Maintenance menu can be protected by a passcode.

If your pH Transmitter is equipped with the InClean function (option 404), you can start the InClean program.

The measurement point maintenance allows to dismount the electrode. If the instrument is equipped with option 404, the retractable probe is moved into maintenance position.

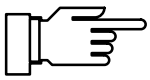
The probe rinsing function (option 352) permits automatic rinsing and cleaning of the electrode: see page 9–48.

The current source allows to manually adjust the output currents (1 and 2) for adjusting and checking connected peripheral devices (such as indicator or recorder).

Temperature probe adjustment allows individual calibration of a Pt 100/Pt 1000 temperature probe.

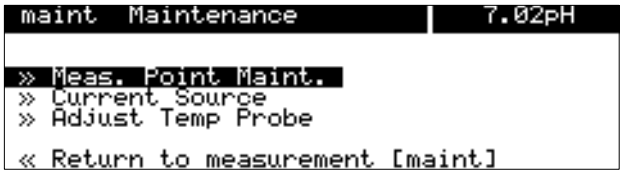
If the pH Transmitter is equipped with a controller function (option 353 or 483), controller output (manipulated variable Y) can be entered manually.

Only with option 404: In the ”Meas. Point Maint.” submenu a timer controlled rinsing cycle will not be started (see page 9–47).

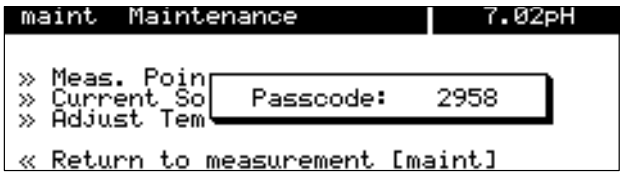


Only with option 352: In the ”Meas. Point Maint.” submenu the ”probe” contact is active. A timer controlled rinsing cycle will not be started.
(see page 9–51).

How to access the Maintenance menu

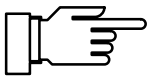


Press **maint** to open the Maintenance menu.



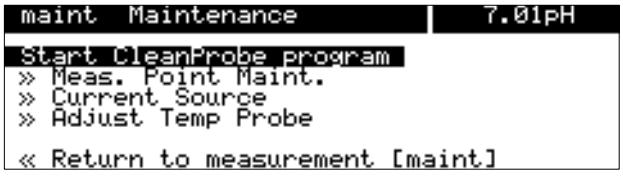
If you are prompted for a passcode, you must know the **maintenance passcode**:

Enter the maintenance passcode using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



The maintenance passcode can be edited or disabled on the Administrator level (see page 8–4).

How to start the InClean program



If the pH Transmitter is equipped with option 404 (InClean function) and InClean has been activated during parameter setting, you can start the InClean program using ▶ or **enter**.
For further information refer to page 9–39.

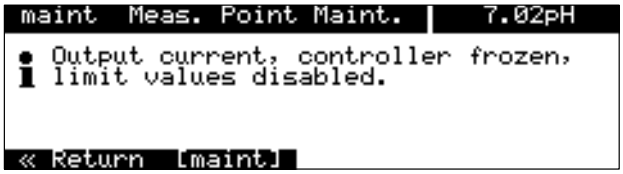
Rinsing program selected

The probe moves to ”Rinsing” position. All steps are executed. The probe returns to ”Measurement” position.

Measurement program selected

The probe moves to ”Measurement” position.After the measurement interval has been terminated, the probe returns to ”Rinsing” position. All steps are performed. The probe remains in ”Rinsing” position.

Measurement Point Maintenance



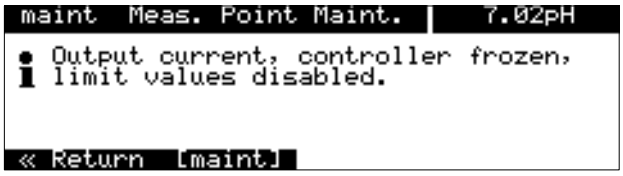
Press ▶ or **enter** to select ”Meas. Point Maint.”.

Now you can remove the electrode for cleaning or replacement.
Output current (1 and 2) and controller output are frozen at their last values, limit contacts are disabled, NAMUR contact ”Functional Check” is active.

Instrument with InClean function (option 404)

If the pH Transmitter is equipped with option 404 (InClean function), you will see one of the following displays.

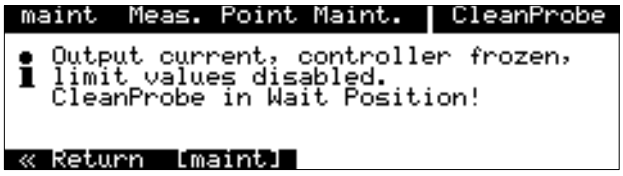
InClean function turned off



The retractable probe has been turned off during parameter setting.

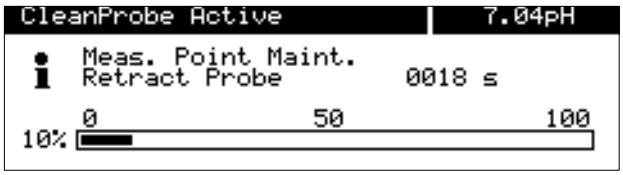
For further information refer to page 9–44.

InClean: Measuring program selected

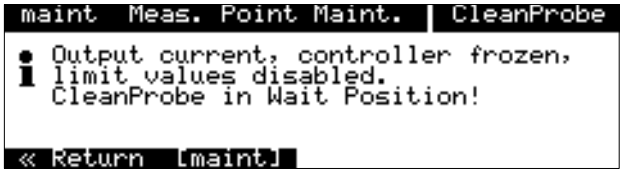


The retractable probe has been turned on, the **measuring program** has been selected.
The probe remains in the wait position until you press **maint**. Start of InClean program by timer or start contact is not possible.

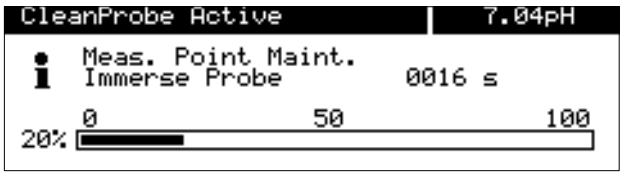
InClean: rinsing program selected



The retractable probe has been turned on, the **rinsing program** has been selected.
The probe moves to ”Rinsing” position, all steps of the InClean program, such as rinsing and cleaning the electrode are executed until wait position.



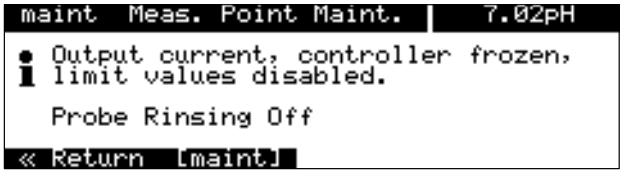
The probe remains in the wait position until you press **maint**. Start of InClean program by timer or start contact is not possible.



All steps of the InClean program after the wait position, such as rinsing and cleaning the electrode are executed. The probe moves to ”Measurement” position.

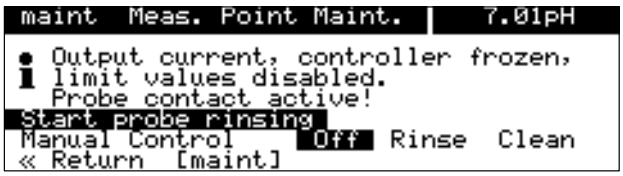
Instrument with probe rinsing function (option 352)

If your pH Transmitter 2500 is equipped with option 352 (probe rinsing), you will see one of the following two displays.

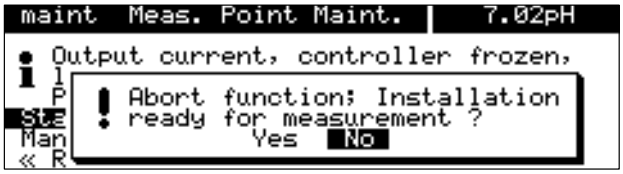


Probe rinsing has been disabled during parameter setting.

For further information refer to page 9–50.



Probe rinsing is enabled.
You can start a **rinsing cycle**:
Press ▲ to select ”Start probe rinsing” and confirm with **enter**. *When the rinsing cycle is terminated, the instrument will go to measuring mode.*

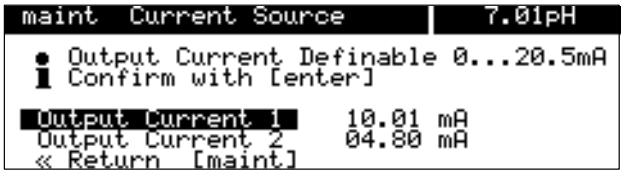


Press **maint** to return to the Maintenance menu, or press **meas** to return to measuring mode. In this case, you will be prompted to confirm your decision to exit the function. If you really want to, press ◄ to select ”Yes” and confirm with **enter**.

Current Source Function

During current source function, the output currents do *not* follow the measured value!
The values can be entered manually.
NAMUR contact ”Functional Check” is active.

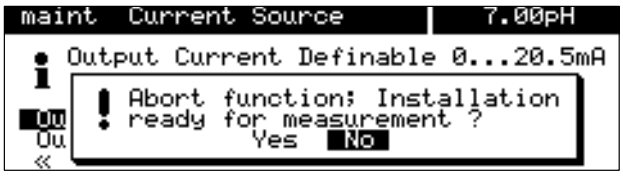
Therefore, you must be sure that the connected peripherals (control room, controller, indicator) will not interpret the current value as measured value!



Press ▼ and **enter** to select ”Current Source”.

Now you can manually set the values for output current 1 (and 2) to check the connected peripheral devices.

Enter the desired current value using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



Press **maint** to return to the Maintenance menu, or press **meas** to return to measuring mode. In this case, you will be prompted to confirm your decision to exit the function. If you really want to, press ◄ to select ”Yes” and confirm with **enter**.

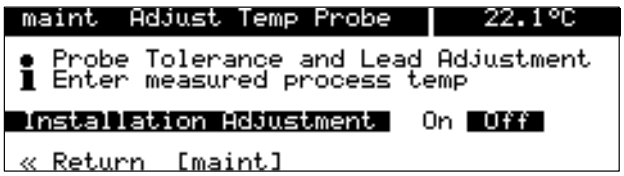
Temperature Probe Adjustment

This function allows you to compensate for the individual temperature probe tolerance and the influence of the lead resistances to increase accuracy of temperature measurement.

This adjustment may only be performed after process temperature has been precisely measured using a calibrated reference thermometer!
The reference thermometer must have an accuracy better than 0.1 °C.

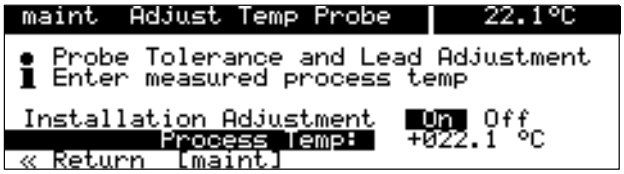
Adjustment without precise measurement might result in strong deviations of the displayed pH value!

To make adjustment easier, set
”Measurement Display: Meas Variable °C”
(see page 9–2).



Open the Maintenance menu and select ”Adjust Temp Probe” using ▼ and **enter**.

If measurement display has been set correspondingly, the *temperature measured by the temperature probe* is now read in the upper right corner of the display.



To start adjustment, press ◀ to select ”Installation Adjustment On” and confirm with **enter**.

Enter the process temperature measured by the reference thermometer using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Now the *adjusted temperature measured by the temperature probe* will be read in the upper right corner of the display.

Permissible adjustment range is ± 5 °C from the value measured by the temperature probe.

Press **maint** to return to Maintenance menu, or press **meas** to return to measuring mode.

Manual Entry of Controller Output

If your pH Transmitter is equipped with a controller function (option 353 or option 483) and the controller has been enabled during parameter setting, you can manually adjust the controller output (manipulated variable Y) for test purposes or for starting a process.

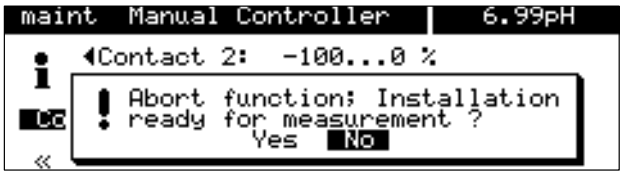
If you manually adjust the controller output, *automatic control* of the controlled variable *stops!*

Therefore, you must be sure that the connected actuators and the control loop will be monitored correspondingly!

Select ”Manual Controller” using ▼ and **enter**.

Now you can enter a controller output in the range –100 % ... +100 % in order to check connected actuators, for example.

Enter the desired controller output using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



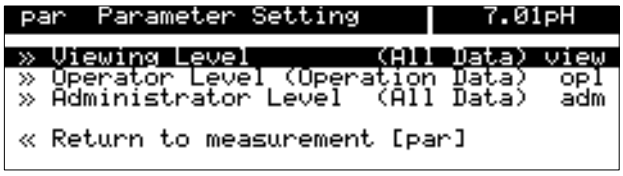
Press **maint** to return to the Maintenance menu, or press **meas** to return to measuring mode. In this case, you will be prompted to confirm your decision to exit the function. If you really want to, press ◀ to select ”Yes” and confirm with **enter**.

6 Display of Settings

What you can do on the Viewing level

On the Viewing level you can display all instrument settings.
Settings cannot be edited!

How to access the Viewing level



Press **par** to open the Parameter Setting menu.

Pressing **meas** exits the Parameter Setting menu.

Press ▶ or **enter** to select ”Viewing Level (All Data)”.

Pressing **par** returns you to the Parameter Setting menu.

Now you can read out all settings.

How to select a menu item

Press **scrolling key** ▲ or ▼ to select a display line. The selected line is marked by a dark bar (reverse video).

The scrolling keys provide a repeat function:
When the key is held down, the lines are scrolled through.

The arrows ”↑” and ”↓” indicate that more lines can be accessed by scrolling.

The symbols ≪ and ≫ at the beginning of the display line indicate that you can access another menu level by pressing cursor key ◀ or ▶:

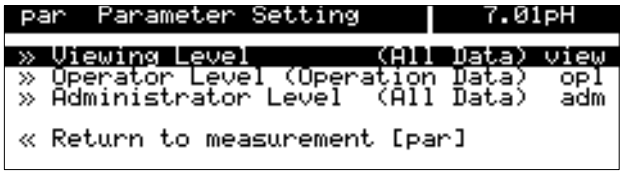
≫ Pressing ▶ or **enter** accesses the next (lower) menu level.

≪ Pressing ◀ or **par** accesses the previous (higher) menu level.

An Example

You want to read out the settings for glass electrode alarm.

Press **par** to open the Parameter Setting menu.



Press ▶ or **enter** to select ”Viewing level (All Data)”.

Select ”Alarm Settings” using **scrolling key** ▼. The selected line is marked by a dark ba (reverse video).

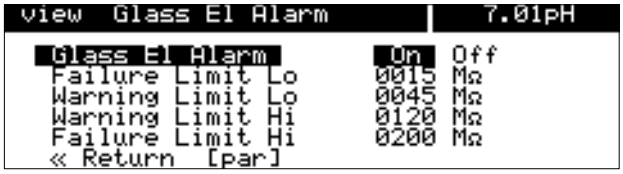
The scrolling keys provide a repeat function: When the key is held down, the lines are scrolled through.

≫ Press ▶ or **enter** to access the next (lower) menu level.

Select ”Glass El Alarm” using **scrolling key** ▼. The selected line is marked by a dark bar (reverse video).

Here you can already see if alarm is enabled.

≫ Press ▶ or **enter** to access the lowest menu level.



The settings for glass electrode alarm will be displayed.

≪ Press ◀ or **par** to return to the previous (higher) level.

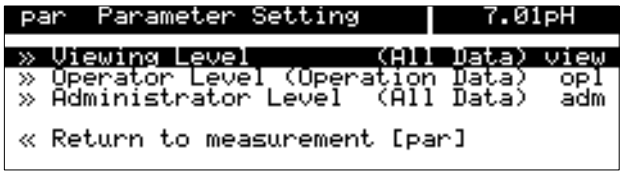
Press **meas** to exit the Parameter Setting menu.

7 Parameter Setting on the Operator Level

What you can do on the Operator level

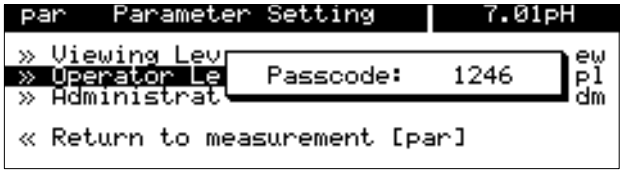
On the Operator level you can edit certain parameters (menu items) of the meter.
Access to the Operator level can be protected by a passcode.

How to access the Operator level



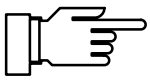
Press **par** to open the Parameter Setting menu.

Pressing **meas** exits the Parameter Setting menu.



Press ▼ and **enter** to select ”Operator Level”.

If prompted for passcode entry, enter the **operator passcode** using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



The operator passcode can be edited or disabled on the Administrator level (see page 8–4).

Pressing **par** returns you to the Parameter Setting menu.

You can edit the marked menu items:

- ● This menu item has been enabled on the Administrator level: It can be edited.
- ○ This menu item has been locked on the Administrator level: It *cannot* be edited. *The menu item is skipped during scrolling.* However, it can be read out on the Viewing level.

How to select a menu item

Press **scrolling key** ▲ or ▼ to select a display line. The selected line is marked by a dark bar (reverse video).

The arrows "↑" and "↓" indicate that more lines can be accessed by scrolling.

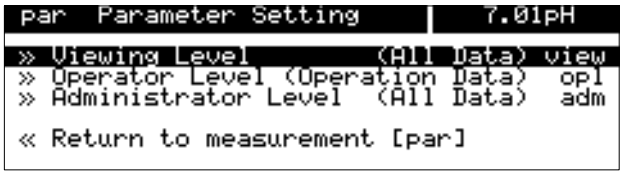
The symbols ≪ and ≫ at the beginning of the display line indicate that you can access another menu level by pressing cursor key ◀ or ▶:

≫ Pressing ▶ or **enter** accesses the next (lower) menu level.

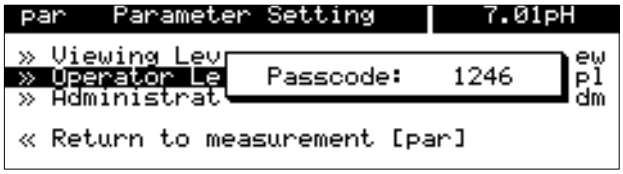
≪ Pressing ◀ or **par** accesses the previous (higher) menu level.

An Example

You want to change the settings for the input filter.



Press **par** to open the Parameter Setting menu.

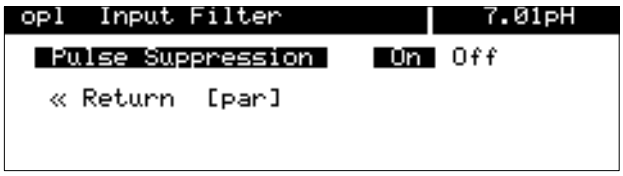


Press ▼ and **enter** to select "Operator Level (Operation Data)".

Enter the **operator passcode** using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Press ▼ to select menu item "Input Filter".

≫ Press ▶ or **enter** to access the next (lower) menu level.



To activate the input filter, press ◀ to select "Pulse Suppression On" and confirm with **enter**.

How to keep the old setting

Pressing menu key **par** instead of **enter** restores the old setting ("undo" function).

≪ Pressing ◀ or **par** returns you to the previous (higher) menu level.

Pressing **meas** exits the Parameter Setting menu.

8 Parameter Setting on the Administrator Level

Before first start-up of the pH Transmitter 2500, a *complete parameter setting* procedure must be performed by a system specialist.

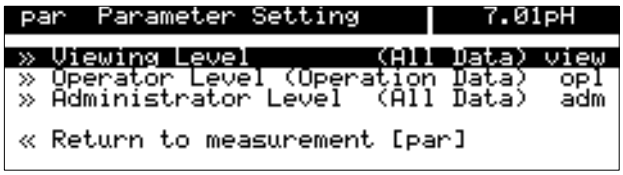
What you can do on the Administrator level

On the Administrator level you can edit all instrument settings including the passcodes. In addition, the marker function allows to lock individual menu items to prevent access from the Operator level.

As delivered, all menu items are enabled.

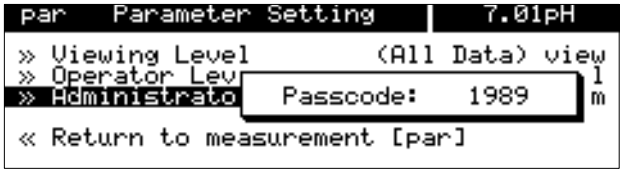
Access to the Administrator level is protected by a passcode.

How to access the Administrator level



Press **par** to open the Parameter Setting menu.

Pressing **meas** exits the Parameter Setting menu.



Select ”Administrator Level (All Data)” using ▼ and **enter**.

Enter the **administrator passcode** using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Pressing **par** returns you to the Parameter Setting menu.

Marker Setting

On the Administrator level, marker setting is explained by an information text.

What you can do with marker setting

Marker setting allows you to enable or lock each menu item on the highest level of the Parameter Setting menu (except ”Passcode Entry”) for the Operator level:

● This menu item has been enabled on the Administrator level: It can be edited on the Operator level.

○ This menu item is locked: It *cannot* be edited on the Operator level. However, it can be read out on the Viewing level.

As delivered, all menu items are enabled.

How to set a marker

Press ◀ to select the marker.
Press ▼ or ▲ to enable (●) or lock (○) the menu item.
Confirm the setting with **enter**.

How to select a menu item

Press **scrolling key** ▲ or ▼ to select a display line. The selected line is marked by a dark bar (reverse video).

The arrows ”↑” and ”↓” indicate that more lines can be accessed by scrolling.

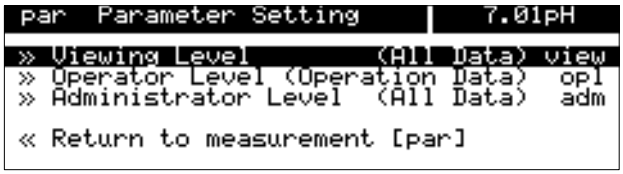
The symbols ≪ and ≫ at the beginning of the display line indicate that you can access another menu level by pressing cursor key ◀ or ▶:

≫ Pressing ▶ or **enter** accesses the next (lower) menu level.

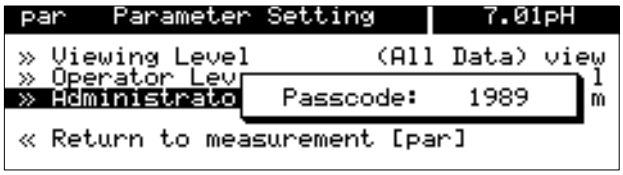
≪ Pressing ◀ or **par** accesses the previous (higher) menu level.

An Example

You want to change the settings for the input filter.



Press **par** to open the Parameter Setting menu.



Press ▼ and **enter** to select ”Administrator Level”.

Enter the **administrator passcode** using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Press **enter** to confirm the information text.

Press ▼ to select menu item ”Input Filter”.

≫ Press ▶ or **enter** to access the next (lower) menu level.

To activate the input filter, press ◀ to select ”Pulse Suppression On” and confirm with **enter**.

How to keep the old setting

Pressing **par** instead of **enter** restores the old setting (”undo” function).

≪ Pressing ◀ or **par** returns you to the previous (higher) menu level.

Pressing **meas** exits the Parameter Setting menu.

Passcode Protection

Access to the Calibration menu, Maintenance menu, Parameter Setting on Operator level and Administrator level can be protected by passcodes.
You can set or disable each passcode individually. (Administrator passcode cannot be disabled.)

When a passcode is disabled, there is no protection against unauthorized access to the corresponding menu!

The factory set passcodes are the same for all instruments.
Therefore, you should define your own passcodes.

How to set the passcodes

Select ”Administrator Level” using ▼ and **enter**.

Enter the **administrator passcode** using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Select ”Passcode Entry” using ▼ and **enter**.

Select ”cal”, ”maint” or ”opl” using ▼.

You can individually enable or disable the calibration passcode, maintenance passcode and operator passcode.

Only if a passcode is enabled, the line ”Change passcode” is displayed.
The passcode remains stored even if it has been disabled.

Edit the passcodes using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

How to keep the old passcode

Pressing **par** instead of **enter** restores the old passcode (”undo” function).

How to set the administrator passcode

If you have lost the administrator passcode, system access is locked! The Administrator level cannot be accessed for parameter setting. All menu items locked for the Operator level (○) cannot be edited any more.

Contact in this case:
Mettler Toledo GmbH
Hotline
Im Hackacker 15
CH–8902 Urdorf
Switzerland
Phone: +41–1–736 22 14
Fax: +41–1–736 26 36

Press ▼ and **enter** to select ”adm”.

Edit the administrator passcode using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

For reasons of safety you have to enter the administrator passcode for a second time.

If the second entry does not correspond to the first entry or if you abort by pressing **par***, the administrator passcode will not be changed.*

If you set the administrator passcode to ”0000”, Administrator level can be accessed without passcode entry, by pressing **enter** at the passcode prompt.

If you set the administrator passcode to ”0000”, menus and instrument settings will not be protected against unauthorized access!
Unauthorized change of parameter settings can lead to instrument malfunction and wrong measured value outputs!

Factory Set Passcodes

The pH Transmitter is shipped with the following passcode settings:

Calibration Passcode:	1 1 4 7
Maintenance Passcode:	2 9 5 8
Operator Passcode:	1 2 4 6
Administrator Passcode:	1 9 8 9

9 Capabilities of the pH Transmitter 2500

Installation of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual and per applicable local and national codes.
Before first start-up, a *complete parameter setting* procedure must be performed by a system specialist.

Overview

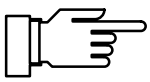
The pH Transmitter 2500 provides a great variety of features and capabilities.
This chapter describes:

- the instrument's measurement capabilities
- how to connect the instrument
- how to set the parameters

Power Supply for the pH Transmitter 2500

Read chapter 10 "Information on Installation" before connecting the power supply!
Check if your mains voltage corresponds to the ratings given on the instrument's rating plate:

- 230 Vac
- 115 Vac (option 363)
- 24 Vac/dc (option 298)



For approx. 10 s after connection of power supply, the current outputs and contacts are frozen at the levels before power supply failure. This ensures that no invalid messages are activated after power-on.

Simple pH Measurement

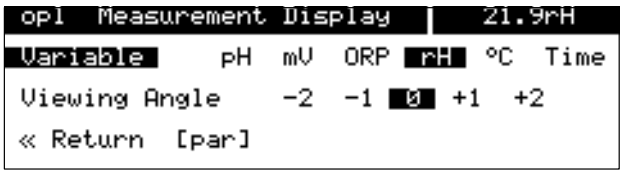
Fig. 9–1, page 9–3 shows how the pH Transmitter 2500 is configured for simple pH measurement with glass electrode impedance monitoring, automatic temperature detection and pH signal evaluation by a connected recorder.

Measurement Display

During parameter setting, you can define which of the values measured will be read out on the large display. The following variables can be displayed:

- pH value
- mV value
- ORP value
- rH value
- measured temperature (°C)
- time

How to set the measurement display parameters



Open the Parameter Setting menu (adm or opl level resp.), select ”Measurement Display” and confirm with **enter**.

Select the process variable you want to have displayed during measuring mode using ◀ and ▶ and confirm your choice with **enter**.
The corresponding measured value will be read in the upper right corner of the display.

With ”Variable pH” selected, you can select ”Display Format” to define if the pH value will be displayed with one (xx.x) or two (xx.xx) digits behind the decimal point.

The menu item ”Viewing Angle” allows you to adjust the viewing angle of the display.
When the pH Transmitter is mounted at a very high or very low position, you can adjust the viewing angle for optimum display readability.
Select the desired viewing angle using ◀ and ▶ (+ means viewing angle upwards and – means viewing angle downwards) and confirm your choice with **enter**.
The angle is changed immediately.

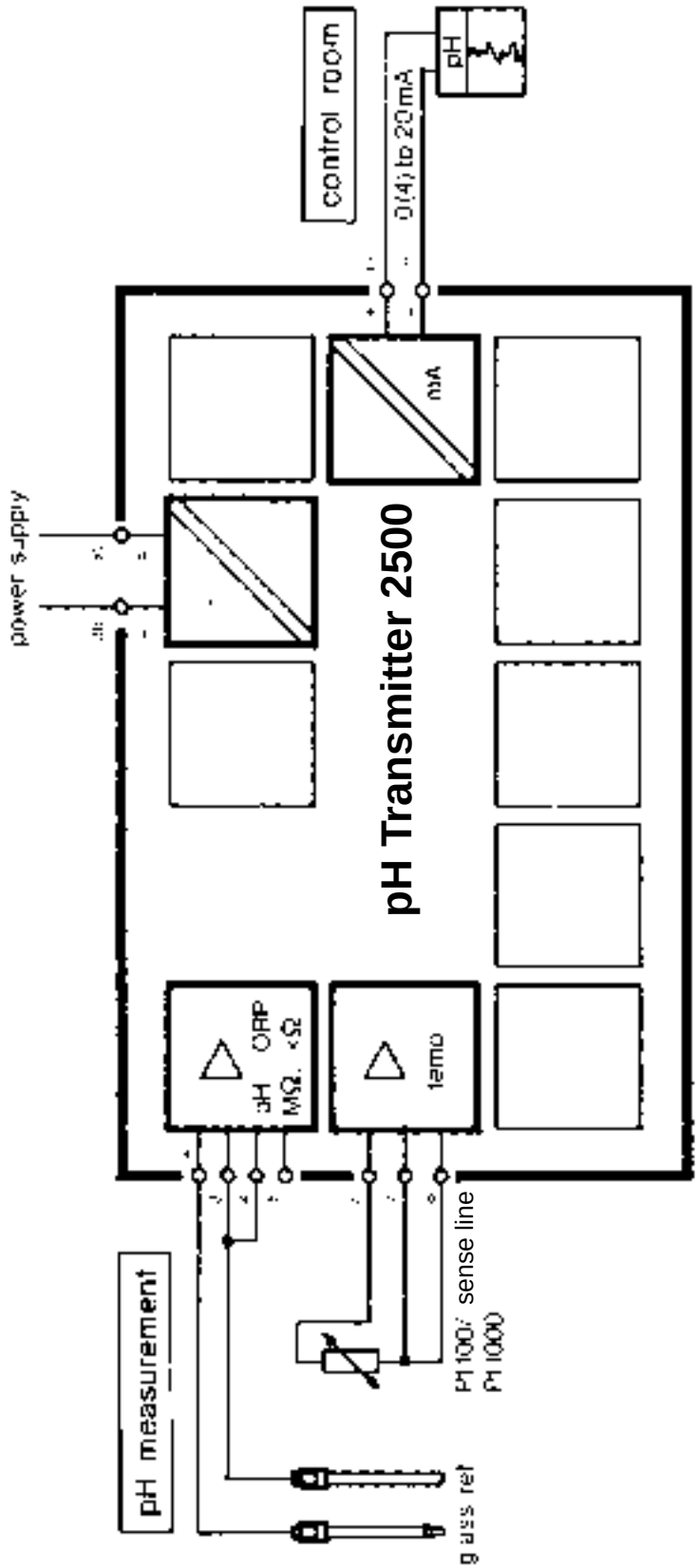


Fig. 9–1 pH Measurement with recorder evaluation

pH Measurement

Fig. 9–2 shows how to connect a combination electrode to the pH Transmitter 2500. If the outer shield of the electrode cable is grounded, it must be connected to terminal 5, if it is not grounded, it must be connected to the electrode shield (terminal 0).
Terminals 3 and 4 must be jumpered!

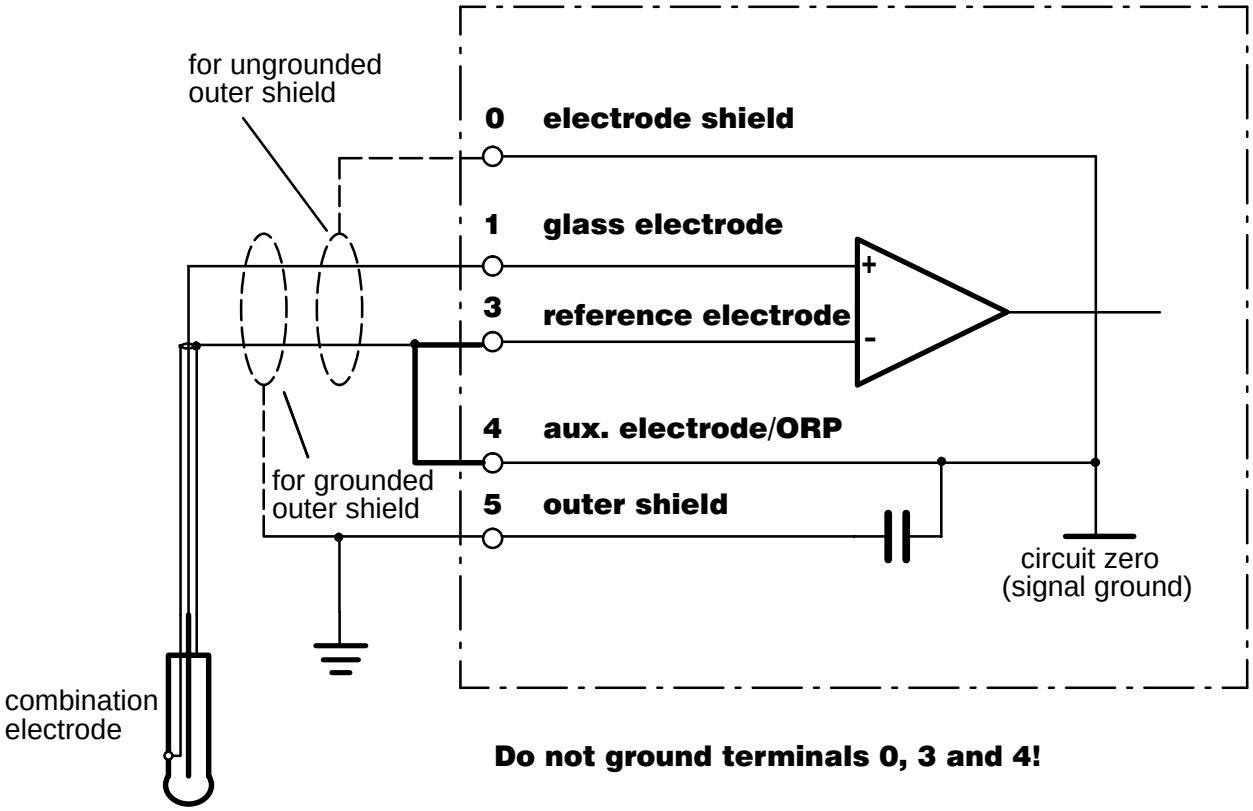


Fig. 9–2 Connection of pH input for simple pH measurement with glass electrode impedance monitoring

For detailed information on Sensocheck® electrode monitoring, refer to page 9–14.

If you operate an instrument with option 298 at a grounded 24 Vac power supply and the process medium is also grounded, compensating currents (via internal EMC wiring) can lead to measurement errors.

Therefore, connect terminal 4 with the process medium (conductive tank wall) as shown in Fig. 9–3. *Do not jumper terminals 3 and 4!*

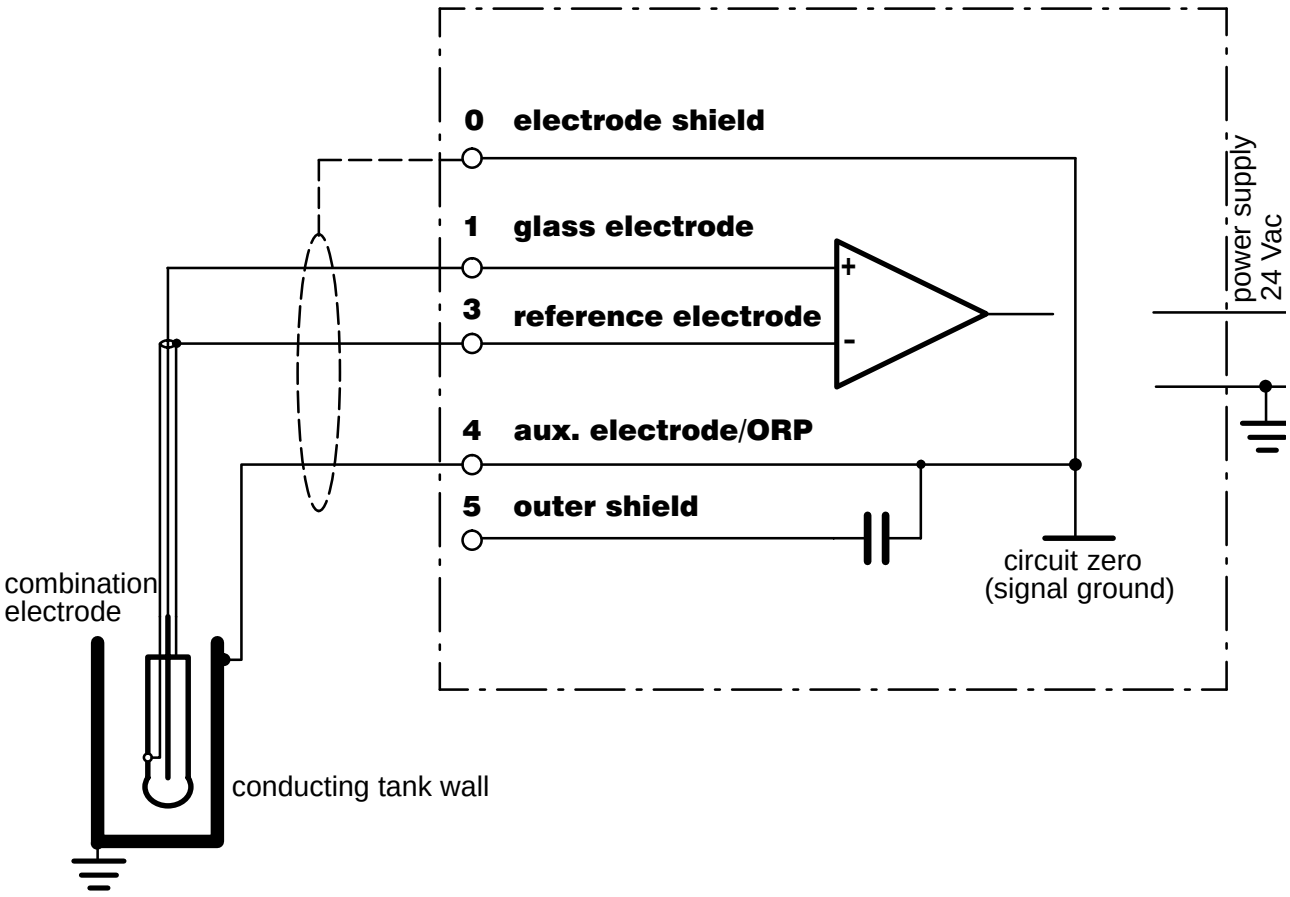


Fig. 9–3 Connection of pH input for instruments with Option 298 at grounded 24 Vac power supply with grounded process medium

Input Filter

For pH measurement with increased immunity to interference, you can activate an input filter. When the filter is activated, momentary interference pulses will be suppressed, and slow changes in the measured value will be detected.

If you want to measure fast changes in the measured value, you must turn off the input filter.

How to set the input filter parameters

Open the Parameter Setting menu (adm or opl level resp.), press ▼ to select ”Input Filter”, and confirm with **enter**.

To activate the filter, press ◄ to select ”Pulse Suppression On” and confirm with **enter**.

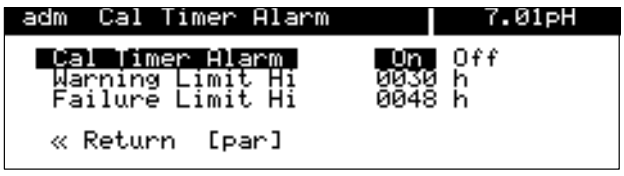
Cal Timer

The cal timer allows you to monitor if the electrode is regularly calibrated.
The cal timer counts the time passed since the last calibration. When the preset time is reached, a message will be activated.
In the menu ”Alarm Settings” you can preset one interval each for a warning and a failure message.

The cal timer count can be read out on the secondary display (see page 2–1).

How to set the cal timer

Open the Parameter Setting menu (adm or opl level resp.), select ”Alarm Settings” using ▼, and confirm with **enter**.



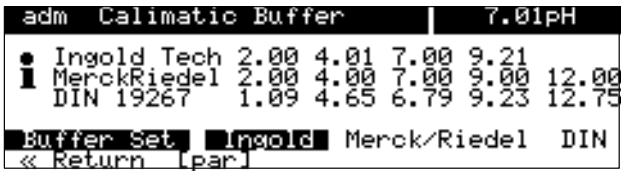
Select ”Cal Timer Alarm” using ▼ and confirm with **enter**.

You can enable or disable alarm and set an interval for a warning and a failure message each.

Calimatic® Buffer Set

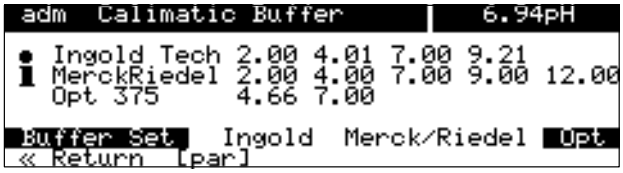
For automatic calibration via Calimatic®, you must define the buffer set you want to use. For calibration, you must then use buffer solutions from this buffer set, the sequence being irrelevant.

How to define the Calimatic® buffer set



Open the Parameter Setting menu (adm or opl level, resp.), select ”Calimatic Buffer” using ▼, and confirm with **enter** .

Select the buffer set using ◄ and ► and confirm your choice with **enter**.
The nominal buffer values will be displayed.



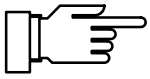
If your pH Transmitter is equipped with one of the options 370 to 379 ”Buffer set to customer requirements”, you can select your optional buffer set *instead of the DIN buffer set*.

For buffer charts, refer to chapter 15.

How to use electrodes with zero point other than pH 7

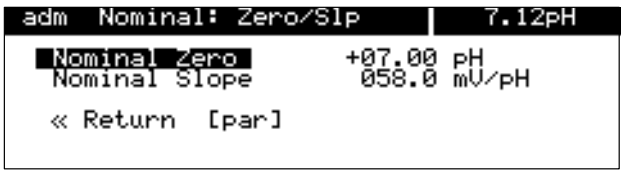
The Option 356 (integrated as standard in all instruments) allows to define the nominal zero and slope of the electrode if you use electrodes with a zero point other than pH 7.

Here, automatic calibration via Calimatic® can also be performed for electrodes with a zero point at pH = 4.6, for example.



Calibration is valid if
electrode zero deviates by < ±1 pH units
and slope by < ± 5.5 mV/pH
from the nominal value.

How to set nominal zero and slope



Open the Parameter Setting menu, select ”Nominal: Zero/Slp” using ▼, and confirm with **enter**.

Enter the values for nominal zero and slope of the electrode using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

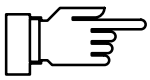
Temperature Detection

Why Temperature Compensation?

There are two important reasons for determining the temperature of process or buffer solution, resp.:

The slope of the pH electrode is temperature dependent. Therefore the measured voltage must be corrected for the temperature influence (Nernst equation).

The pH value of the buffer solution is temperature dependent. For calibration, the buffer solution temperature must therefore be known in order to choose the actual pH value from the buffer chart.



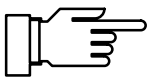
During parameter setting you define if process and/or calibration temperature are automatically measured or must be entered manually.

Automatic Temperature Compensation

For automatic temperature compensation, the pH Transmitter 2500 detects the process temperature using a Pt 100/Pt 1000 temperature probe.

For automatic temperature compensation, there *must* be a temperature probe in the process medium. This probe must be connected to the Pt 100/ Pt 1000 input of the pH Transmitter 2500!
If no temperature probe is connected, you must select manual entry of measuring temperature.

Fig. 9–1 shows how to connect the temperature probe to the pH Transmitter 2500 in **3-wire configuration**. 3-wire configuration of the Pt 100/ Pt 1000 temperature probe eliminates the temperature measurement error caused by the lead resistance.
The leads to terminals 6 and 7 must have equal cross sections.



For 2-wire configuration, connect the Pt 100/ Pt 1000 to terminals 6 and 7. *Terminals 7 and 8 must be jumpered.*

How to define measuring temperature detection

Open the Parameter Setting menu, select ”Temp Detection” using ▼, and confirm with **enter**.
Select the temperature probe you are using and confirm with **enter**.
Press ▼ to select ”Measuring Temp”.
Select ”Measuring Temp Auto” or ”Measuring Temp Manual” using ◄ and ► and confirm with **enter**.

Manual Temperature Compensation

Manual temperature compensation only makes sense if the process is running at a constant temperature!
With ”Measuring Temp Manual” selected, ”MAN.TEMP” will be read in the lower right corner of the display in measuring mode. The reading ”MAN.TEMP” will *not* appear if the measuring temperature is read on the measurement display. You can read out the manually defined temperature on the secondary display (see page 2–1).

With ”Measuring Temp Manual” selected, automatic temperature measurement continues, and display, limit values and alarm messages are controlled by the measured value.

You must enter the process temperature:

Measure the temperature of the process medium using a glass thermometer, for example,
or
make sure that the temperature of the process medium is at a constant level, e.g. using a thermostat.

Enter the measured temperature using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

How to define calibration temperature detection

Manual compensation of calibration temperature makes sense if the temperature probe remains in the process medium during calibration.

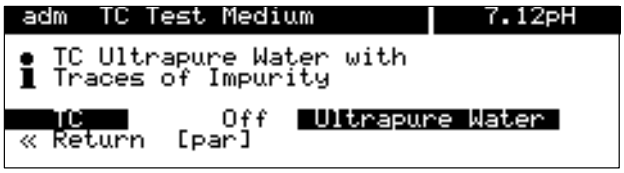
Select ”Cal Temp” using ▼.

Select ”Cal Temp Auto” or ”Cal Temp Manual” using ◀ and ▶ and confirm with **enter**.

For manual entry of calibration temperature, refer to page 3–6.

Temperature Compensation for Ultrapure Water with Traces of Impurity

If your process solution is ”ultrapure water with traces of impurity”, you can calculate the pH value accordingly, depending on temperature.



Open the Parameter Setting menu (opl or adm level, resp.) and select ”TC Test Medium” using ▼.
Press ▶ to select ”TC Ultrapure Water” and confirm with **enter**.

Correction is done according to the following equation:

$$pH(25°C) = pH(T) + Corr(T)$$

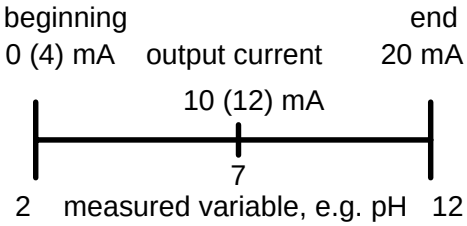
pH(25°C)	pH value corrected for 25°C
pH(T)	pH value measured at T[°C]
Corr(T)	correction value [pH] from chart

The correction chart stored in the pH Transmitter 2500 was calculated for completely dissociated electrolytes (strong acids and bases) and for the weakly dissociating electrolyte ammonia. This is of special interest for power plant applications, where ammonia is the main substance for pH determination.

Current Output

The current output provides an impressed standard current of 0 to 20 mA or 4 to 20 mA. The output current can be read out on a secondary display (see page 2–1).
You can assign the output current to any of the following variables:

- pH value
- measured mV value
- ORP value
- rH value
- measured temperature (°C)



To determine the span corresponding to current range 0 (4) to 20 mA, set an initial and an end value for the measured variable.

For permissible spans, refer to Specifications, chapter 14.

If the initial value is lower than the end value, a rising output curve will result.
To define a *falling output curve,* set the higher value as initial value and the lower value as end value.

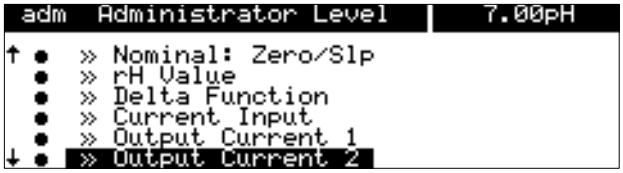
Output current will be frozen at its last value:

- during calibration
- during current source function (manual entry)
- in maint menu “Meas. Point Maint.”
- after the corresponding interface command

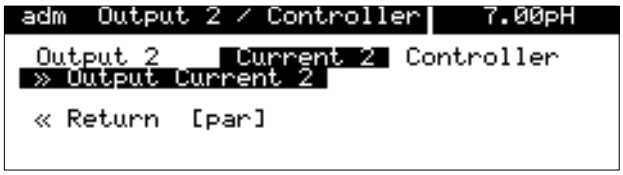
2nd Current Output

If your pH Transmitter is equipped with option 350, you can simultaneously output a second process variable via the second current output (Fig. 9–4, page 9–13).
If the instrument does not provide a 2nd current output, the Parameter Setting menu reads ”Output Current 2 (Optional)”.

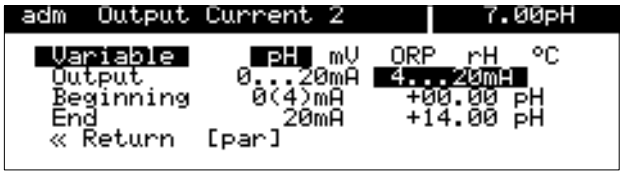
How to set the current output



Select the menu item “Output Current 2” with ▼ in the Parameter Setting menu and confirm with **enter** .



If the pH Transmitter 2500 is also equipped with option 483 (analog controller), the intermediate menu “Output 2 / Controller” appears instead of “Output Current 2”. In this case, select “Current 2” with ◀ , confirm the selection with **enter** and open the Parameter Setting menu “Output Current 2” with **enter** .
To set as a controller, see Pg. 9–27.



Press ◀ or ▶ to select the process variable to which you want to assign the output current and confirm with **enter**.

Press ▼ to select ”Output”.
Press ◀ or ▶ to set the current output to 0 to 20 mA or 4 to 20 mA (live zero) and confirm with **enter**.

Press ▼ to select ”Beginning”.
Enter the initial value for the process variable (corresponding to 0/4 mA) using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Press ▼ to select ”End”.
Enter the end value for the process variable (corresponding to 20 mA) and confirm your entry with **enter**.

Complete Installation using all Functions

Fig. 9–4, page 9–13 shows how to connect the pH Transmitter 2500 if you want to make use of all measurement and control capabilities.

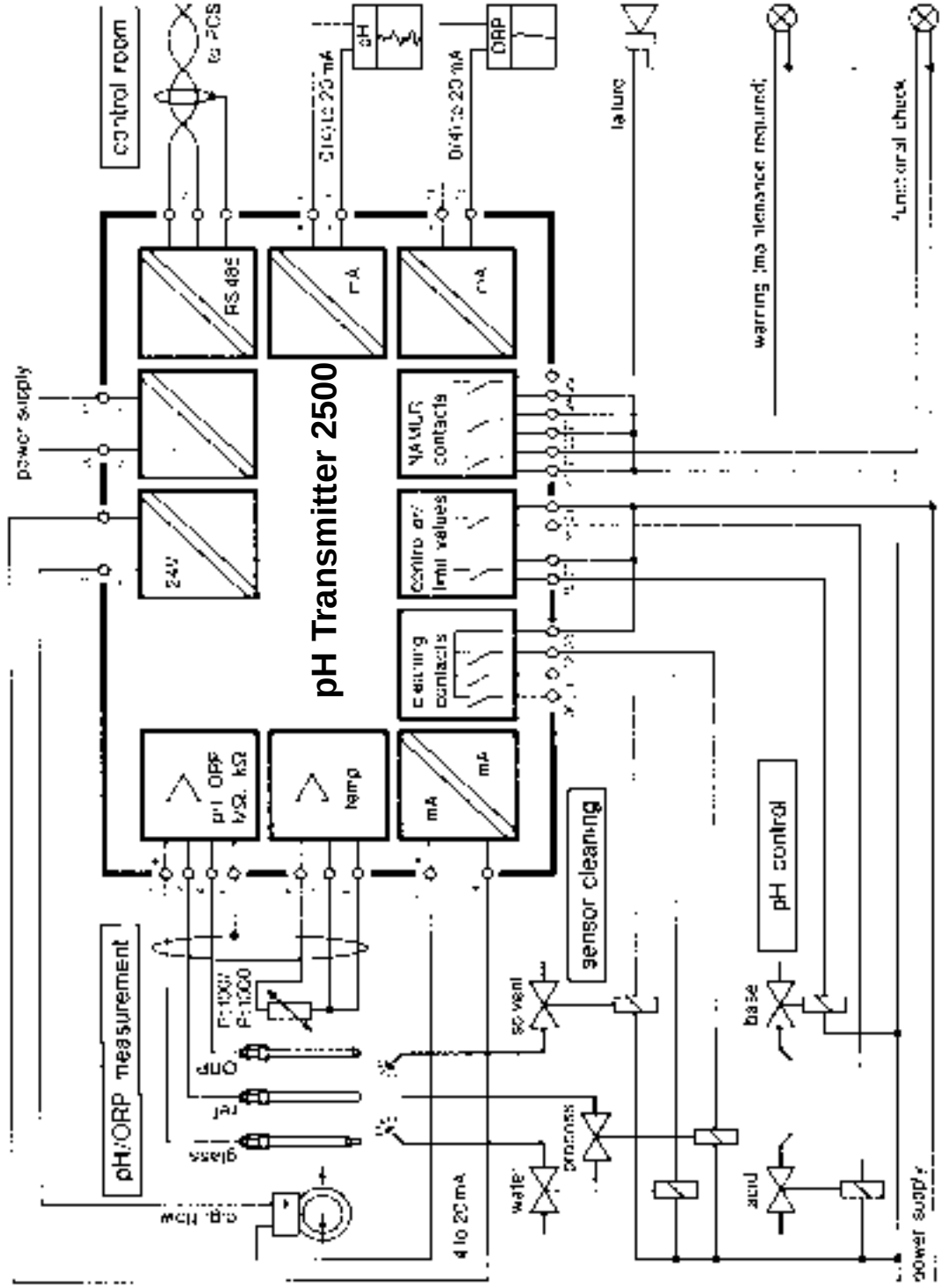


Fig. 9–4 pH and ORP Measurement with Flow Monitoring, Control, Sensor Cleaning, Computer Connection, Recorder Evaluation of pH and ORP, and Monitoring via NAMUR Contacts

Sensocheck® Electrode Monitoring

Sensocheck® electrode monitoring measures the impedances of glass and reference electrodes. This measurement is taken continuously together with pH measurement.

The electrode impedances are a good indicator for electrode status, contamination (of reference electrode), glass breakage (of glass electrode), aging and open circuit conditions.

How to make use of Sensocheck®

If you only want to monitor the glass electrode impedance, you can connect the electrode as shown in Fig. 9–2, page 9–4. This allows you to perform a simple breakage monitoring.
To measure the reference electrode impedance, you require an auxiliary electrode. Refer to Fig. 9–5 for wiring. This allows you to monitor the reference electrode for contamination.
Instead of using an auxiliary electrode, you can also connect terminal 4 to the process medium tank if it is metallically conductive. The tank may be grounded.

The absolute electrode impedance values depend strongly on manufacturer and type.
Therefore you must take a new electrode to determine the setpoints for the electrode in use.
To do so, you can read out the values for glass and reference electrode impedance on the secondary display (see page 2–1) or take them from the data listed in the calibration record (see page 4–3).
During parameter setting of ”Alarm Settings” you set the limits for warning and failure messages. If the value for glass or reference electrode impedance exceeds such a preset limit, a warning or failure message, respectively, will be activated.

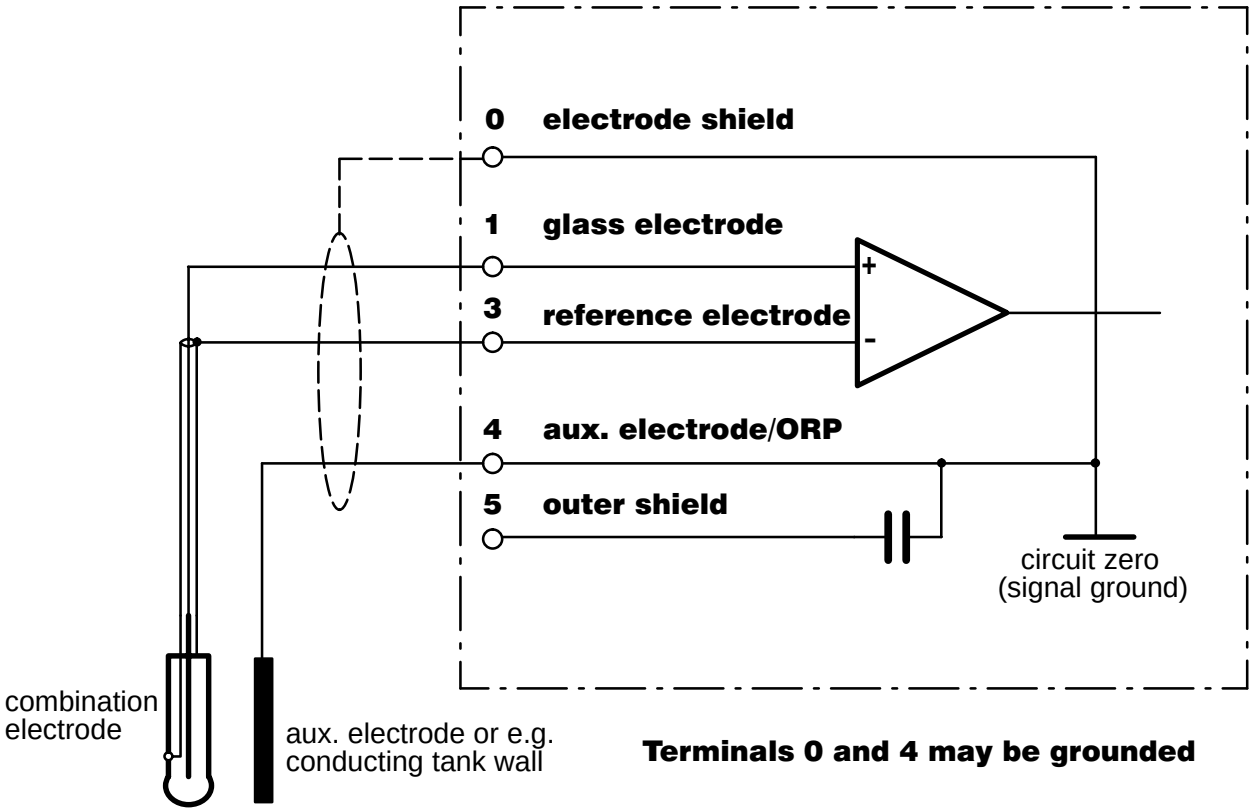
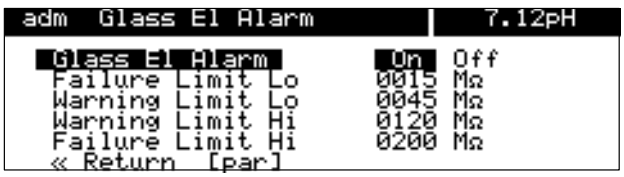


Fig. 9–5 Connection of pH input for impedance measurement of glass and reference electrode

Higher value for glass electrode impedance exceeded: Glass or cable broken or electrode dry.
Higher value for reference electrode impedance exceeded: Reference electrode contaminated.
Lower value for reference electrode impedance exceeded: Short circuit.

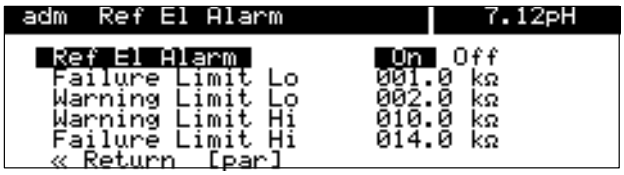
Glass electrode and reference electrode impedance can be read out on the secondary display (see page 2–1).

How to set the Sensocheck® parameters



Open the Parameter Setting menu (adm or opl, resp.), select ”Alarm Settings” using ▼, and confirm with **enter**.
Select ”Glass El Alarm” using ▼ and confirm with **enter**.

Set ”Glass El Alarm On”.
Enter the values for warning message (Warning Limit Lo and Hi) and failure message (Failure Limit Lo and Hi) using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



Press **par** to return to the previous menu, select submenu ”Ref El Alarm” and confirm with **enter**.

Set ”Ref El Alarm On”.
Enter the values for warning message (Warning Limit Lo and Hi) and failure message (Failure Limit Lo and Hi) using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.

Information on Impedance Measurement

To assure correct monitoring of the glass electrode impedance, you must connect the electrode using suitable leads with sufficiently low lead capacitance.

When using a pH isolation amplifier, electrode monitoring is not possible!

The electrode impedances are measured dynamically at a low alternating voltage. The resulting values for the glass electrode are approx. 0.8 times as high as with static measurement to IEC 746-2.

The electrode lead capacitance has no influence as long as it does not exceed 2 nF (corresponding to approx. 20 m lead length). Since the low-resistance reference electrode impedance can only be detected via the measured electrolyte, the electrolyte conductivity influences the total impedance measured. Here, the resulting impedance values can be considerably higher than with measurement to IEC 746-2.
If you use a reference electrode with very low resistance (< 100 Ω), you can connect a 100 Ω resistor in series so that the range for the pH Transmitter 2500 will not be exceeded.

The impedances are continuously evaluated according to a mean value calculated after several measurements. If the alarm window (defined by a minimum and a maximum value) is exceeded, a warning or failure message will be activated. Since the electrode impedances – especially glass membrane impedance – are temperature dependent, they are calculated for a reference temperature of 25 °C. This allows you to read out and evaluate comparable impedance values even with strongly varying measuring temperatures. It also makes it easier to define appropriate ranges for electrode monitoring.

ORP Measurement

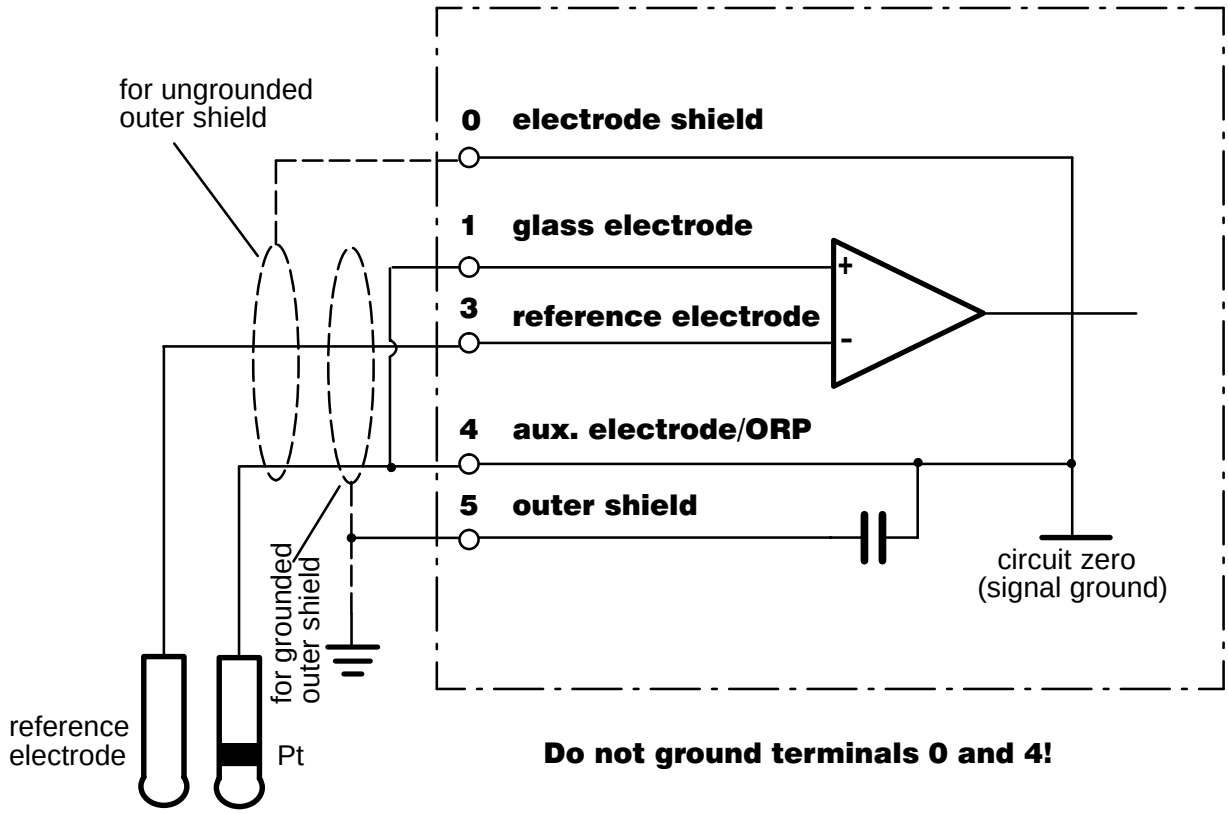


Fig. 9–6 Connection of pH Transmitter 2500 for ORP measurement

When measuring oxidation-reduction potential (ORP), an indication must be made as to which electrode was used as reference and whether the result has been converted to the standard hydrogen electrode.

Specification of ORP is completed by indicating the sensing electrode in use (e.g. ”platinum”), measuring temperature and pH value.

Differential voltages of reference electrodes compared to standard hydrogen electrode (±5 mV, at 25 °C):

Reference Electrode		Differential Voltage
Ag/AgCl	KCl 1 molar	+236 mV
Ag/AgCl	KCl 3 molar	+207 mV
Ag/AgCl	KCl 3.5 molar	+200 mV
Ag/AgCl	KCl saturated	+197 mV
Argenthal	KCl 3 molar	+207 mV
Hg/Hg_2Cl_2	KCl 3.5 molar	+252 mV (Calomel)
Hg/Hg_2Cl_2	KCl saturated	+244 mV (Calomel)
Thalamid	KCl 3.5 molar	**-571** mV

Simultaneous pH and ORP Measurement

If you use a platinum electrode as auxiliary electrode, you can *simultaneously* measure pH and ORP.
If your pH Transmitter 2500 is equipped with a 2nd current output (option 350), you can also simultaneously output pH and ORP.

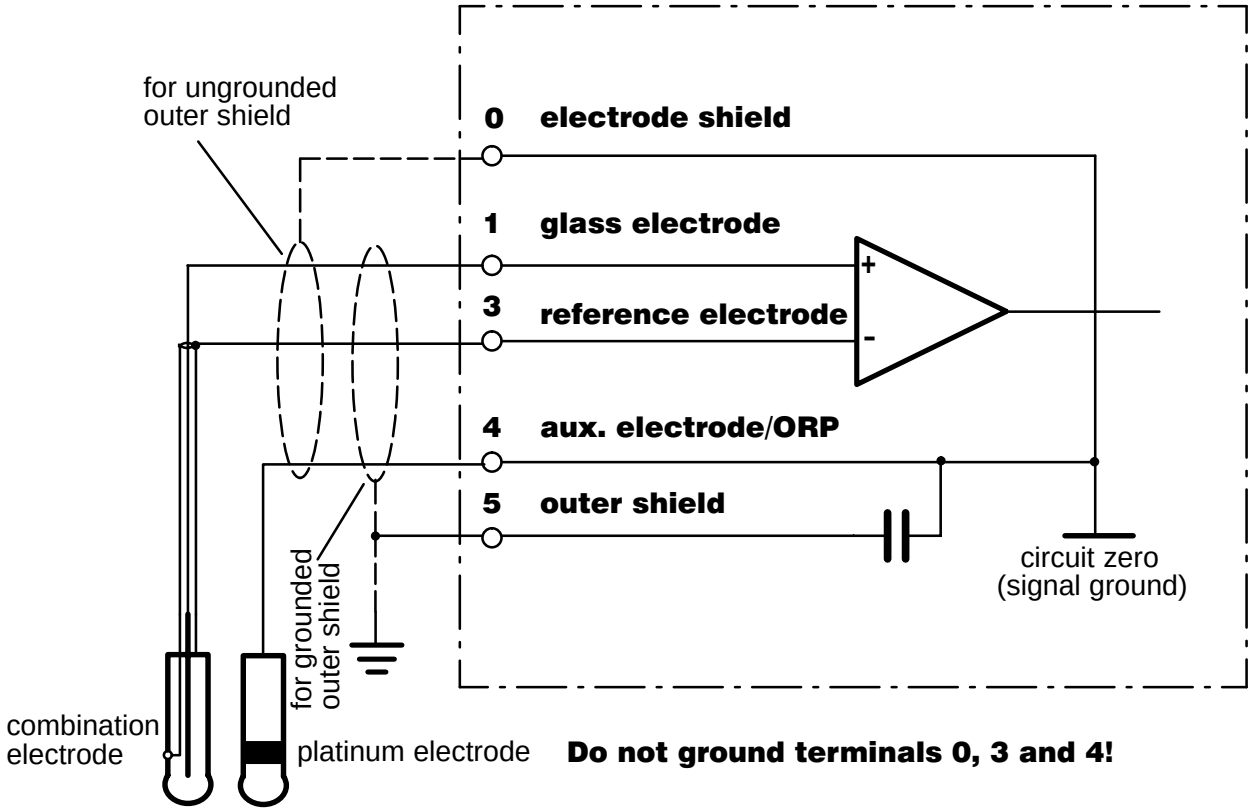


Fig. 9–7 Connection of pH input for glass and reference electrode impedance measurement with simultaneous ORP measurement

rH Measurement

The pH Transmitter 2500 calculates the rH value from two separately measured values (pH and ORP).
Direct calibration of rH measurement is not possible, but the pH electrode can be calibrated separately.
You can use a combination electrode for pH measurement. The additionally required metal (platinum) electrode is connected to terminal 4 (auxiliary electrode). It also serves as auxiliary electrode for impedance measurement to permit electrode monitoring (see Fig. 9–7).

Do not make further connections to terminal 4!

The electrode is calibrated using ordinary pH buffer solutions, since the additional platinum electrode can be regarded as practically calibration-free.

After pH calibration, pH and rH value can be checked using rH buffer solutions.

In the Parameter Setting menu you can choose between different reference electrodes whose temperature dependent reference potentials E_{ref} against standard hydrogen electrode (SHE) are listed in the pH Transmitter 2500:

Silver Chloride	Ag/AgCl, KCl 1M
Silver Chloride	Ag/AgCl, KCl 3M
Thalamid	Hg,Tl/TlCl, KCl 3.5M
Mercury Sulfate	Hg/Hg_2SO_4, K_2SO_4 saturated

Theory of rH Measurement

Reduction-**ox**idation (redox) behavior of substances in an aqueous solution is correctly described by specifying the potential E_H across a chemically indifferent metallic electrode and the standard hydrogen electrode (SHE), as well as the measuring temperature.
Since in most cases ORP measurement is pH dependent, you must also indicate the pH value.

The sensing electrode is a chemically nonreactive, electron-sensitive electrode consisting of a noble metal, such as platinum.

E_H = ORP + E_{ref}

The SHE is usually not employed as reference electrode, but an electrode that is easier to handle, such as an Ag/AgCl electrode. Its temperature-dependent potential E_{ref} related to SHE must be known. It must be added to the measured potential.

Another measure for redox behavior is the **rH value**.
It is calculated from the so-called pe value which describes redox behavior and the pH value.
The pe value is a theoretical auxiliary value calculated by multiplication of E_H and $1/E_N$ (reciprocal of Nernst potential).

The rH value is defined as follows:

$rH = (pe+pH) * 2$ or $rH = (E_H/E_N + pH) * 2$

The pH Transmitter 2500 processes this equation in the following way:

$rH = (((ORP + E_{ref}) / E_N) + pH) * 2 *$ factor.

with

ORP:	potential measured across platinum and reference electrode
E_{ref} :	listed, temperature-dependent potential of reference electrode against SHE (user defined)
E_N:	Nernst potential (temperature dependent)
pH:	currently measured pH value
”2”:	theoretical factor for rH value
factor:	additional, empirical factor (user defined, standard: 1)

Thus, two potentials across three electrodes are required for rH measurement:
Glass electrode against reference electrode (pH electrode) and platinum electrode against reference electrode (ORP electrode).
ORP and pH are combined to form the rH value to obtain a pH-independent measure for redox behavior. However, this is only valid if the following conditions apply, among others:

Protons play a decisive role in the reaction.

Preferably exactly one mole of protons is transformed.

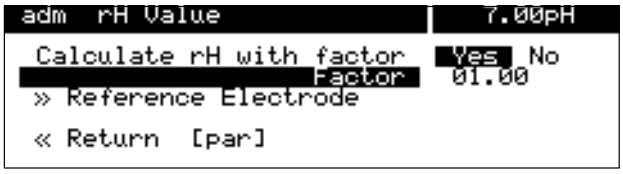
The range for pH variation is as low as possible.

The rH value can also be measured ”directly” by measuring the potential across a platinum and a glass electrode of a so-called rH electrode. However, from this value you can neither calculate the pH nor the ORP value. Therefore, automatic calculation of rH as provided by the pH Transmitter 2500 should be preferred.

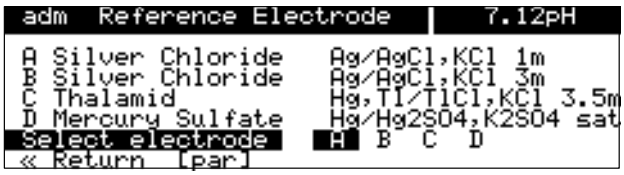
The factor ”2” in the equation for determining the rH value results from the fact that an H_2 molecule dissociates into two protons.
The equation also includes a user defined additional factor for some special empirical measurement procedures used in the chemical production industry.

The equation for determining the theoretical rH value only applies if you have set ”Calculate rH with factor No” or if you have set the factor to 1 during parameter setting.

How to set the rH measurement parameters



Open the Parameter Setting menu (opl or adm level, resp.), select ”rH Value” using ▼, and confirm with **enter**.
If you want to calculate the rH value with additional factor, select ”Calculate rH with factor Yes”. Enter the factor using scrolling and cursor keys (see page 2–6) and confirm your entry with **enter**.



Press ▼ to select ”Reference Electrode” and confirm with **enter**.
Select the applied reference electrode using ◄ and ► and confirm with **enter**.

Alarm Settings and NAMUR Contacts

Alarm Settings

You can define **alarm limits** for each of the following process variables:

pH value

measured mV value

rH value

ORP value

measured temperature

cal timer

electrode zero

electrode slope

glass electrode impedance

reference electrode impedance

input current at current input
(only when used as signal input)

feeding time (controller output: ±100 %)
(only with controller enabled)

You can define four independent alarm limits for each of these variables (except cal timer and feeding time):

Failure Limit Lo
If the measured value *falls below* this limit, NAMUR contact ”Failure” will be activated, the display will read ”FAIL”.

Warning Limit Lo
If the measured value *falls below* this limit, NAMUR contact ”Warning” will be activated, the display will read ”WARN”.

Warning Limit Hi
If the measured value *exceeds* this limit, NAMUR contact ”Warning” will be activated, the display will read ”WARN”.

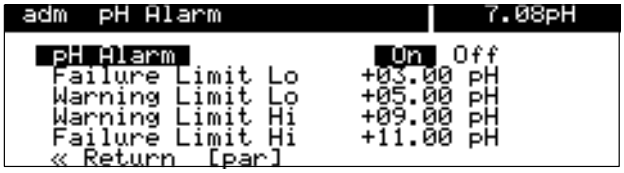
Failure Limit Hi
If the measured value *exceeds* this limit, NAMUR contact ”Failure” will be activated, the display will read ”FAIL”.

The activated alarm messages can be read in the Diagnostics menu ”Message List” (see page 4–2).

Furthermore, you can enable or disable the alarm messages for each process variable. The alarm limits remain stored even if the message is disabled.

To define alarm messages for temperature, you must set ”Measuring Temp Auto” (see page 9–9) and enable alarm.

Example: Settings for pH Alarm

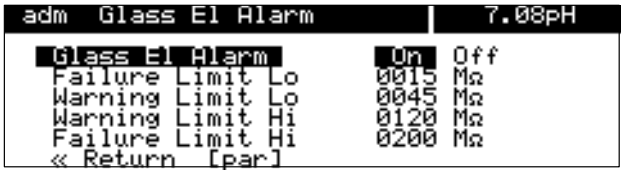


Meas Value [pH]		Message
≤	3.00	Fail Lo pH value and Warn Lo pH value
	3.01 – 5.00	Warn Lo pH value
	5.01 – 8.99	
	9.00 – 10.99	Warn Hi pH value
≥	11.00	Fail Hi pH value and Warn Hi pH value

How to set the alarm parameters

Open the Parameter Setting menu (opl or adm level), select ”Alarm Settings” using ▼, and confirm with **enter**.

On this menu level, you can see which alarms are enabled.



Press ▼ to select the alarm you want to set (e.g. ”Glass El Alarm”) and confirm with **enter**.

Enter the warning and failure limits using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

Press **par** to return to menu level ”Alarm Settings”. Repeat the procedure for setting further alarms.

NAMUR Contacts

The three NAMUR contacts functional check, warning (maintenance required) and failure are provided as standard.

Functional check is activated:
during calibration (**cal**),
during maintenance (**maint**): current source, probe maintenance,
during parameter setting (**par**) on the Operator level (opl) and the Administrator level (adm), and
during a rinsing cycle.

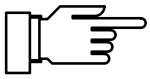
Warning (maintenance required) is activated if a value has exceeded (or fallen below, resp.) a preset ”Warning Limit Hi” or ”Warning Limit Lo”, or if other warning messages have been activated.
That means that the measuring installation is still functioning properly but should be maintained, or that certain process parameters have reached a value that requires intervention.
Warning is *disabled* during ”Functional Check”.

Failure is activated
if a value has exceeded (or fallen below, resp.) a preset ”Failure Limit Hi” or ”Failure Limit Lo”, if the range limits of the pH Transmitter 2500 have been exceeded, or if other failure messages have been activated.
That means that the measuring installation is *not* properly functioning any more, or that certain process parameters have reached a critical value.
Failure is *disabled* during ”Functional Check”.

You can set the three NAMUR contacts as normally open contacts (active: closed) or as normally closed contacts (active: open).

For safe operation, the NAMUR contacts must be set as *normally closed contacts*.
Only this ensures that power failure will activate an alarm message!

You can define a **delay time** for both the warning and the failure contact. If an alarm message is released, the contact will only be activated after this preset delay time.



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

How to set the NAMUR contacts

Open the Parameter Setting menu (opl or adm level, resp.), select ”NAMUR Contacts” using ▼, and confirm with **enter**.

Press ◀ or ▶ to select ”NAMUR Contacts N/O” (normally open) or ”NAMUR Contacts N/C” (normally closed) and confirm with **enter**.

Enter failure delay time and warning delay time using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

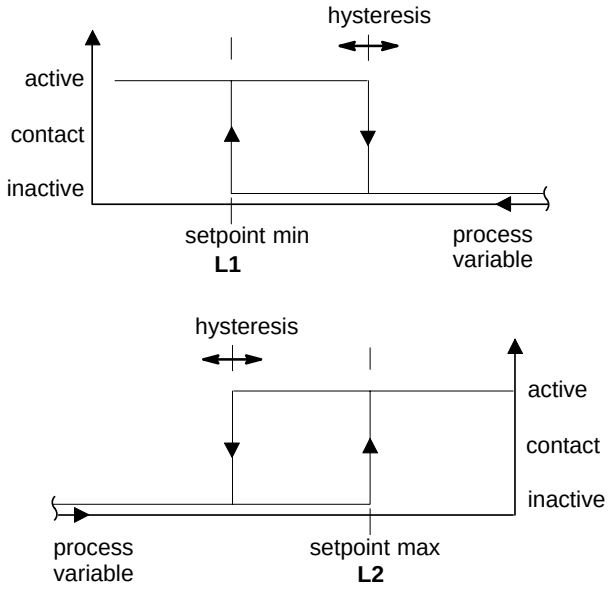
Limit Contacts

Two limit contacts are provided as standard. The limit contacts can be controlled by the following process variables:

- pH value
- measured mV value
- ORP value
- rH value
- measured temperature value (°C)
- input current at current input

Each of the two contacts can be set *separately:*

Limit Values and Hysteresis



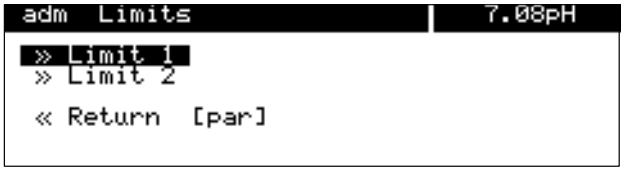
- The *process variable* controls the limit contact.
- The *direction* indicates if the contact will be activated when the measured value falls below (min) or exceeds (max) the limit value.
- *Limit values 1 and 2* (L1, L2) define the switching thresholds.
- The *hysteresis (deadband)* defines how far the measured value must exceed (min) or fall below (max) the limit value until the contact returns to its rest position.
- *Normally open* or *normally closed contact* defines if the active contact is closed (N/O) or open (N/C).

If the measured value exceeds the preset limits, ”L1” and/or ”L2” will appear in the upper right corner of the display.
Contact 1 and/or contact 2 are active.

During calibration the limit contacts are disabled!
During sample calibration, the ”L1”/”L2” display is covered by ”Sample”!
When the pH Transmitter is in remote status during interface operation, the ”L1”/”L2” display is covered by ”Remote”!

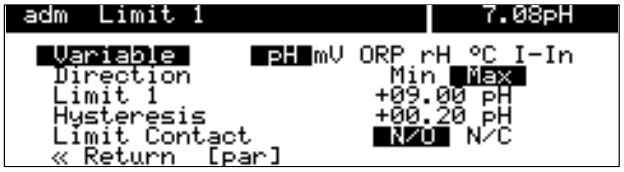
As delivered, the relay contacts are suitable for low signal currents (down to approx. 1 mA).
If currents above approx. 100 mA are switched, the gold plating is destroyed during the switching process. *After that, the contacts will not reliably switch low currents.*

How to set the limit contacts



Open the Parameter Setting menu (opl or adm level’, resp.), select ”Limits” using ▼, and confirm with **enter**.

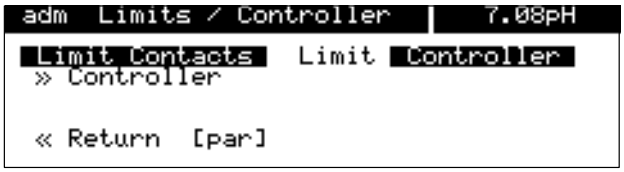
Press ▼ or ▲ to select ”Limit 1” or ”Limit 2” and confirm with **enter**.



Select the variable to be measured, direction and N/O or N/C contact, respectively using scrolling and cursor keys and confirm your choice with **enter**.
Enter limit value and hysteresis each using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

Press **par** to return to menu level ”Limits”. Repeat the procedure for the other limit value.

If your pH Transmitter is provided with a controller function (option 353), you will read the following menu.



To set the limit contacts, press ◀ to select ”Limit” and confirm with **enter**.

Controller Function

You can only make use of the controller function if your pH Transmitter is equipped with option 353 for the digital controller **or** with the options 350 and 483 for the analog controller (Output 2). Without these options only the “Limit values” menu item appears in the Parameter Setting menu, otherwise “Limit Values/Controller” or “Output Current 2”, or “Output Current 2 (optional)” instead of “Output 2 / Controller” for the analog controller.

Digital Controller

The parameters of the digital controller are set with the “Limit Values / Controller” menu item. The bidirectional PI controller enables quasi-continuous (switched) control.
Two controller types can be selected:

Type A: Pulse length controller (see Pg. 9–32)

Type B: Pulse frequency controller (see Pg. 9–32)

Analog Controller

The parameters of the analog controller are set with the “Output 2 / Controller” menu item.

Three controller types can be selected:

Type A: 3-way mixing valve (see Pg. 9–33)

Type B: Straightway valve (< setpoint) (see Pg. 9–34)

Type C: Straightway valve (> setpoint) (see Pg. 9–35)

Controlled Variables

You can define as **controlled variables**:

pH value

measured mV value

ORP value

rH value

measured temperature value (°C)

In measuring mode the present value of the controller output can be read out on the secondary display (CTL-Y [%]).

During calibration the controller output is frozen at its last value!

With the user defined **feed time alarm,** you can monitor how long the controller output is at +100 % or -100 %, that is how long the valve is fully open.
If this time is exceeded, the feed chemical might be missing or the valve might be defective.

Control Characteristic

Fig. 9–8 shows the characteristic of the controller in the pH Transmitter 2500. All points of the curve are user definable:

- *Beginning of control* and
- *end of control*
  define the control range.
  Outside the control range, the controller output is fixed at +100 % or -100 %, respectively.
- It is controlled according to the *setpoint*.
- In the *neutral zone* no control is exerted.
  The neutral zone is symmetrical to the setpoint. Its width is user definable.
- *Corner point X* and *corner point Y* are user definable corner points for the two control ranges (◀: controlled variable < setpoint and ▶: controlled variable > setpoint). This allows you to define two different slopes to obtain an optimum control characteristic for strongly nonlinear titration curves, for example.
- The *reset time* determines the I-action component of the controller. The setting ”Reset Time 0000 s”, turns the I-action component off. Reset time can be defined separately for each of the two control ranges (◀: controlled variable < setpoint and ▶: controlled variable > setpoint).

For test purposes, the controller output (manipulated variable Y) can be manually entered in the Maintenance menu (see page 5–6).

Controller Output

The method for determining the controller output (manipulated variable) is the same for the digital and the analog controller. However, the output of the manipulated variable at the limit value contacts or at Output 2 differs as follows:

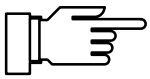
Digital Controller

The manipulated variable is output via the two limit contacts 1 and 2.

Limit contact 1
operates in the controller output range
0 to +100 %
Controlled variable < setpoint

Limit contact 2
operates in the controller output range
0 to -100 %
Controlled variable > setpoint

The contacts can be used, for example, to control valves or feeding pumps. In the process, the contact ON time or the switching frequency of the contacts varies in accordance with the controller output.
The currently valid controller output can be read out on the secondary display (see page 2–1).



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

Analog Controller

The manipulated variable is output proportionally as an analog current via Output 2.

Controller type A (3-way mixing valve)
operates in the controller output range
-100 to +100 %

Controller type B (straightway valve)
operates in the controller output range
0 to +100 %
Controlled variable < setpoint

Controller type C (straightway valve)
operates in the controller output range
0 to -100 %
Controlled variable > setpoint

Valves can be controlled with Output 2. In the process the current varies in accordance with the controller output.
The currently valid controller output can be read out on the secondary display (see page 2–1).

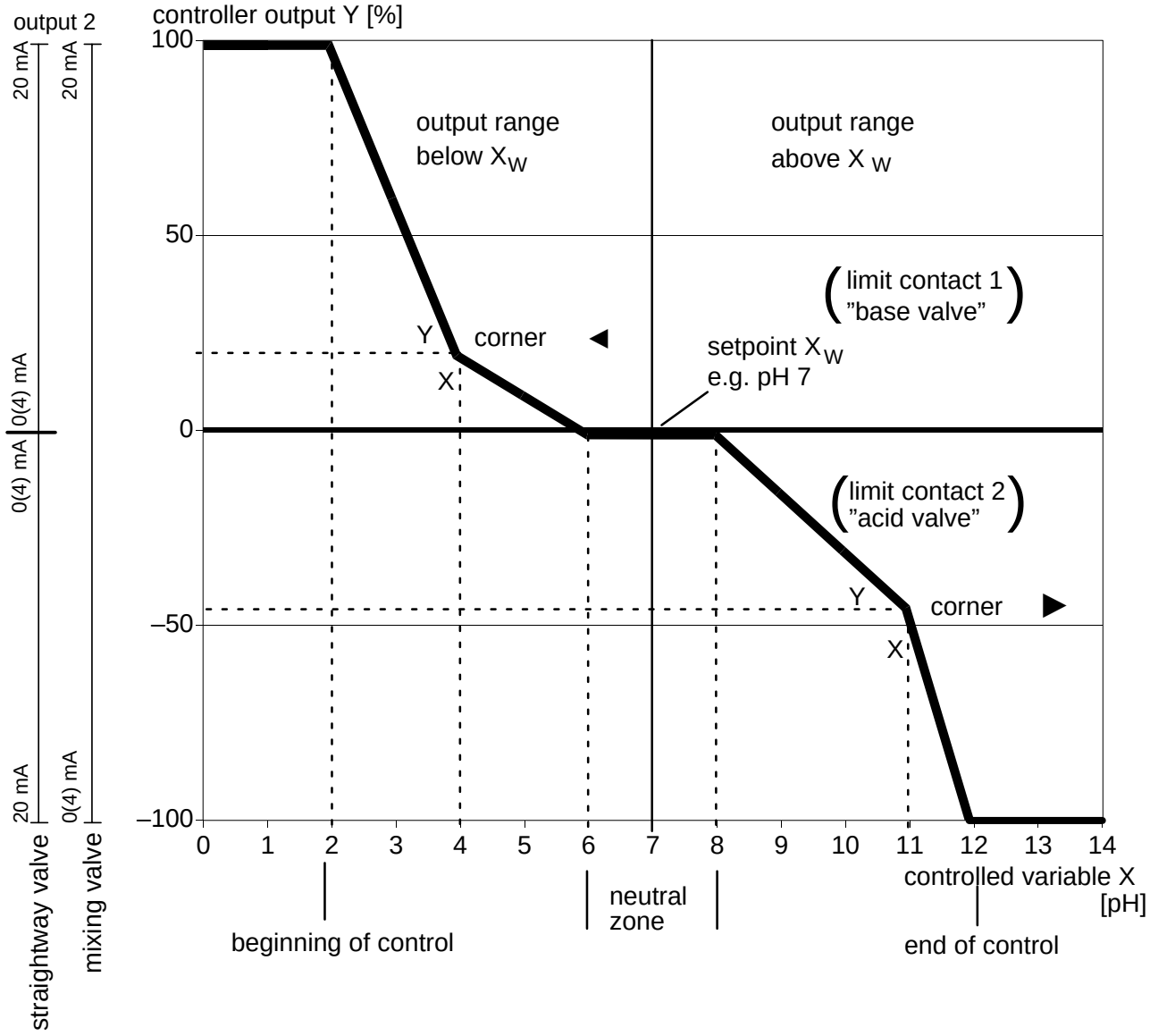
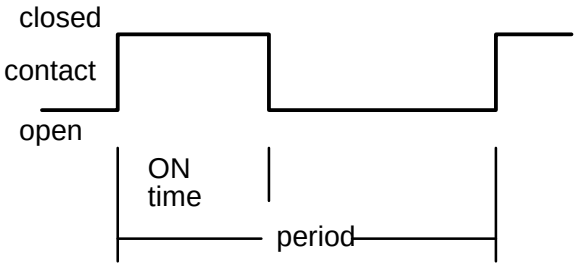


Fig. 9–8 Control characteristic

Pulse Length Controller
(with Option 353 only)

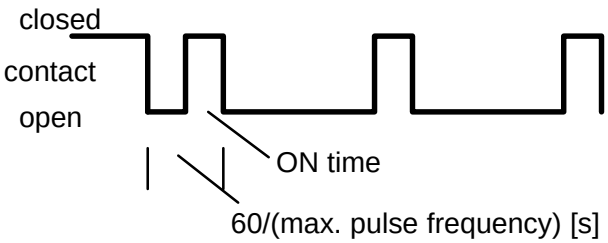
The pulse length controller controls valves used as actuators.



The pulse length controller switches the contacts on, the ON time depending on the controller output.
The *period* is constant. It can be separately defined for each of the two control ranges to adjust for two different valve types, for example.
A *minimum ON time* is maintained even if the controller output takes corresponding values. This helps to allow for the reaction time of a valve, for example.
If the minimum ON time is set to 0, there is still a minimum ON time of 0.25 s for technical reasons.

Pulse Frequency Controller
(with Option 353 only)

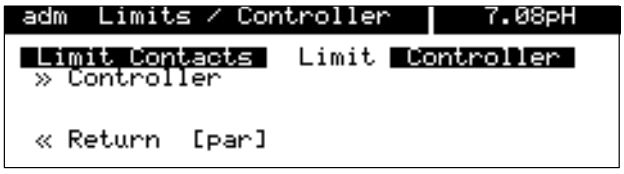
The pulse frequency controller controls (frequency controlled) feeding pumps used as actuators.



The pulse frequency controller varies the frequency at which the contacts are switched on.
You can define a maximum pulse frequency [p/min]. It depends on the feeding pump in use.
The maximum value to be entered is 120 p/min.
ON time is constant.
It is automatically calculated from the user-defined maximum pulse frequency:

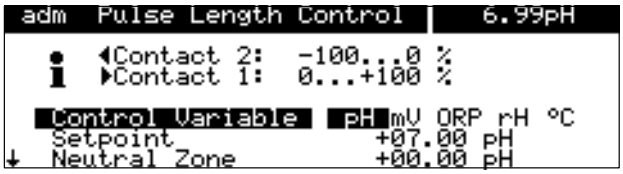
ON time [s] = 30 / max. pulse frequency [p/min]

How to set the controller function parameters



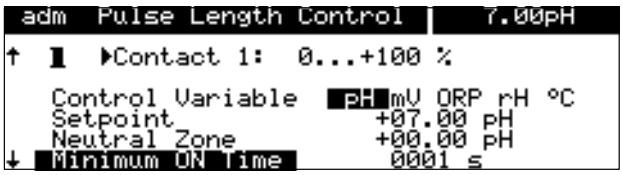
Open the Parameter Setting menu (opl or adm level, resp.), select ”Limits/Controller” using ▼, and confirm with **enter**.
Press ▶ to select ”Controller” and confirm with **enter**.
Press ▶ or **enter** to open the submenu ”Controller”.

Press ◀ or ▶ to select the controller type and confirm with **enter**.
To set the control parameters, press ▶ or **enter** to open the submenu ”Control Parameters”.



The information text shows the contact assignment:
Contact 2 operates in the controller output range of 0 to -100 % (e.g. acid valve).
Contact 1 operates in the controller output range of 0 to +100 % (e.g. base valve).

Type A: Pulse Length Controller

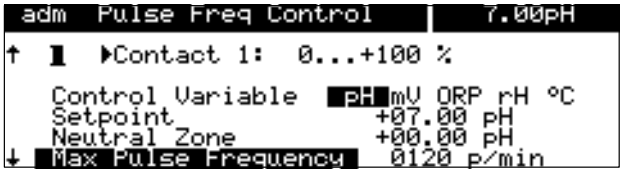


Select the controlled variable using ◀ and ▶. Enter the setpoint, neutral zone and minimum ON time using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

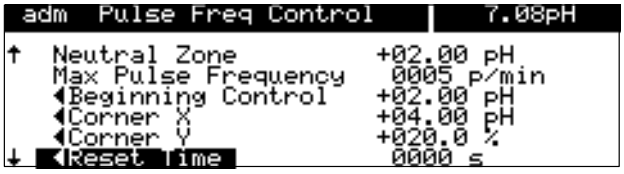
Enter beginning of control, corner X, corner Y, reset time and period for the left control range (◀: controlled variable < setpoint).

Enter end of control, corner X, corner Y, reset time and period for the right control range (▶: controlled variable > setpoint).

Type B: Pulse Frequency Controller



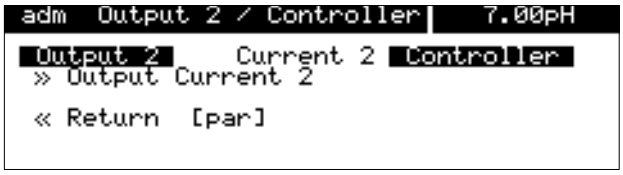
Select the controlled variable using ◀ and ▶. Enter the setpoint, neutral zone and minimum ON time using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.



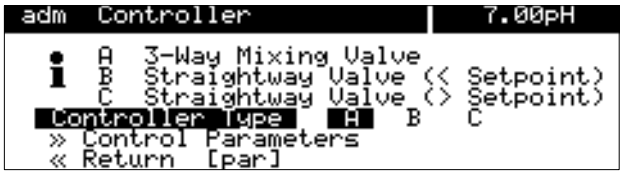
Enter beginning of control, corner X, corner Y, reset time and period for the left control range (◀: controlled variable < setpoint).

Enter end of control, corner X, corner Y, reset time and period for the right control range (▶: controlled variable > setpoint).

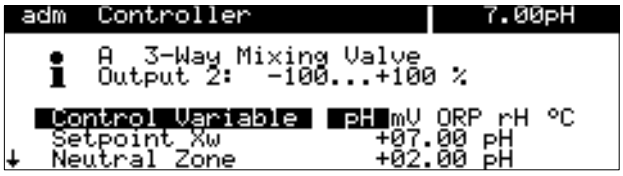
How to set the parameters of the analog controller
(with Option 483 only)



Select the menu item “Output 2 / Controller” with ▼ in the Parameter Setting menu and confirm with **enter** .
Move to “Controller” with ▶ and confirm with **enter** .
To open the submenu ≫ “Controller”, press ▶ or **enter** .

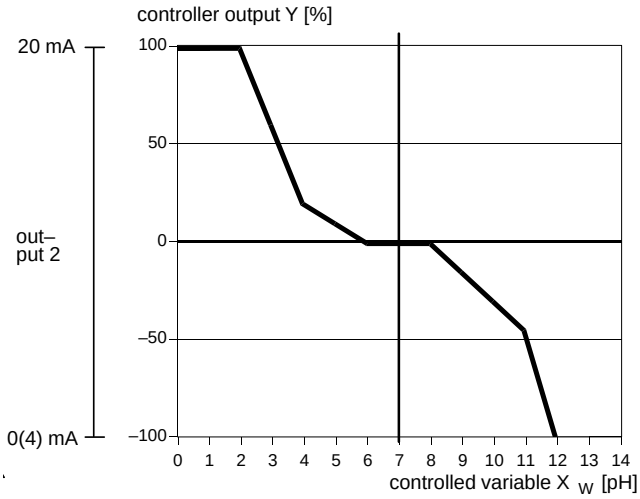


Select controller type A, B or C with ◀ and ▶ and confirm with **enter** .
To select the control parameters, open the submenu ≫ “Control Parameters” with ▼ or **enter** and confirm with **enter**.



The information text shows the selected controller type and the controller output range.

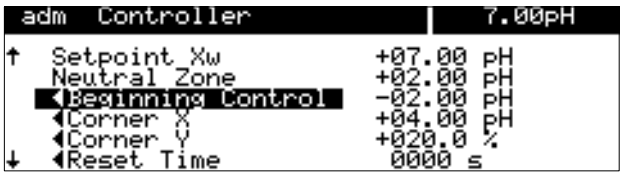
Type A: 3-Way Mixing Valve



For the 3-way mixing valve, the analog controller output operates in the manipulated variable range -100 % to +100 %*). A controller output Y = 0 % corresponds to a current of 10 or 12 mA.

*) Controller output range corresponds to 0(4) – 20 mA

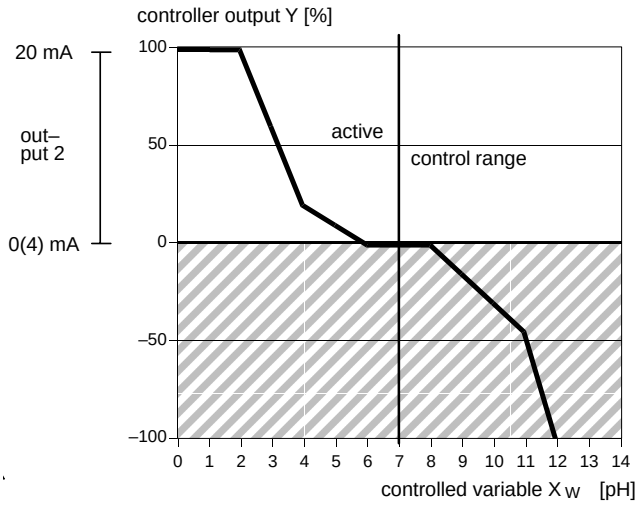
The parameters of the controlled variable which controls the controller are set with ◀ and ▶ . Press ▲ and ▼ to choose between the control parameters. Enter each of the control parameters with the scrolling keys and the cursor keys (see also Pg. 2–6) and confirm the entries with **enter**.



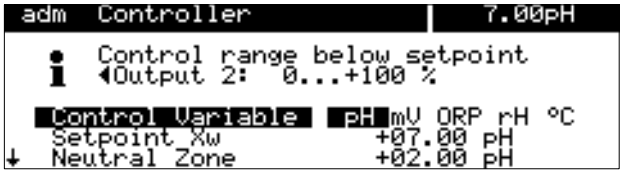
Enter Beginning Control, Corner X, Corner Y and Reset Time for the left control range (◀: Controlled variable < setpoint).

Enter End Control, Corner X, Corner Y and Reset Time for the right control range (▶: Controlled variable > setpoint).

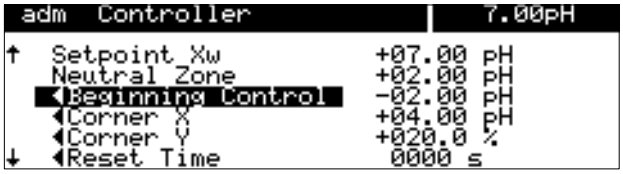
Type B: Straightway valve (< setpoint)



For the straightway valve Type B the analog controller output operates in the manipulated variable range 0 to +100 %. Here +100 % corresponds to a current of 20 mA. The controller only outputs the manipulated variable for the selected side. On the other side of the setpoint the manipulated variable cannot be output and the output remains at 0 (4) mA.



The parameters of the controlled variable which controls the controller are set with ◀ and ▶. Press ▲ and ▼ to choose between the control parameters. Enter each of the control parameters with the scrolling and cursor keys (see page 2–6) and confirm the entries with **enter**.

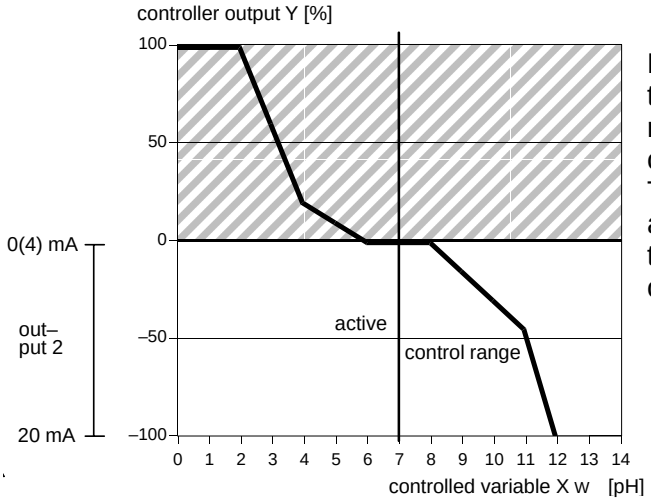


Enter Beginning Control, Corner X, Corner Y and Reset Time for the left control range (◀: Controlled variable < setpoint).

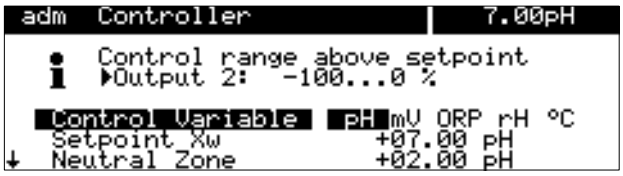
For a pure P-controller (reset time = 0 s), only the parameters for the control range used must be set. However, for the unused range realistic parameters must be entered, as otherwise the error message “Warn Control Parameter” is output.

For use as a PI-controller (reset time ≠ 0 s), it is mandatory that the parameters for the unused range are also set. The manipulated variable of both control ranges is influenced by the integration time.

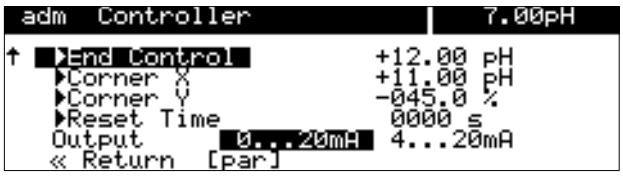
Type C: Straightway valve (> setpoint)



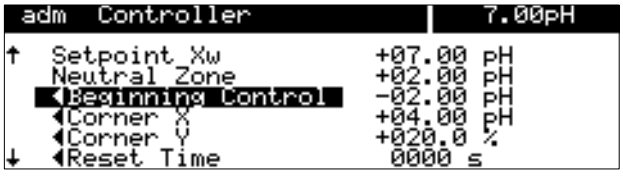
For the straightway valve Type C the analog controller output operates in the manipulated variable range 0 to -100 %. Here -100 % corresponds to a current of 20 mA.
The controller only outputs the manipulated variable for the selected side. On the other side the of the setpoint the manipulated variable cannot be output and the output remains at 0 (4) mA.



The parameters of the controlled variable which controls the controller are set with ◀ and ▶ . Enter the setpoint and the neutral zone with the scrolling and cursor keys (see Pg. 2–6) and confirm the entries with **enter**.

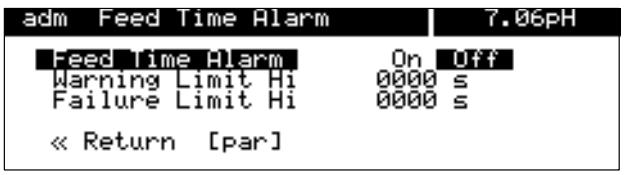


Enter Beginning Control, Corner X, Corner Y and Reset Time for the right control range (▶: Controlled variable > setpoint).



For a pure P-controller (reset time = 0 s), only the parameters for the control range used must be set. However, for the unused range realistic parameters must be entered, as otherwise the error message “Warn Control Parameter” is output. For use as a PI-controller (reset time ≠ 0 s), it is mandatory that the parameters for the unused range are also set. The manipulated variable of both control ranges is influenced by the integration time.

Feed Time Alarm



Open the Parameter Setting menu (opl or adm level, resp.), select ”Alarm Settings” using ▼, and confirm with **enter**.
Select ”Feed Time Alarm” using ▼ and confirm with **enter**. *This menu item is only displayed if the controller is turned on!*

Enter the values for warning message (Warning Limit Hi) and failure message (Failure Limit Hi) using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

Error Messages for Controller Settings

The controller will be turned off (both contacts open) and the alarm message ”Warn Control Parameter” will be activated if any of the following conditions applies:

- beginning ≥ setpoint – neutral zone / 2
- ◀ corner X < beginning
- ◀ corner X > setpoint – neutral zone / 2
- end ≤ setpoint + neutral zone / 2
- ▶ corner X < setpoint + neutral zone / 2
- ▶ corner X > end
- ◀ corner Y > 100 %
- neutral zone < 0
- ▶ corner Y > +100 %

Additionally with Pulse Length Controller:

- ◀ period < min. ON time * 2
- ▶ period < min. ON time * 2

Additionally with Pulse Frequency Controller:

- max. pulse frequency ≤ 0 p/min
- max. pulse frequency > 120 p/min

Power Output

The pH Transmitter 2500 provides a floating, short-circuit-proof power output (as standard). With this power output, you can supply sensors, switching contacts or a pH isolation amplifier, for example, with 24 Vdc, 30 mA (see Fig. 9–4, page 9–13).

How to use the power output together with the current input to form a ”2-wire transmitter supply” is described as follows.

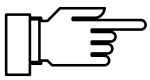
Current Input

The pH Transmitter 2500 provides a current input (as standard). The current input processes standard signals of 0 to 20 mA or 4 to 20 mA.
The input current can be read out on the secondary display (see page 2–1).

In addition, the input current can be monitored by alarm limits (see page 9–22). Warning and failure limits can be set in the menu ”Alarm Settings”.
The alarm limits are entered as percentage of input current range.
With

0 %	corresponding to	0 or 4 mA,
100 %	corresponding to	20 mA.

With current input setting ”Input 0...100% 4...20mA”, you can enter negative percentage values.
-25 % correspond to 0 mA.

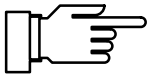


The currently active alarm messages can be read out in the Diagnostics menu ”Message List” (see page 4–2).

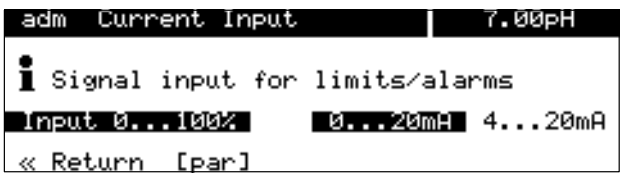
Typical Application

The application example in Fig. 9–4, page 9–13 shows the connection of a 2-wire flow transmitter. During a bypass measurement, for example, the flow transmitter can be used to monitor if the flow of the process medium is sufficient.
The flow transmitter is supplied from the power output.
The current from the flow transmitter is measured via the current input. The flow transmitter signal can be monitored by setting four alarm limits for the current input.

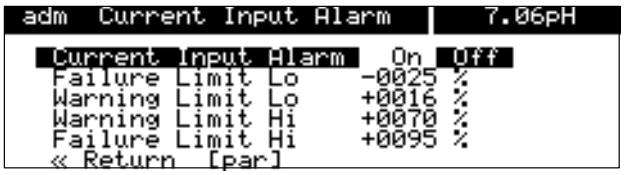
How to set the current input parameters



If your pH Transmitter is equipped with option 352 and probe rinsing has been enabled during parameter setting, the current input can be set to control probe rinsing (see below).



Open the Parameter Setting menu (opl or adm, resp.), select ”Current Input” using ▼, and confirm with **enter** .
Press ◄ or ► to select ”Input 0...100% 0...20mA” or ”Input 0...100% 4...20mA” and confirm your choice with **enter**.

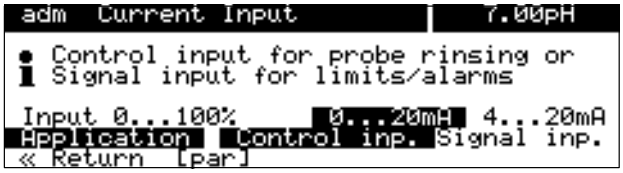


To monitor the current input via alarm limits, open the Parameter Setting menu and select ”Alarm Settings”, submenu ”Current Input Alarm”.
Enter the alarm limits using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

Input current can also be controlled via the limit contacts. For setting procedure, refer to page 9–26.

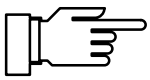
Current input as control input for probe rinsing

If your pH Transmitter is equipped with option 352 probe rinsing, the current input can be used for remote control of probe rinsing (see page 9–50).
When current input is used as control input, the menu item ”Current Input Alarm” does not appear in the ”Alarm Settings” menu.



To set the current input as control input, open the Parameter Setting menu, select ”Current Input” using ▼, and confirm with **enter**.
Select menu item ”Application”.
Press ◀ or ▶ to select ”Control Input”, and confirm your choice with **enter** (if current input has been set to live zero, this only applies for current display, current input alarm is disabled).

InClean Retractable Probe



You can only control the InClean retractable probe if your pH Transmitter is equipped with Option 404. Without this option, the item ”CleanProbe (optional)” is listed in the menu and cannot be selected.

Please refer to the InClean operating manual for installation, commissioning and maintenance of the InClean probe.

With the InClean retractable probe the pH electrode can be rinsed automatically, cleaned with a cleaning agent and the operation checked. The retractable probe is remote-controlled by the pH Transmitter 2500.

To rinse/clean the electrode, start the **InClean program**.

The InClean program can be started:

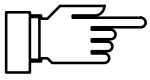
- via timer control after the user-defined **interval time** has expired,
- manually in the **maint** menu,
- with a switching contact on the InClean,
- by remote control via the interface (see page).

You can program an interval time within the range from 0.1 to 999.9 hrs. The interval time lasts from the start of a InClean program until the start of the next InClean program.

You can switch off the timer-controlled InClean program by setting the interval time parameter to ”000.0 h”.

Before starting the InClean program, you must program the individual steps in the parameter setting menu in the menu item ”InClean CleanProbe” (see Pg. 9–53)!

Operation of the InClean controller



For technical reasons the InClean retractable probe is only called ”CleanProbe” in the menu texts of the pH Transmitter 2500.

The InClean retractable probe is controlled via three contacts:

- ”Probe” contact
- ”Rinsing” contact
- ”Cleaning” contact

If the pH Transmitter is equipped with the Option 404 ”InClean” and the InClean function is switched on in the parameter setting menu, the **current input** is used together with the power supply output to evaluate status signals. The following status signals from the InClean are evaluated individually and in combination:

Probe in ”Measuring” position:
Electrode in process

Probe in ”Rinsing” position:
Electrode in rinsing chamber

Mode selector in ”Service” position

Start
The start contact was closed for longer than 2 sec. and triggers a retractable probe program.
As long as the start contact is closed, the probe remains in the ”Wait position”.

Lock:
As long as the lock contact is closed, a timer-controlled start of the retractable probe program is prevented.

InClean program

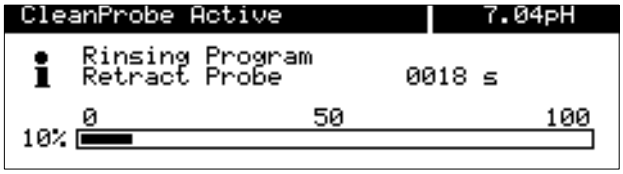
Two procedures can be selected for the InClean program in the parameter setting menu:
The rinsing program and the measuring program.

If one of the step times is defined at 0000 s, the step is eliminated entirely.
With **meas** you can display the measured value for approx. 5 sec. during the retractable probe program.

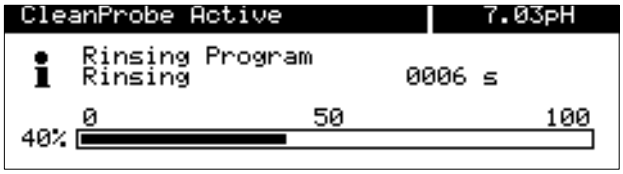
Rinsing program

If the rinsing program has been defined, the probe is normally located in the process for measuring and moves into the rinsing chamber at the start of the program. Here the electrode can be rinsed, cleaned and checked. At the end of the program the probe moves into the process again for measuring.

The rinsing program starts:
The NAMUR contact ”Functional check” is active,
the output current 1 (and 2) and the manipulated controller variable are frozen, the limits are inactive, the **maint** and the **cal** menus are blocked,
and the interval timer is reset.

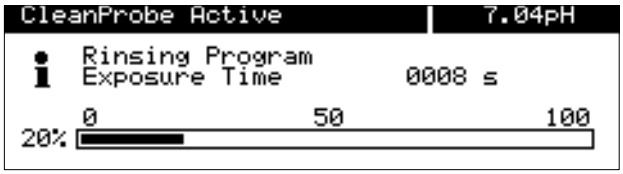


Retract probe:
During this time the instrument checks whether the probe reaches the ”Rinsing” end position. If this is not the case after 20 sec., the error message ”Fail CleanProbe” is output and no further timer-controlled retractable probe programs are started. After eliminating the error the probe can be put into operation again by switching the mode selector to ”Run”.



Rinsing (1):
The electrode is rinsed with water for the defined interval.
The step may be eliminated (step time 0 sec.) if the electrode is to be cleaned first.

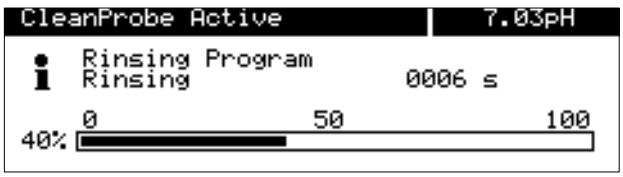
Cleaning:
The cleaning agent is pumped into the rinsing chamber in accordance with the defined cleaning time (via the additional valve or the metering pump). This step can be eliminated (step time 0 sec.).



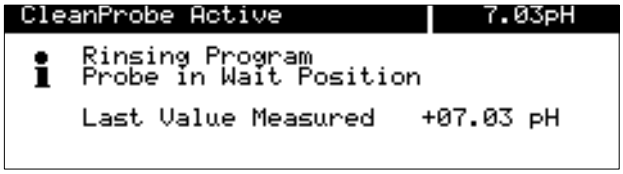
The cleaning agent acts on the electrode for the defined time.

Rinsing (2):
The electrode is rinsed with water for the defined time.
This step must be eliminated (step time 0 sec.) if the electrode is to be checked with the pH value of the cleaning solution.

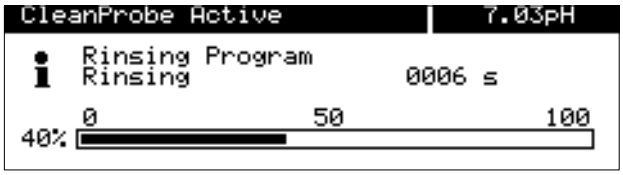
Sensor check:
After the user-defined check lead time has expired, the system checks whether the pH measured by the electrode lies within the user-defined warning and failure limits.
If it does not, a warning or failure message is output.



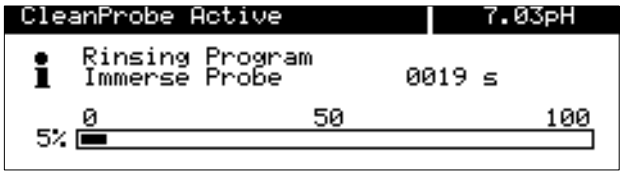
Rinsing (3):
The electrode is rinsed with water for the defined time.
This step can be eliminated (step time 0 sec.) if the electrode is to be stored in the cleaning solution.



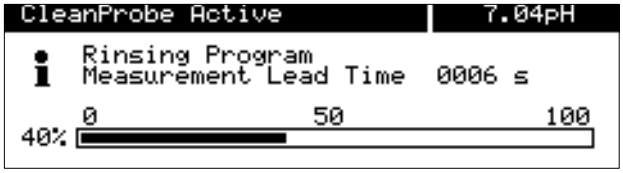
Wait position:
The probe remains in the wait position as long as the start contact is closed.
If the start contact has been opened before reaching the step, it is skipped.



Rinsing (4):
The electrode is rinsed with water for the defined time.
This step can be eliminated (step time 0 sec.) if the electrode was already rinsed beforehand.

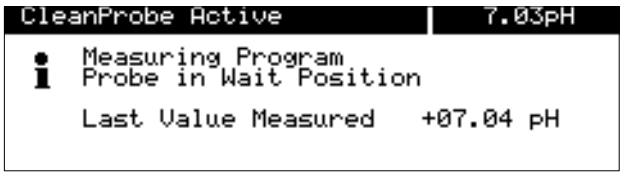


Immerse probe:
During this time the system checks whether the probe has reached the ”Measuring” end position. If this is not the case after 20 sec., the error message ”Fail CleanProbe” is output and no further timer-controlled InClean programs are started.After eliminating the error, the probe can be put into operation again by switching the mode selector to ”Run”.



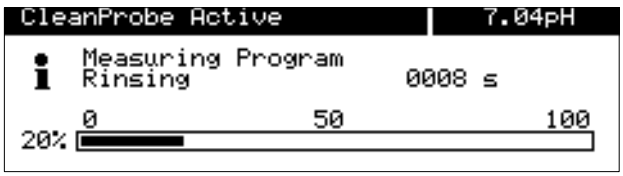
Measurement lead time:
The defined wait time up to the end of the rinsing program runs out.
Then the ”Functional check” becomes inactive and the measurement starts.

Measuring program

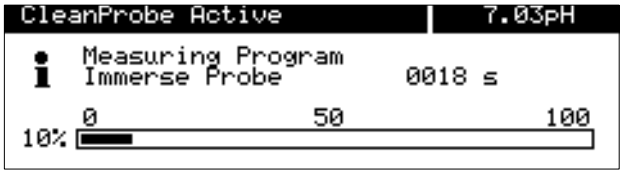


If the measuring program has been defined, the probe is normally in the rinsing chamber and moves into the process at the start of the program. After the defined measuring time expires, the probe moves back into the rinsing chamber. Here the electrode can be rinsed, cleaned and checked and remains there until the measuring program is started again.

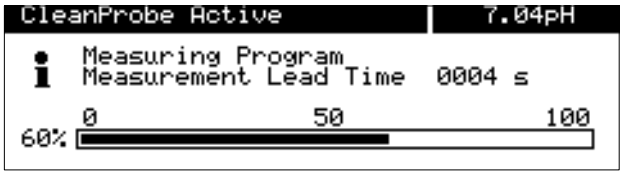
The measuring program starts:
the **maint** and the **cal** menus are blocked and the interval timer is reset.



Rinsing (1):
The electrode is rinsed with water for the defined time.
This step can be eliminated (step time 0 sec.) if the electrode was rinsed in the last step.

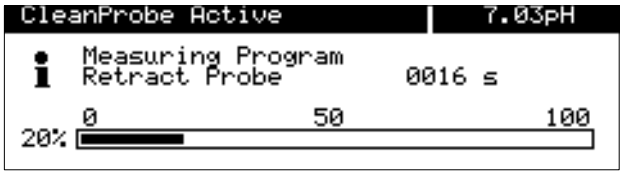


Immerse probe:
During this time the system checks whether the probe reaches the ”Measuring” end position. If this is not the case after 20 sec., the error message ”Fail CleanProbe” is output and no further timer-controlled InClean programs are started. After eliminating the error, the probe can be put into operation again by switching the mode selector to ”Run”.



Measuring lead time:
The defined wait time runs out.
Then the ”Functional check” becomes inactive, the output current 1 (and 2) and the manipulated controller variable are released, the limits are active and the measurement begins.

Measuring:
The pH is measured for the defined time.
After the measuring time expires the NAMUR contact ”Functional check” becomes active, the output current 1 (and 2) and the manipulated controller variable are frozen and the limits are inactive.



Retract probe:
During this time the system checks whether the probe reaches the ”Rinsing” end position. If this is not the case after 20 sec., the error message ”Fail CleanProbe” is output and no further timer-controlled InClean programs are started. After eliminating the error the probe can be put into operation again by switching the mode selector over to ”Run”.

Rinsing (2):
The electrode is rinsed with water for the defined time.
This step can be eliminated (step time 0 sec.) if the electrode is to be cleaned first.

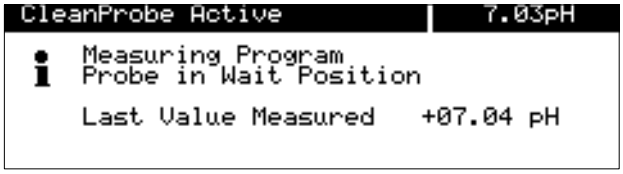
Cleaning:
The cleaning agent is pumped into the rinsing chamber in accordance with the defined cleaning time (via the additional valve or the metering pump). This step can be eliminated (step time 0 sec.).

- The cleaning agent acts on the electrode for the defined time.

- Rinsing (3):
  The electrode is rinsed with water for the defined time.
  This step must be eliminated (step time 0 sec.) if the electrode is to be checked with the pH value of the cleaning solution.

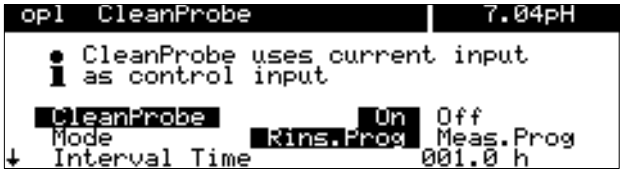
- Sensor check:
  After the user-defined check lead time has expired, the system checks whether the pH measured by the electrode lies within the user-defined warning and failure limits.
  If it does not, a warning or failure message is output.

- Rinsing (4):
  The electrode is rinsed with water for the defined time.
  This step can be eliminated (step time 0 sec.) if the electrode is to be stored in the cleaning solution.



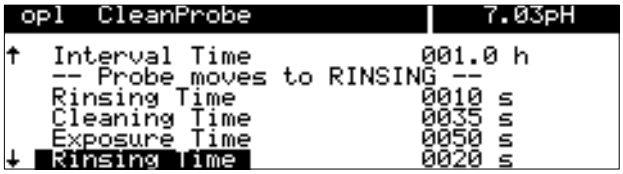
- Wait position:
  The probe remains in the wait position until a new measuring program is started.

Setting parameters for the InClean program



Select the menu item ”InClean CleanProbe” in the Parameter Setting menu.
Set the parameters for ”CleanProbe On” with ◀ and confirm with **enter**.

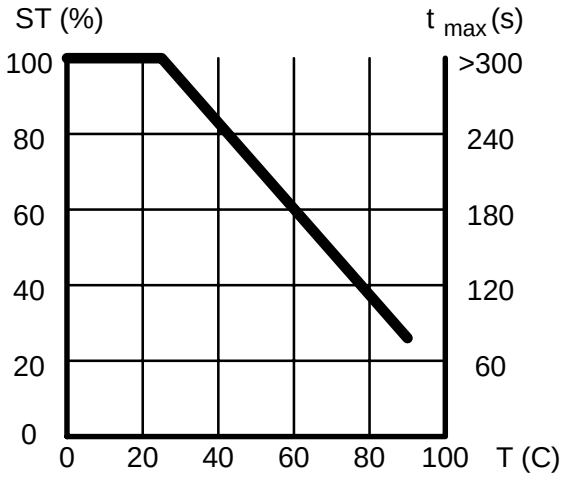
Set the parameters for the operating mode (rinsing program or measuring program) with ◀ and ▶ and confirm with **enter**.



Enter the interval time and the step times with the scroll keys and the cursor keys and confirm your entries with **enter**.

If you program the step times for 0000 sec., the step is completely eliminated.

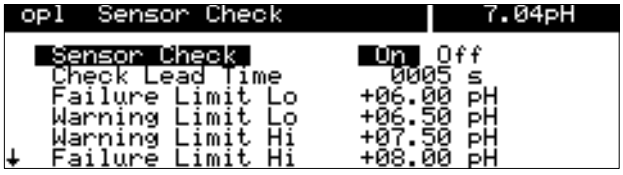
Please note that the permissible switch-on time of the water valve is dependent on the rinsing water temperature. At rinsing temperatures > 25 ˚C the switch-on time decreases as shown in the chart at the left. The switch-on time is indicated based on 300 sec. (= 5 min.).



Example:

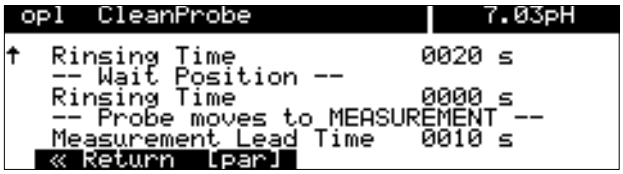
At a rinsing-water temperature of 60 ˚C the maximum switch-on time is 60 % (based on 300 sec.), i.e. a maximum of 180 sec. This means that a maximum rinsing time of 180 sec. (= 60 %) may be defined and then a pause of 120 sec. (= 40 %) must be maintained until the water valve is switched on again (until the next rinsing step).
If, for example, a rinsing time of 60 sec. is defined, a pause of 40 sec. must be maintained until the valve switches on again. This is achieved when the following step lasts 40 sec., for example by defining the check lead time, cleaning time or exposure time at 40 sec.

With ▶ you reach the submenu for the sensor check (see Pg. 9–47 for explanation).



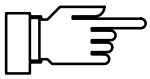
You can switch the sensor check on or off with ◀ and ▶; confirm your selection with **enter**.
Enter the check lead time and the warning and failure limits for the sensor check with the scrolling keys and the cursor keys and confirm your entries with **enter**.

The temperature compensation for the sensor check can take place either automatically through measuring (when using an electrode with an integrated temperature probe) or manually by entering the temperature of the check solution.
For automatic temperature compensation select ”auto”. For manual temperature compensation select ”man” with ▶ and **enter** and then enter the solution temperature with the scrolling keys and the cursor keys and confirm your entries with **enter**.
Important! The pH Transmitter only compensates the temperature coefficient of the electrode, however not the temperature coefficient of the cleaning fluid or the buffer solution!



Enter the step times with the scrolling keys and the cursor keys and confirm your entries with **enter**.

If you program one of the step times for 0000 sec., the step is completely eliminated.



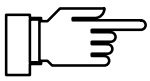
After switching on the retractable probe program in the parameter setting menu, the next automatic program start does not take place until an entire interval has been completed.

Instructions for use

The step times can be changed in the parameter setting menu while the program steps are running. This makes it possible to shorten or end step times which prove to be too long.

Timer-controlled program start

Set the parameters of an interval time.
After the interval time has expired the InClean program is started automatically.
If you wish to block the timer-controlled program start (e.g. in order not to interrupt an important measurement), the ”Lock” contact on the InClean must be closed. As long as the contact is closed no program sequence will be started.



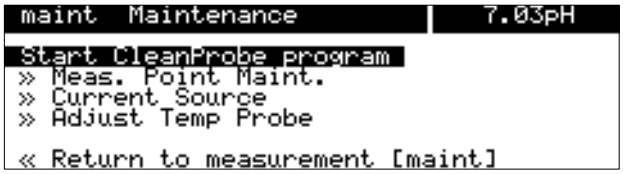
Following a power-supply failure the interval timer is reset. The next automatic start then takes place after an entire interval has been completed.

No timer-controlled rinsing cycle is started in the ”Meas. Point Maint.” submenu (see operating manual for pH Transmitter 2500).

Remote-controlled program start

Closing the ”Start” contact on the InClean for at least 2 sec. starts the InClean program (the interval timer is reset). If the contact remains closed, the probe remains in the wait position until the contact is opened again.

Manual program start



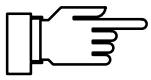
Start the InClean program in the **maint** menu with ▶ or **enter**.

- If the rinsing program is selected, the probe moves into the ”Rinsing” position, all steps are run through and the probe moves into the ”Measuring” position again.

- If the measuring program is selected, the probe moves into the ”Measuring” position. After the measuring time expires the probe moves into the ”Rinsing” position and all steps are run through while the probe remains in the wait position.

Sensor check

Lower and upper warning and failure limits can be defined for the sensor check. When the program has reached this step, the pH of the fluid in the rinsing chamber is measured. If the measured value lies outside the alarm limits, a warning or failure message (”Sensor check”) is output.



If a cleaning fluid with a known pH or a buffer solution is used, an effective check of the sensor operation is possible. However, please note that a temperature measurement in the rinsing chamber for temperature compensation of the measured value is only possible when using an electrode with an integrated temperature probe.
If an electrode without a temperature probe is used, the temperature of the cleaning fluid or the buffer solution must be manually selected (see Pg. 9–10).
Important! The pH Transmitter only compensates the temperature coefficient of the electrode slope, however not the temperature coefficient of the buffer solution!

The warning or failure message is reset in the case of:

- Successful execution of a sensor check (measured value within alarm limits)

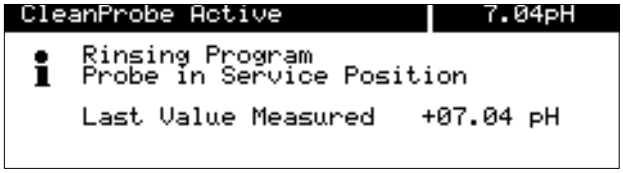
- Electrode calibration

- Defining InClean for ”Off”

- Power-supply failure

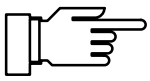
Service position

To perform an electrode change and for all other maintenance work, the mode selector on the InClean must be moved into the ”Service” position.



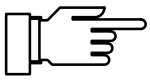
The probe moves out of the process and the remote control for the pH Transmitter 2500 is interrupted.

If the switch is set to the ”Run” position after reinstalling the electrode, the steps of the InClean program defined after the wait position are worked off.



If an InClean program is interrupted by a power supply failure, the program sequence is continued when the power supply is switched on again. This continuation begins at the last step carried out, whereby the full defined step time is run through again.

Probe Rinsing



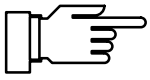
You can only make use of the probe rinsing function if your pH Transmitter is equipped with option 352. Without this option, the menu reads ”Probe Rinsing (Optional)”. This menu item cannot be selected.

Probe rinsing is used, for example, for automatic rinsing and cleaning of the pH electrode.
To do so, a **rinsing cycle** is started.

A rinsing cycle can be started:

- timer controlled after expiration of the user defined **interval**,
- manually in the **maint** menu,
- by a current pulse (see page 9–50) at the current input (if current input has been set as control input, see page 9–38),
- remote-controlled via interface (see page 9–53).

You can define an interval in the range 0.1 to 999.9 h. The interval extends from the start of one rinsing cycle to the start of the next rinsing cycle.



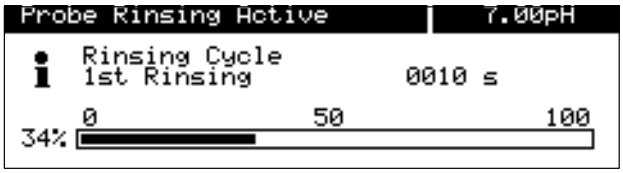
To turn off the automatic rinsing cycle, set the interval to ”000.0 h”.

Before starting a rinsing cycle, you must enter the individual step durations on the Parameter Setting level, menu item ”Probe Rinsing” (see page 9–50)!

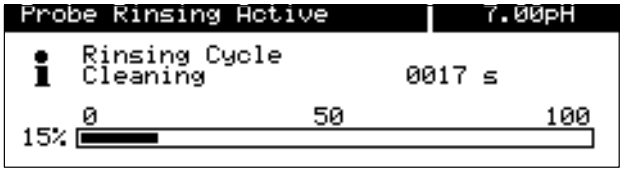
A rinsing cycle comprises the following steps:

Start of Rinsing Cycle:
NAMUR contact ”functional check” and contact ”probe” are activated, output current 1 (and 2) and controller output are frozen, limits are disabled, **maint** and **cal** menus are locked, the interval timer is reset.

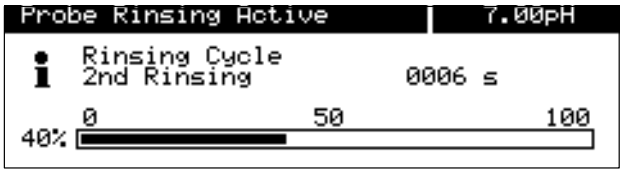
Rinsing Lead Time:
User defined waiting time until contact ”rinsing” closes. This allows you to monitor response times of the valve ”probe”, for example .



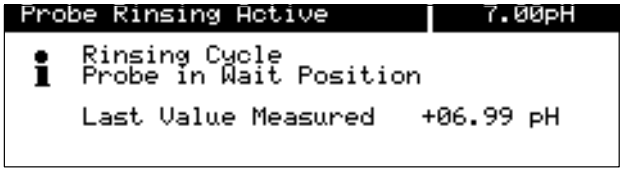
First Rinsing:
The contact ”rinsing” is closed for the (user defined) duration of first rinsing.



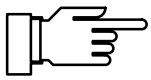
Cleaning:
The contact ”cleaning” is closed for the (user defined) duration of cleaning.



Second Rinsing:
The contact ”rinsing” is closed for the (user defined) duration of second rinsing.

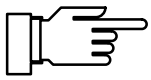


Wait Position:
If current input has been set as control input, the probe remains in wait position as long as the start current of 10 to 20 mA is applied to the current input.



Wait position can only be controlled via the current input. If current input has been set as signal input, wait position is omitted.

Measurement Lead Time:
The contact ”probe” is deactivated.
Now, the user defined waiting time until rinsing cycle is terminated starts running.
After expiration, ”functional check” will be turned off.



If you have set one of these steps to 0000 s, it is omitted completely.
Pressing **meas** during the rinsing cycle displays the measured value for approx. 5 s.

How does probe rinsing operate?

The rinsing equipment is controlled via three contacts:

Contact ”probe”:
This contact can be set as normally open or normally closed. It controls a process valve in a flow-through fitting, for example. In measuring mode the contact is deactivated. During rinsing cycle it is active to close the process valve, for example.

Contact ”rinsing”:
can control the valve for the rinsing medium. The contact is closed during first and second rinsing.

Contact ”cleaning”:
can control a valve for the cleaning liquid. The contact is closed during cleaning.

The three contacts are electrically connected on one side.

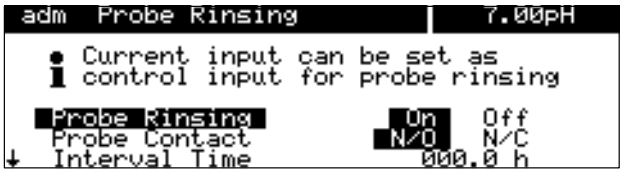
If your pH Transmitter is equipped with option 352 probe rinsing, the **current input** is used for remote control of the rinsing cycle (see page 9–38):

0 – 10 mA (normal operation):
A current in this range permits *start of rinsing cycle* by user defined *interval* or *manually* in the **maint** menu.

10 – 20 mA (start):
A current in this range *starts* a rinsing cycle. The current must be applied for at least 2 s. As long as this current is applied, the probe remains in wait position. That means: rinsing lead time, first rinsing, cleaning, and second rinsing are executed. Then the probe remains in wait position. When the current is removed, the cycle will be continued with measurement lead time.

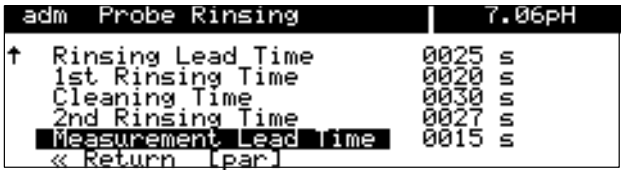
> 20 mA (lock):
A current in this range *locks* start of a rinsing cycle independent of the user defined interval.

How to set the rinsing cycle parameters



Open the Parameter Setting menu (opl or adm, resp.), select ”Probe Rinsing” and confirm with **enter**.

Press ◀ to select ”Probe Rinsing On” and confirm with **enter**.



Enter interval and step durations using scrolling and cursor keys (see page 2–6) and confirm your entries with **enter**.

If you have set one of these steps to 0000 s, it is omitted completely.

When probe rinsing is enabled in the Parameter Setting menu, the next automatic start of the rinsing cycle is only performed after a complete interval has been expired.

Tips for Application

While the rinsing steps are performed, you can change the step durations. This allows you to shorten or terminate step times that are too long.

Timer Controlled Rinsing Cycle

Set an interval.
After expiration of this interval a rinsing cycle will be started automatically.
If you want to lock automatic rinsing cycle (e.g. because you do not want to interrupt an important measurement), apply a current > 20 mA to the current input (e.g. by directly connecting the power output to current input).

After a power failure the interval timer is reset. Then the next automatic start is only performed after a complete interval has been expired.

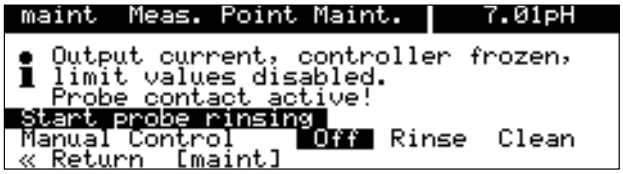
While in the “Meas. Point Maint.” submenu, a timer-controlled rinsing cycle is not started (see Pg. 5–3).

Remote Controlled Rinsing Cycle

Set the interval ”0000”.
Apply a current of 10 to 20 mA to the current input for at least 2 s (e.g. by connecting the power output via a resistor of 1.5 kΩ). This starts a rinsing cycle. (Interval timer will be reset.) If the current is applied for a longer period of time, the probe remains in wait position until the current is removed.

Manual Start of Rinsing Cycle

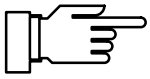
Open the **maint** menu and press ▶ or **enter** to select ”Meas. Point Maint.”.



You can start a **rinsing cycle**:
Press ▲ to select ”Start probe rinsing” and confirm with **enter**.
This starts a rinsing cycle. (The interval timer will be reset.) *After termination of the rinsing cycle, the instrument will return to measuring mode.*

Manual Switching of ”Rinsing” and ”Cleaning”

Press ▲ to select ”Manual Control”.
Press ▶ or ◀ to select ”Rinse” or ”Clean” and confirm with **enter**. The corresponding contact will remain closed until you enter ”Manual Control Off” or press **maint** or **meas** to exit the menu.
You can never close two contacts at the same time!
When a rinsing cycle is running, manual control is locked.

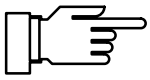


As delivered, the relay contacts are suitable for low signal currents (down to approx. 1 mA).
If currents above approx. 100 mA are switched, the gold plating is destroyed during the switching process. *After that, the contacts will not reliably switch low currents.*

If a rinsing cycle is interrupted by a power failure, probe rinsing is blocked. The error message ”Fail Rinsing Cycle” is released. All automatic starts are blocked!
The cycle can be reactivated by:

- a manual start in the **maint** menu
- disabling and re-enabling probe rinsing in the Parameter Setting menu
- an interface command

Remote Interface Operation



You can only make use of the interface if your pH Transmitter is equipped with option 351.
Without this option, the menu reads ”Interface (Optional)”. This menu item cannot be selected.

When the RS 485 interface is used, terminal 15 (RS 485 shield) must be grounded to meet the radio interference limits (according to German decree 243/91). Do not use the protective conductor for grounding!

To operate the pH Transmitter 2500 at a PC, a commercial RS 232 C/RS 485 interface converter can be used.

What you can do with the interface

The serial RS 485 interface allows you to:

read out all measured values

query instrument status including limit and alarm messages, instrument diagnostics and logbook

perform complete parameter setting

start a rinsing cycle via remote control

For description of the complete command set and the transmission protocol, refer to chapter 12.

If the instrument is in remote status during interface operation, the reading ”Remote” appears in the upper right corner of the display in measuring mode.
The keypad is locked for all entries!
When the pH Transmitter is in measuring mode, you can press **meas** to return to ”local” status. (You are prompted for confirmation.) The keypad will be enabled.

The interface can be defined for:

point-to-point operation
(pH Transmitter 2500 connected with a controller, e.g. PC) or

bus operation with up to 31 instruments and a controller (e.g. PC) at a bus.

Interface Parameters

Baud rate (transmission speed):
The baud rate is indicated in bits/second. When selecting the baud rate the transmission time (high baud rates) or the transmission quality (low baud rate) may be decisive. Baud rates between 300 and 9,600 baud can be set on the pH Transmitter 2500.

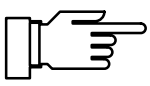
Parity (transmission error recognition):
The parity is an additional bit that supplements the data bits in such a way that an even number (parity even) or an odd number (parity odd) of logical “ones” is transmitted. In the case of a parity error, the error message “Warn Interface” appears.

Data bit (data width):
The pH Transmitter 2500 transmits a data width of either 7 bits or 8 bits. The pH Transmitter 2500 exclusively uses characters that can be transmitted in both the 7-bit and the 8-bit mode. The setting serves solely for adjustment to the controlling computer.

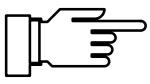
The baud rate can be defined as
300, 600, 1,200 or 9,600 baud,
and the transmission formats as
“7 Bit/Parity Even”,
“7 Bit/Parity Odd” or
“8 Bit/No Parity“

The interface is permanently set to 1 stop bit.

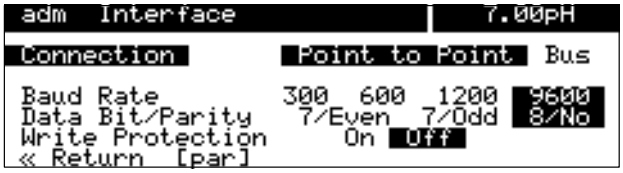
To protect the instrument against unauthorized access also in interface mode, you can set a write protection.
With write protection enabled, parameter or control commands can only be released after the write protection has been disabled via an interface command together with the administrator passcode (see page 12–33). Reading of measured values, parameters and status information is possible even with write protection enabled.
After having sent the last control command, write protection can be reactivated by an interface command or by pressing the **meas** key.



With write protection enabled, all attempts to write without previous disabling of write protection or by using a wrong passcode will be recorded in the logbook.



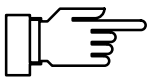
As supplied, write protection is disabled.



How to set the interface parameters

Open the Parameter Setting menu (opl or adm level, resp.), select ”Interface” using ▼, and confirm with **enter**.
Select the type of bus connection, baud rate and number of data/parity bits, and enabled or disabled write protection using ◀ and ▶ respectively, and confirm with **enter**.

Tips for Application



If you connect the pH Transmitter 2500 to the RS 232 interface of a PC or compatible via an RS 232 C/RS 485 interface adapter, you must observe the following:

The connection lead between pH Transmitter 2500 and PC is bidirectional. Therefore the converter must know the direction of transmission. If no data are sent, the converter *must* disable its transmission driver. With commercial converters, this changeover is usually done via a handshake line (e.g. DTR or RTS).

The changeover must be controlled by the driver program of the PC. *Commercial PC terminal programs do not automatically perform this changeover.*

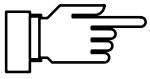
Some converters (e.g. W&T Type 860006) can operate in ”Automatic Mode”. Here, the driver will be automatically disabled after a short period. However, this can cause bus timing errors if the automatic turn-off time does not correspond to the baud rate used. The W&T converter has automatic turn-off times for the baud rate 115200 bauds.

According to experience, operating the pH Transmitter 2500 in this case at the highest possible baud rate (9600 Baud) will offer the best results.

Delta Function

The delta function allows calculation and direct indication and output of differential values for the measured pH, mV, ORP and rH values.
To do so, enter a delta value that will be subtracted from the selected process variable.

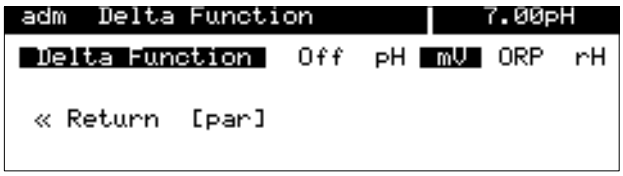
Output Value = Measured Value – Delta Value



Current outputs, controller and limit values are driven by the output value.

This is used for example to directly relate a measured ORP value to a standard hydrogen electrode.

How to set the delta function



Open the Parameter Setting menu (opl or adm level, resp.), select ”Delta Function” using ▼, and confirm with **enter**.
Select the process variable using ◀ and ▶ and confirm with **enter**.

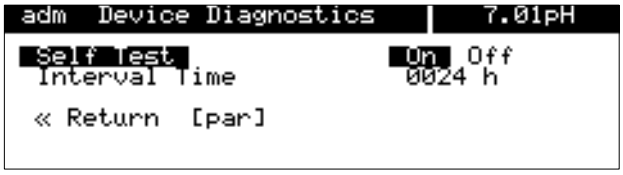
Enter the delta value using scrolling and cursor keys. Confirm your entries with **enter**.

When delta function is active, the reading “DELTA” appears in the measurement display below the unit symbol.

Automatic Device Diagnostics

The pH Transmitter 2500 can regularly perform an automatic self test (memory test). In the case of memory error a warning message is released. Self test is only performed when the instrument is in measuring mode. During testing measurement is continued in the background. All outputs remain active.

How to set the device diagnostics parameters



Open the Parameter Setting menu (opl or adm level, resp.), select ”Device Diagnostics” using ▼, and confirm with **enter**.
Turn automatic device diagnostics on or off using ◀ or ▶ and **enter**.
Enter the interval time using scroling and cursor keys and confirm with **enter**.

10 Information on Mounting, Installation and Maintenance

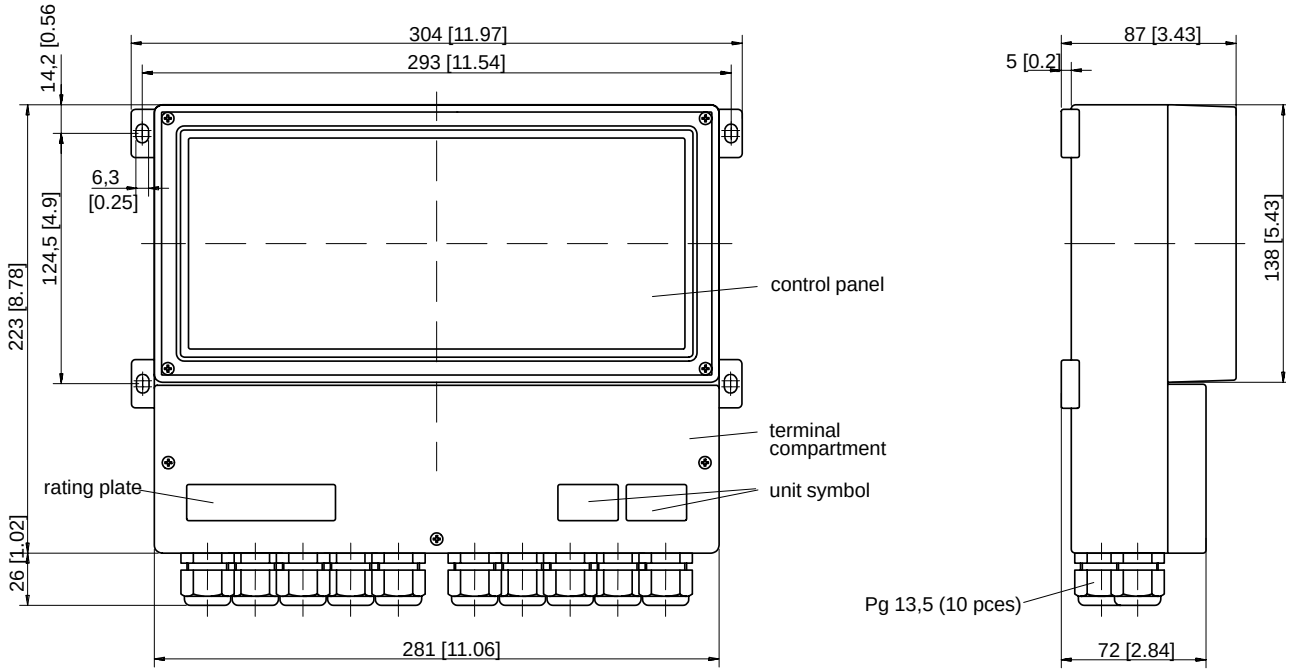
Mounting

The weatherproof enclosure allows direct wall mounting. For dimension drawing, see Fig. 10–1.

With ZU 0126 mounting plate and ZU 0125 bracket kit, the instrument can also be post or pipe mounted. For dimension drawing, see Fig. 10–2.

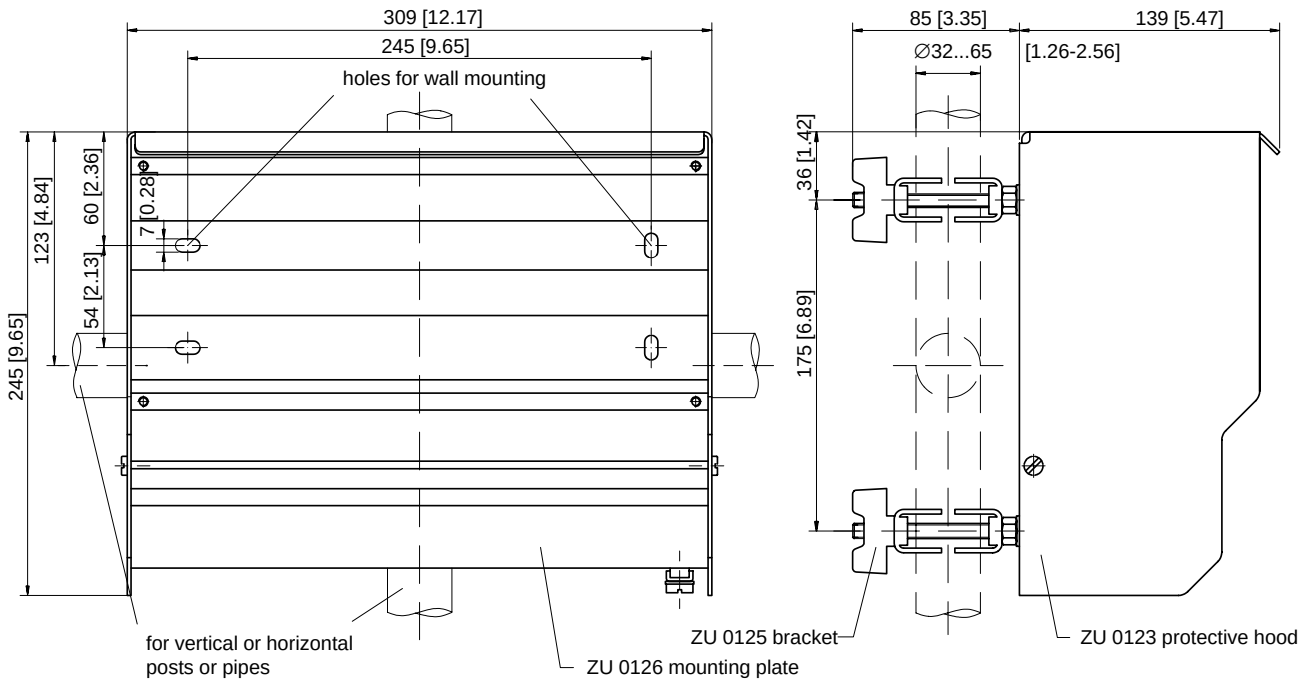
ZU 0123 protective hood provides additional protection against direct weather exposure and mechanical damage. For dimension drawing, see Fig. 10–2.
For mounting the protective hood, you require ZU 0126 mounting plate.

ZU 0124 protective case provides optimum protection against dust, moisture and mechanical damage. For dimension drawing, see Fig. 10–3.
With ZU 0128 bracket kit, the protective case can also be post or pipe mounted.



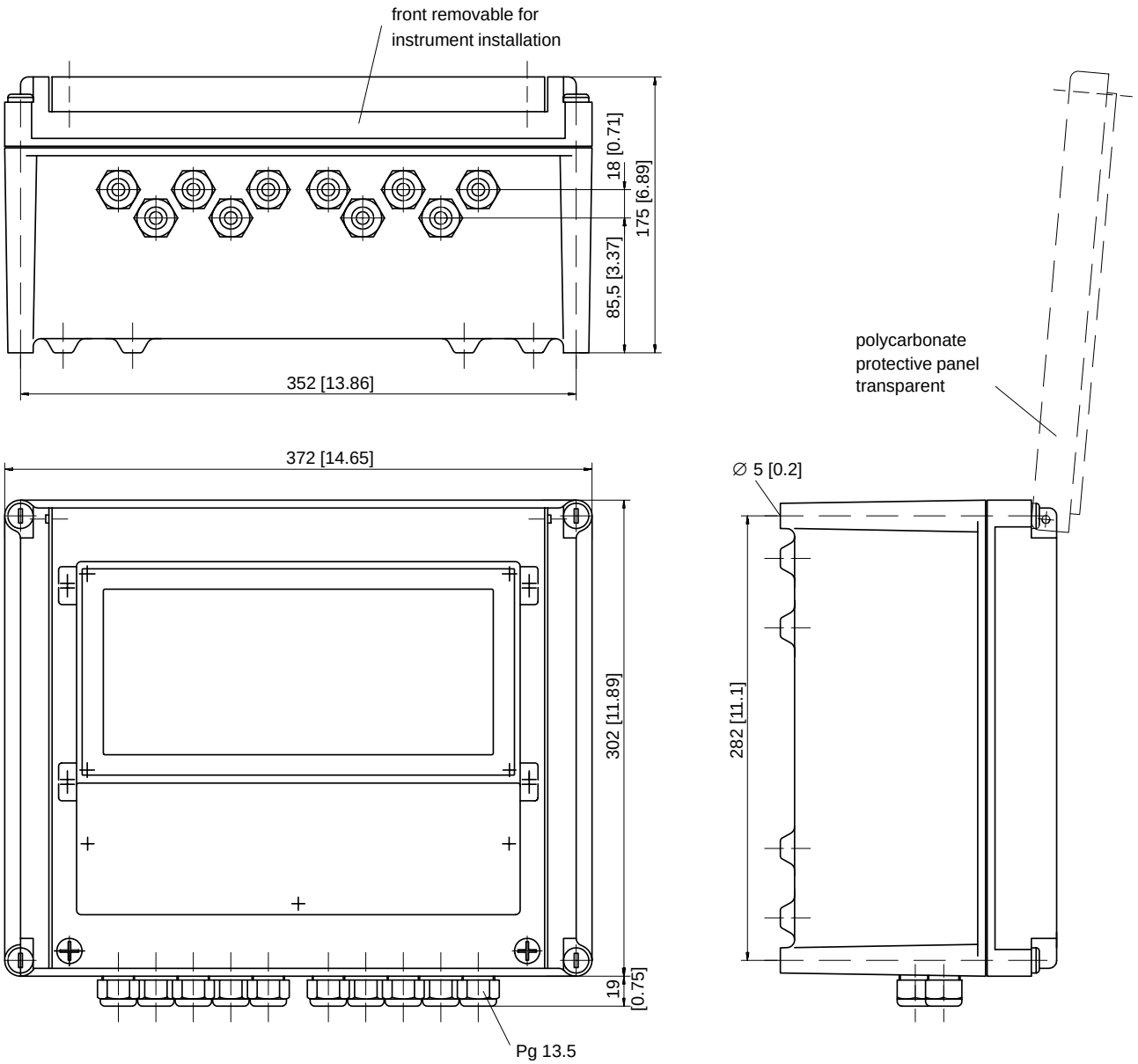
Note: All dimensions in millimeters [inches].

Fig. 10–1 Dimension drawing pH Transmitter 2500



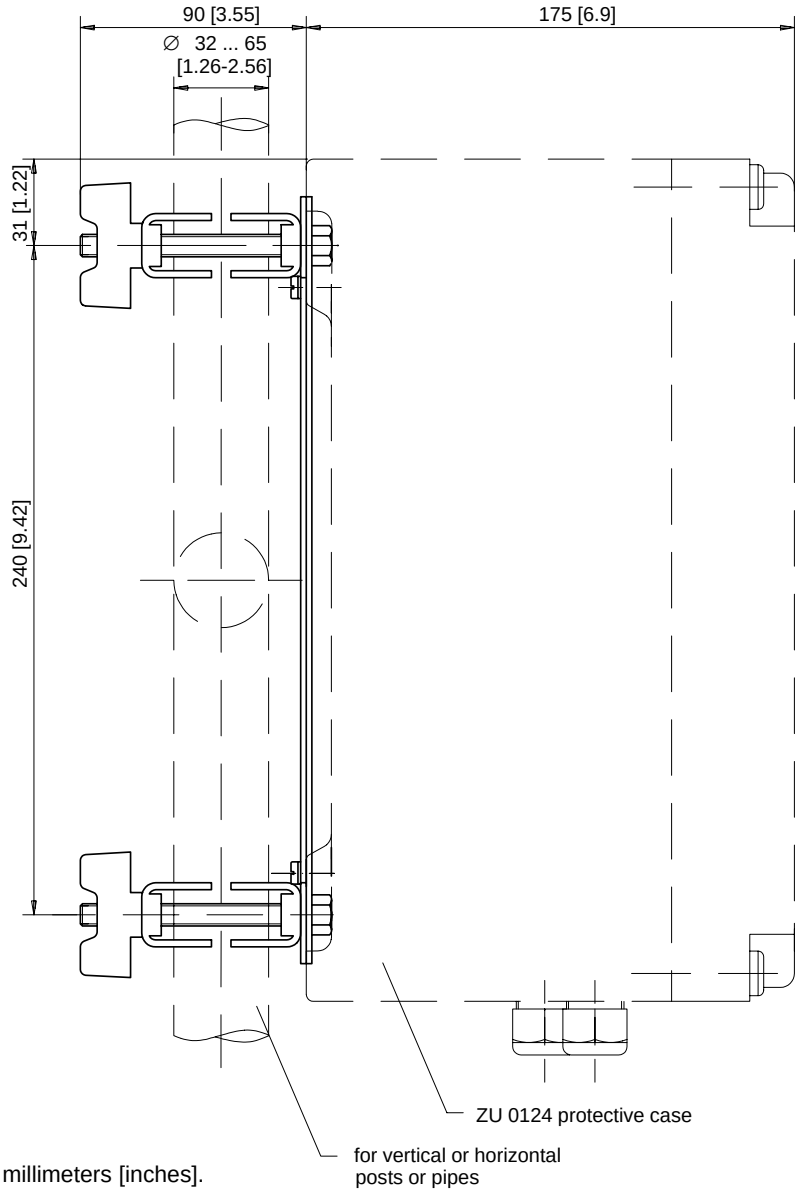
Note: All dimensions in millimeters [inches].

Fig. 10–2 Dimension drawing ZU 0126 mounting plate and ZU 0123 protective hood



Note: All dimensions in millimeters [inches].

Fig. 10–3 Dimension drawing ZU 0124 protective case



Note: All dimensions in millimeters [inches].

Fig. 10–4 ZU 0128 bracket kit for ZU 0124 protective case

How to mount the pH Transmitter 2500 in the ZU 0124 protective case

Construction

The pH Transmitter 2500 is screwed to the cabinet of the protective case via two support rails. The connection leads are passed through extension pieces to the bottom part of the protective case where they are sealed by Pg threaded cable glands.

Mounting Instruction

Transcribe the specifications from the rating plate of the pH Transmitter 2500 to the rating plate (1) supplied with the protective case. See Fig. 10–5.

Unscrew all Pg threaded cable glands and their gaskets from the pH Transmitter 2500 and save them for later mounting.

Screw the included extensions (3) with their corresponding gaskets (2) at the positions of the Pg cable glands.

Screw the two support rails (4), using two M4x8 screws and two 4.3 toothed lock washers each, *in the same direction* into the cabinet of the protective case.
Do not tighten the screws before having aligned the complete unit!

Screw the pH Transmitter 2500 (using four M5x16 screws and four 5.3 washers) onto the two support rails.
Do not tighten the screws before having aligned the complete unit!

Push the four threaded inserts (5) evenly into the free blind holes at the lid of the protective case and spread them a bit apart.

Stick the rating plate (1) onto the front cover (6) at a clearly visible position.

Screw the front cover (6) to the lid of the protective case using four screws and toothed lock washers.
Caution! The lid window must open upwards!

Place the lid onto the opening of the cabinet to align the pH Transmitter 2500 in the protective case.

Screw the Pg cable glands with gaskets into the extension pieces.

Remove the lid and hand-tighten all fastening screws.

Make the electrical connections to the pH Transmitter 2500 (see page 10–8).

Fasten the lid to the cabinet using the four assembly screws.

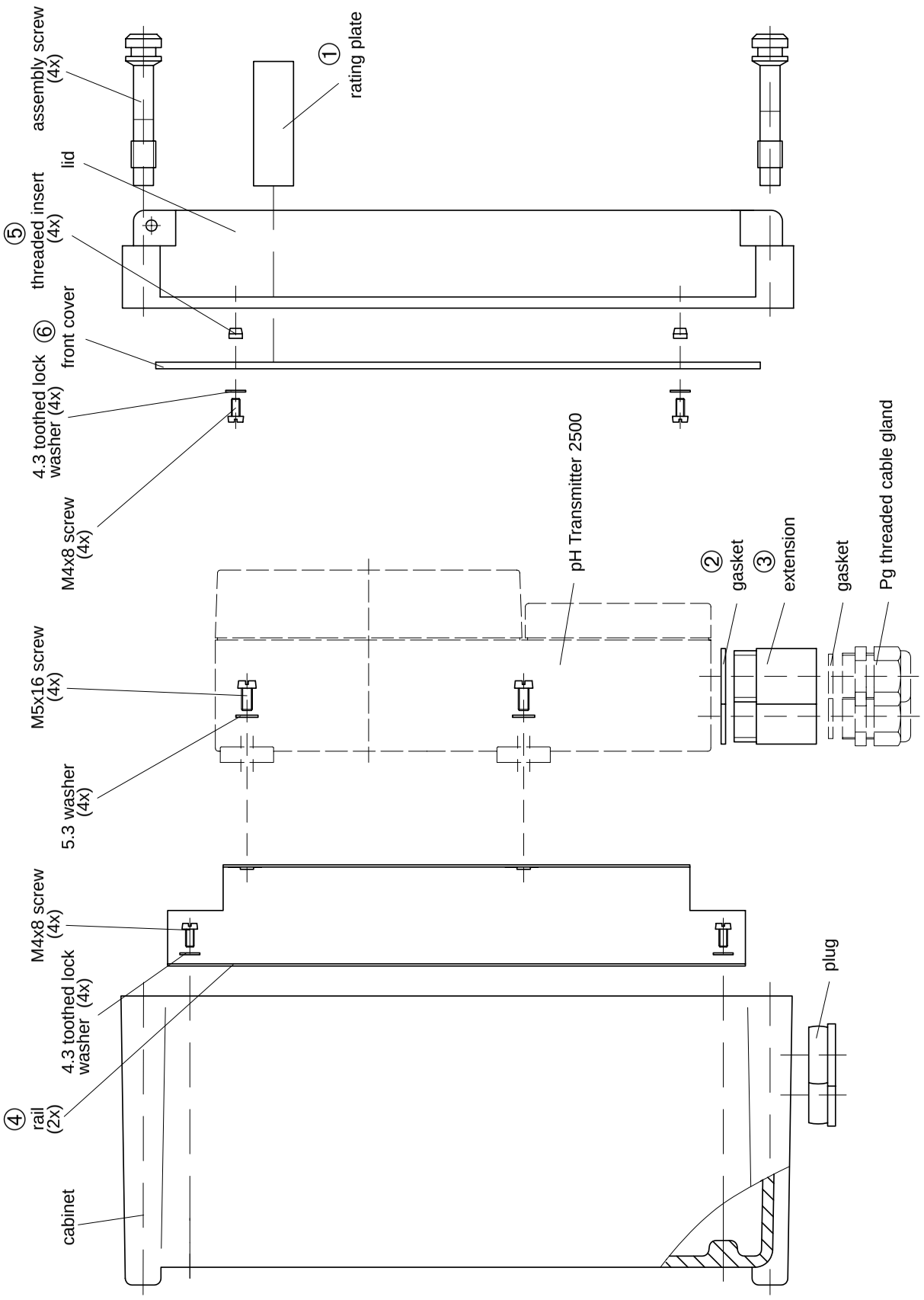


Fig. 10–5 Mounting the pH Transmitter 2500 in the protective case

Installation

Installation of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual and per applicable local and national codes. Make sure that the technical specifications and input ratings are observed.

Start-up of the pH Transmitter 2500 must be carried out only by specially trained personnel in accordance with this instruction manual and per applicable local and national codes.
Before first start-up, a *complete parameter setting* procedure must be performed by a system specialist (see chapter 8).

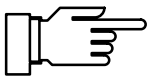
Before connecting power supply, make sure that your mains supply corresponds to the ratings on the instrument's rating plate:

230 Vac

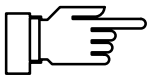
115 Vac (option 363)

24 Vac/dc (option 298)

To connect the pH Transmitter 2500, open the cover of the terminal compartment (lower part of the instrument) by removing the three screws.
Refer to Fig. 10–6 for terminal assignments.
The terminals are suitable for solid wires and stranded wires up to 2.5 mm^2.
At the left side of terminal 1 there are two clamping screws for connecting the electrode cable shield.
These clamping screws are electrically connected to terminal 4! (See also wiring examples on pages 9–15 ff.)



As delivered, all terminals are open in order to allow easy insertion of the connecting wires.
If the terminals are only half open, it may occur that the wire is pushed below the contacting element and thus does not contact when the terminal is closed.



Should your pH Transmitter be supplied with a German assignment label, simply pull it out and turn it over to read the English text.

Terminal Assignments

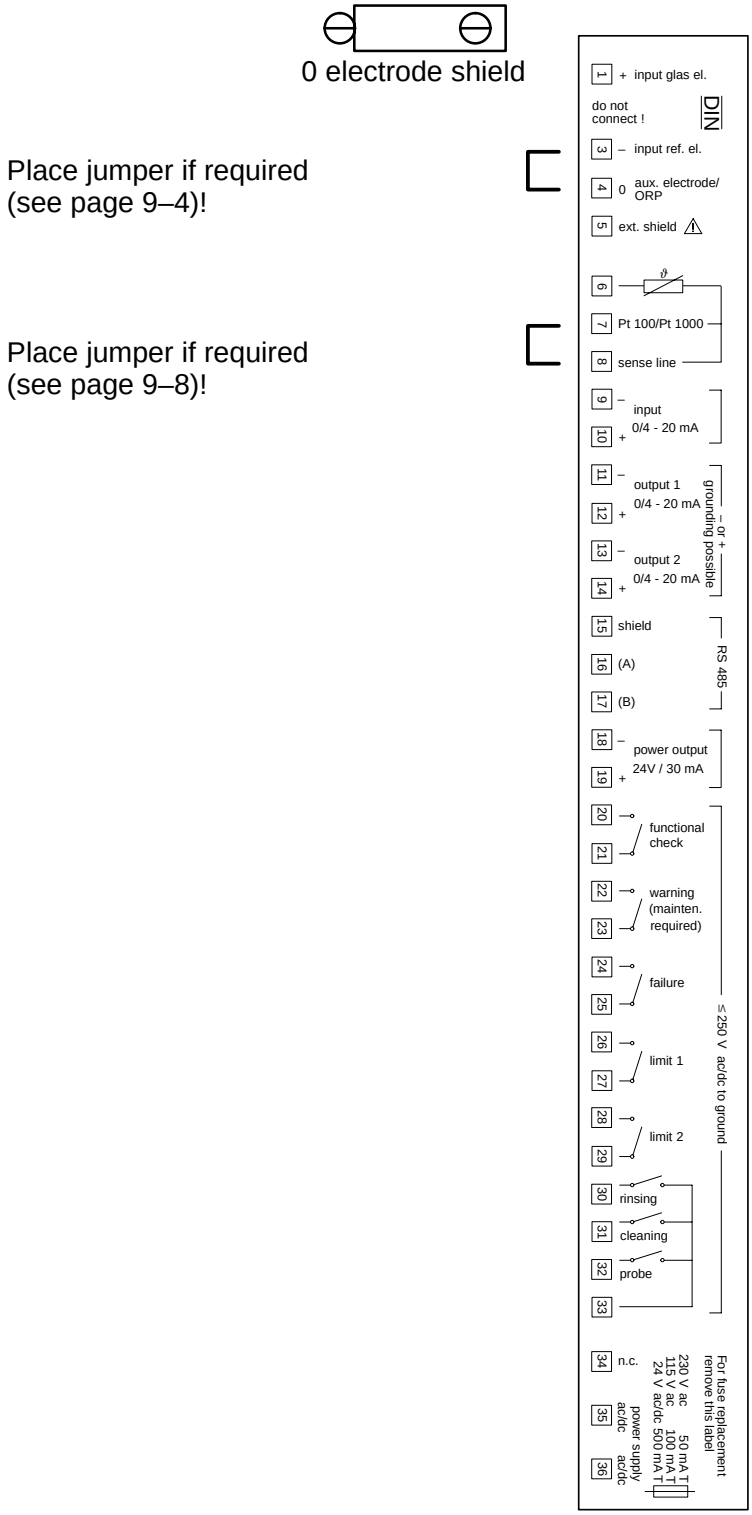


Fig. 10–6 Terminal Assignments pH Transmitter 2500

Maintenance and Cleaning

The pH Transmitter 2500 is maintenance free.

To remove dust, dirt and stains, the outer surfaces of the instrument may be wiped using a soft, lint-free cloth moistened with water. If required, you may also use a mild detergent or 2-propanol (iso-propyl alcohol).

11 Error Messages

Alphabetical Order

Error Message (Display in Diagnostics Menu “Message List”)	Possible Error Causes and Remedies
Fail CleanProbe	InClean does not reach end position (e.g. due to dirt, damage or failure of compressed air or power supply) or cleaning fluid tank empty
Fail CRC Error par	CRC data error during parameter setting: Check complete settings on the Administrator level!
Fail Hi Cal Time	Cal timer above failure limit
Fail Hi Current Inp	Input current above failure limit
Fail Hi El Slope	Slope of electrode > 61 mV/pH (Option 356: > 61 mV/pH or > (nominal slope + 5.5 mV/pH)) or above failure limit
Fail Hi El Zero	Zero point of electrode > pH 8 (Option 356: > (nominal zero point + 1 pH unit)) or above failure limit
Fail Hi Feed Time	Controller: Feed time above failure limit
Fail Hi Glass El	Glass electrode impedance above failure limit
Fail Hi mV Value	Measured value > +2,000mV or above failure limit
Fail Hi ORP Value	Measured value > +2,000 mV or above failure limit
Fail Hi pH Value	Measured value > pH 16 or above failure limit
Fail Hi Ref El	Reference electrode impedance above failure limit
Fail Hi rH Value	Measured value > 200 rH or above failure limit
Fail Hi Sensor Check	InClean sensor check above failure limit
Fail Hi Temp	Measured value > 250 °C or above failure limit
Fail Current1 Load	Current output 1: Load too high or circuit interrupted
Fail Current2 Load	Current output 2: Load too high or circuit interrupted
Fail Lo Current Inp	Input current below failure limit
Fail Lo El Slope	Slope of electrode < 50 mV/pH (Option 356: < 50 mV/pH or < (nominal slope – 5.5 mV/pH)) or below failure limit
Fail Lo El Zero	Zero point of electrode < pH 6 (Option 356: < pH 0 or < (nominal zero point – 1 pH unit)) or below failure limit

Error Message (Display in Diagnostics Menu “Message List”)	Possible Error Causes and Remedies
Fail Lo Glass El	Glass electrode impedance below failure limit
Fail Lo mV Value	Measured value < –2,000mV or below failure limit
Fail Lo ORP Value	Measured value < –2,000mV or below failure limit
Fail Lo pH Value	Measured value < pH –2 or below failure limit
Fail Lo Ref El	Reference electrode impedance below failure limit
Fail Lo rH Value	Measured value < 0 rH or below failure limit
Fail Lo Sensor Check	InClean sensor check below failure limit
Fail Lo Temp	Measured value < –50 °C or below failure limit
Fail Probe Position	InClean not in correct position (e.g. due to failure of compressed air or power supply)
Fail Rinsing Cycle	Rinsing cycle interrupted; must be restarted
Fail System Failure	Clock failure or CRC error in factory settings memory: Have meter checked by manufacturer!
Warn Buf Interchanged	Only for manual calibration
Warn Buf Unknown	Buffer not stored in Calimatic® buffer set
Warn Cal Temp	Manual calibration temperature < –50 °C or > +250°C (Calimatic®: < 0 °C or > +100°C)
Warn Control Parameters	Parameter error at controller (see page 9–36)
Warn Current1 Span	Current output 1: Initial and end value too close
Warn Current1 <0/4 mA	Current output 1: Output current below defined initial value
Warn Current1 > 20 mA	Current output 1: Output current above defined end value
Warn Current2 Span	Current output 2: Initial and end value too close
Warn Current2 <0/4 mA	Current output 2: Output current below defined initial value
Warn Current2 > 20 mA	Current output 2: Output current above defined end value
Warn Hi Cal Time	Cal timer above warning limit
Warn Hi Current Inp	Input current above warning limit
Warn Hi El Slope	Slope of electrode above warning limit
Warn Hi El Zero	Zero point of electrode above warning limit
Warn Hi Feed Time	Controller: Feed time above warning limit
Warn Hi Glass El	Glass electrode impedance above warning limit
Warn Hi mV Value	Measured mV value above warning limit

Error Message (Display in Diagnostics Menu “Message List”)	Possible Error Causes and Remedies
Warn Hi ORP Value	Measured ORP value above warning limit
Warn Hi pH Value	Measured pH value above warning limit
Warn Hi Ref El	Reference electrode impedance above warning limit
Warn Hi rH Value	Measured rH value above warning limit
Warn Hi Sensor Check	InClean sensor check above warning limit
Warn Hi Temp	Measured temperature above warning limit
Warn Hi Viso	Input value isothermal intersection potential V_{iso} > +200 mV (Option 356: > +500 mV)
Warn Identical Buffers	Calibration with identical buffer solutions
Warn Interface	Interface error: Parity or framing error
Warn Lo Current Inp	Input current below warning limit
Warn Lo El Slope	Slope of electrode below warning limit
Warn Lo El Zero	Zero point of electrode below warning limit
Warn Lo Glass El	Glass electrode impedance below warning limit
Warn Lo mV Value	Measured mV value below warning limit
Warn Lo ORP Value	Measured ORP value below warning limit
Warn Lo pH Value	Measured pH value below warning limit
Warn Lo Ref El	Reference electrode impedance below warning limit
Warn Lo rH Value	Measured rH value below warning limit
Warn Lo Sensor Check	InClean sensor check below warning limit
Warn Lo Temp	Measured temperature below warning limit
Warn Lo Viso	Input value isothermal intersection potential V_{iso} < –200 mV (Option 356: < –500 mV)
Warn RS485 Bus Address	Interface error: Invalid device address entered (0 or >31)
Warn RS485 Overflow	Interface error: Buffer overflow, too many characters received without message terminator
Warn RS485 Parameter	Interface error: Command parameter error
Warn RS485 Syntax	Interface error: Command syntax error or command not available
Warn Sensor Unstable	No stable end value for calibration after 2 min

Error Message (Display in Diagnostics Menu “Message List”)	Possible Error Causes and Remedies
Warn Time/Date	Clock had to be automatically initialized: Time must be set again!
Warn Write Protection	Interface error: Attempt to write without previous disabling of write protection

According to Interface Error Code

Error Code	Error Message (Display in Diagnostics Menu "Message List")	Possible Error Causes and Remedies
001	Fail Hi pH Value	Measured value > pH 16 or above failure limit
002	Warn Hi pH Value	Measured pH value above warning limit
003	Warn Lo pH Value	Measured pH value below warning limit
004	Fail Lo pH Value	Measured value < pH –2 or below failure limit
005	Fail Hi mV Value	Measured value > +2 000 mV or above failure limit
006	Warn Hi mV Value	Measured mV value above warning limit
007	Warn Lo mV Value	Measured mV value above warning limit
008	Fail Lo mV Value	Measured value < –2 000 mV or below failure limit
009	Fail Hi rH Value	Measured value > 200 rH or above failure limit
010	Warn Hi rH Value	Measured rH value above warning limit
011	Warn Lo rH Value	Measured rH value below warning limit
012	Fail Lo rH Value	Measured value < 0 rH or below failure limit
013	Fail Hi ORP Value	Measured value > +2 000 mV or above failure limit
014	Warn Hi ORP Value	Measured ORP value above warning limit
015	Warn Lo ORP Value	Measured ORP value below warning limit
016	Fail Lo ORP Value	Measured value < –2 000 mV or below failure limit
017	Fail Hi El Zero	Zero point of electrode > pH 8 (Option 356: > (nominal zero point + 1 pH unit) or above failure limit
018	Warn Hi El Zero	Zero point of electrode above warning limit
019	Warn Lo El Zero	Zero point of electrode below warning limit
020	Fail Lo El Zero	Zero point of electrode < pH 6 (Option 356: < pH 0 or < (nominal zero point – 1 pH unit)) or below failure limit
021	Fail Hi El Slope	Slope of electrode > 61 mV/pH (Option 356: > 61 mV/pH or > (nominal slope + 5.5 mV/pH)) or above failure limit
022	Warn Hi El Slope	Slope of electrode above warning limit
023	Warn Lo El Slope	Slope of electrode below failure limit

Error Code	Error Message (Display in Diagnostics Menu "Message List")	Possible Error Causes and Remedies
024	Fail Lo El Slope	Slope of electrode < 50 mV/pH (Option 356: < 50 mV/pH or < (nominal slope – 5.5 mV/pH)) or below failure limit
026	Warn Hi Viso	Input value isothermal intersection voltage V_{iso} > +200 mV (Option 356: > +500 mV)
027	Warn Lo Viso	Input value isothermal intersection voltage V_{iso} < –200 mV (Option 356: < –500 mV)
029	Fail Hi Glass El	Glass electrode impedance above failure limit
030	Warn Hi Glass El	Glass electrode impedance above warning limit
031	Warn Lo Glass El	Glass electrode impedance below warning limit
032	Fail Lo Glass El	Glass electrode impedance below failure limit
033	Fail Hi Ref El	Reference electrode impedance above failure limit
034	Warn Hi Ref El	Reference electrode impedance above warning limit
035	Warn Lo Ref El	Reference electrode impedance below warning limit
036	Fail Lo Ref El	Reference electrode impedance below failure limit
037	Warn Buf Unknown	Buffer not stored in Calimatic® buffer set
038	Warn Identical Buffers	Calibration with identical buffer solutions
039	Warn Buf Interchanged	Only with manual calibration
080	Fail Hi Temperature	Measured value > 250 °C or above failure limit
081	Warn Hi Temperature	Measured temperature above warning limit
082	Warn Lo Temperature	Measured temperature below warning limit
083	Fail Lo Temperature	Measured value < –50 °C or below failure limit
084	Fail Hi Current Inp	Input current above failure limit
085	Warn Hi Current Inp	Input current above warning limit
086	Warn Lo Current Inp	Input current below warning limit
087	Fail Lo Current Inp	Input current below failure limit
088	Fail Hi Cal Time	Cal timer above failure limit
089	Warn Hi Cal Time	Cal timer above warning limit
092	Warn RS485 Overflow	Interface error: Buffer overflow, too many characters received without message terminator
093	Warn Interface	Interface error: Parity or framing error

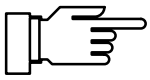
Error Code	Error Message (Display in Diagnostics Menu “Message List”)	Possible Error Causes and Remedies
094	Warn RS485 Syntax	Interface error: Command syntax error or command not available
095	Warn RS485 Parameter	Interface error: Command parameter error
096	Warn RS485 Bus Address	Interface error: Invalid device address entered (0 or > 31)
097	Warn Current1 Span	Current output 1: Initial and end value too close
098	Warn Current1 <0/4 mA	Current output 1: Output current below defined initial value
099	Warn Current1 > 20 mA	Current output 1: Output current above defined end value
100	Fail Current1 Load	Current output 1: Load too high or circuit interrupted
101	Warn Current2 Span	Current output 2: Initial and end value too close
102	Warn Current2 <0/4 mA	Current output 2: Output current below defined initial value
103	Warn Current2 > 20 mA	Current output 2: Output current above defined end value
104	Fail Current2 Load	Current output 2: Load too high or circuit interrupted
105	Warn Cal Temp	Manual calibration temperature < –50 °C or > +250°C (Calimatic®: < 0 °C or > +100°C)
106	Warn Sensor Unstable	No stable end value for calibration after 2 min
108	Warn Time/Date	Clock had to be automatically initialized: Time must be set again!
109	Warn Control Parameters	Parameter error at controller (see page 9–36)
110	Fail CRC Error par	CRC data error during parameter setting: Check complete settings on the Administrator level!
111	Fail Hi Feed Time	Controller: Feed time above failure limit
112	Warn Hi Feed Time	Controller: Feed time above warning limit
115	Fail Rinsing Cycle	Rinsing cycle interrupted; must be restarted
116	Warn Write Protection	Interface error: Attempt to write without previous disabling of write protection
117	Fail CleanProbe	InClean does not reach end position (e.g. due to dirt, damage or failure of compressed air or power supply) or cleaning fluid tank empty
118	Fail Probe Position	InClean not in correct position (e.g. due to failure of compressed air or power supply)
119	Fail Hi Sensor Check	InClean sensor check above failure limit
120	Warn Hi Sensor Check	InClean sensor check above warning limit

Error Code	Error Message (Display in Diagnostics Menu “Message List”)	Possible Error Causes and Remedies
121	Warn Lo Sensor Check	InClean sensor check below warning limit
122	Fail Lo Sensor Check	InClean sensor check below failure limit
255	Fail System Failure	Clock failure or CRC error in factory settings memory: Have instrument checked by manufacturer!

12 Interface Commands

Contents

Transmission behavior



For fault-free data exchange between the connected computer and the pH Transmitter 2500, the parameter settings of both instruments must match (also see Pg. 9–55).

Read/Write

Read commands:
Read commands (queries) always supply an answer.

Write commands:
For write commands the answer depends on the parameter setting.

The “WPMSR1” command switches on the check-back signal following write commands.
The check-back signal is output as an empty string (message terminators only).
The check-back signal acknowledges the complete processing of the received command.
The receiving buffer is released again. The check-back signal does not mean that the command has been transmitted fault-free!
With the check-back signal switched off, it is necessary to wait until the processing time of the pH Transmitter 2500 runs out. This may vary greatly. To avoid transmission errors, the waiting time should be at least one second.

Parameter setting strings

The characters of the standard ASCII character set (numbers 0 – 9, lower-case and upper-case letters, special characters such as +, – ...) are used.
Spaces (blanks) in the parameter setting string are read over. Therefore, they can be used as often as desired for formatting. No spaces may be used in numerical parameters.
Answers of the pH Transmitter 2500 contain only upper-case letters.

Each parameter setting string must be ended with a message terminator. A <cr> (carriage return), <lf> (line feed) or a combination of the two can be transmitted. The pH Transmitter 2500 does not begin processing the received command until the message terminator is received.
Without message terminators the receiving buffer fills up. When the receiving buffer is full, the error message “Warn RS 485 Overflow” appears.

Numerical parameters

Numerical parameters can be entered as desired with or without an exponent. Additional places to the right of the decimal point are ignored. Parameters can only be transmitted in their basic units, e.g., “124 mV” is represented as “124E–3” in volts.

The pH Transmitter 2500 always selects the shortest possible display form, i.e., “pH 7.00” is transmitted as “7”.

VALUE Commands: Query measured values

With the value commands, all measured values of the pH Transmitter 2500 can be queried. Value commands are read commands. As a result, the device status of the pH Transmitter 2500 is not changed.

Command	Meaning
RV0	Query measured pH value
RV1	Query measured mV value
RV2	Query measured °C value
RV5	Query input current
RV6	Query measured rH value
RVUH	Query measured ORP value
RVI1	Query output current 1
RVI2	Query output current 2 (option 350 only)
RVRR	Query reference electrode impedance
RVRG	Query glass electrode impedance
RVTRT	Query time ”hhmmss”
RVDRT	Query date ”ddmmyy” (sequence depending on setting)
RVTCA	Query cal timer count
RVYCI	Query digital controller output (option 353 only)
RVYCN	Query analog controller output (option 483 only)

STATUS Commands: Query messages and states

With the status commands, the device messages, such as the NAMUR messages Functional check, Warning (maintenance required) and Failure can be read out, device states monitored and the logs interrogated. With the status commands, data can be accessed which can be used for QM documentation to ISO 9000. Status commands are read commands. As a result, the device status of the pH Transmitter 2500 is not changed.

Command	Function	Response	Meaning
RSF1	Query first failure message	xxx	
RSFA	Query all failure messages	xxx;xxx ...	
RSW1	Query first warning message	xxx	
RSWA	Query all warning messages	xxx;xxx ...	
RSP	Query device status (”menu”)	00	measuring mode
		01	parameter setting opl, adm
		02	calibration cal
		08	maintenance maint
		10	measuring mode, probe rinsing running, started by timer
		11	parameter setting opl, adm & probe rinsing running, started by timer
		18	maintenance, probe rinsing running, started manually
RSL	Query limit messages	0	no limit message
		1	limit 1 enabled
		2	limit 2 enabled
		3	both limits enabled

Command	Function	Bit	Meaning
RSU	Query device status (messages, limits, SRQS)	1	”1” if one or more failure messages are active
		2	”1” if one or more warning messages are active
		3	”1” if functional check is active
		4	”1” if limit 1 and/or limit 2 are active
		5	”1” if outputs are frozen (e.g. during calibration)
		6	always ”1”
		7	”1” if there has been a status change since last query
		8	always ”0”

Query electrode statistics

Command	Function	Parameter
RSSTT*m*	Query time of calibration	*m* = 0...3
RSSTD*m*	Query date of calibration	*m* = 0...3
RSSTZ0	Query zero point of electrode	
RSSTS0	Query slope of electrode	
RSSTRG0	Query glass electrode impedance	
RSSTRR0	Query reference electrode impedance	
RSSTTR*m*	Query electrode response time	*m* = 0...3
RSSTZD*m*	Query deviation of zero point	*m* = 1...3
RSSTSD*m*	Query deviation of slope	*m* = 1...3
RSSTRGD*m*	Query deviation of glass electrode impedance	*m* = 1...3
RSSTRRD*m*	Query deviation of reference electrode impedance	*m* = 1...3

Query calibration record of last calibration

Command	Function
RSCPT	Query calibration time
RSCPD	Query calibration date
RSCP1NB	Query nominal value of 1st buffer
RSCP11	Query electrode potential with 1st buffer
RSCP12	Query calibration temperature with 1st buffer
RSCP1TR	Query response time with 1st buffer
RSCP2NB	Query nominal value of 2nd buffer
RSCP21	Query electrode potential with 2nd buffer
RSCP22	Query calibration temperature with 2nd buffer
RSCP2TR	Query response time with 2nd buffer

Command	Function	Re-sponse	Meaning
RSCPA	Query calibration mode	”0”	Calimatic®
		”1”	manual input
		”2”	data input
		”3”	sample calibration

Logbook: Query entries (only with option 354)

For complete interrogation of the logbook, first use the “RSLOO” command to read the oldest entry. Then use the “RSLOOC” command until an empty string (message terminators only) is received as an answer. The empty string means that there are no more entries.
If only new logbook entries are to be read which have not yet been read out via the interface, use the “RSLOOC” command immediately.

Command	Function
RSLON	Query latest entry
RSLONC	Query previous entry (starts with entry previous to latest entry)
RSLOO	Query first entry
RSLOOC	Query following entry (starts with entry following the first entry)

Device Diagnostics: Query status

Command	Function	Response	Meaning
RSTETR	Query RAM test time	hhmmss	
RSTEDR	Query RAM test date	ddmmyy*)	
RSTERR	Query RAM test result	”0”	ok
		”2”	failure
RSTETP	Query EPROM test time	hhmmss	
RSTEDP	Query EPROM test date	ddmmyy*)	
RSTERP	Query EPROM test result	”0”	ok
		”2”	failure
RSTETE	Query EEPROM test time	hhmmss	
RSTEDE	Query EEPROM test date	ddmmyy*)	
RSTERE	Query EEPROM test result	”0”	ok
		”2”	failure
RSTETDI	Query display test time	hhmmss	
RSTEDDI	Query display test date	ddmmyy*)	
RSTERDI	Query display test result	”0”	test executed
		”2”	failure
RSTETKY	Query keypad test time	hhmmss	
RSTEDKY	Query keypad test date	ddmmyy*)	
RSTERKY	Query keypad test result	”0”	ok
		”2”	failure

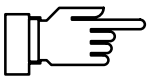
*) format depending on setting

PARAMETER Commands: Query settings and set parameters

With the parameter commands, all functions of the pH Transmitter 2500 can be defined via the computer interface (with the exception of the interface transmission parameters).

With the parameter commands, all instrument parameters can be read and written! Therefore, the correctness of the transmitted commands is particularly important. Transmission in the point-to-point mode is not secured with checksums. To avoid incorrect settings, it is therefore advisable to read back important parameters for a comparison.

With the first write command, the controlling computer (PC, SPS, ...) assumes control of the pH Transmitter 2500. Security prompts must then be implemented in the computer! With the “WCOMIN0” command (go to local) the computer returns control to the pH Transmitter 2500. The pH Transmitter 2500 restarts in the measuring mode. Read commands cause no status changes and do not influence the system functions. The pH Transmitter 2500 continues to be in control.



When the write protection is switched on, any write attempts without switching off the write protection beforehand or with an invalid passcode are entered in the logbook. As delivered, write protection is switched off.

If parameter setting is called up with the device keypad, the NAMUR message Functional check is set. Warning and failure contacts are deactivated until parameter setting is completed.
If device parameters are changed via the RS 485 interface, all messages are released. As a result, temporary messages may occur when changing parameters which would have been suppressed had the keypad been used.

WCOM01 With the interface command “WCOM01” the device can be switched to the parameter setting mode. The NAMUR message Functional check is then set and with it the warning and failure contact also deactivated in the interface mode.
Return to the measuring mode with “WCOM00”.

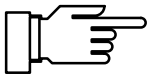
WCOU1 If all device functions are to be frozen during parameter setting, use the command “WCOU1” command. The function check is set, and the warning and failure contact deactivated. The output current and controller are also frozen and the limit-value contacts are inactive.
Unfreeze the device functions with “WCOU0”.

Point of Measurement

RPUAM	Query marker
WPUAM0	Set marker ”Off”
WPUAM1	Set marker ”On”
RPUAW	Query entered point of measurement
WPUAW*aaaaaaaaaaaaaaa*	Enter point of measurement *a* = ASCII character: blank, ”0” ... ”9”, ”A ” ... ”Z”, ”–”, ”+”, ”/”

Clock

RPRTM	Query marker
WPRTM0	Set marker ”Off”
WPRTM1	Set marker ”On”
RPRTDF	Query date format
WPRTDF0	Set date format ”D.M.Y“
WPRTDF1	Set date format ”D/M/Y“
WPRTDF2	Set date format ”M/D/Y“
WPRTDF3	Set date format ”Y–M–D“



For setting time/date: see page 12–32

For query of time/date: see page 12–5

Calibration by Manual Input of Buffer Values

RPCAB*b*	Query settings of manual buffer *b*
WPCAB*b p*	Enter manual buffer *p* (*b* = 0 or 1)

Calibration by Data Entry of Premeasured Electrodes

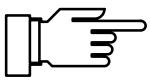
RPCA0Z	Query currently measured zero point
WPCA0Z*p*	Enter zero point *p*
RPCA0S	Query currently measured slope
WPCA0S*p*	Enter slope *p*
RPCA0U	Query currently measured isothermal intersection potential V_{iso}
WPCA0U*p*	Enter V_{iso} *p*

Calibration by Sampling

RPCAP	Query sample value
WPCAP*p*	Enter sample value *p*

Temperature Probe Adjustment

RPTFS	Query temperature probe adjustment settings
WPTFS0	Disable temperature probe adjustment
WPTFS1	Enable temperature probe adjustment



For input of adjustment value: see page 12–33

Measurement Display

RPDIMM	Query marker
WPDIMM0	Set marker ”Off”
WPDIMM1	Set marker ”On”
RPDIMA	Query process variable assigned
WPDIMA0	Assign pH value to measurement display
WPDIMA1	Assign mV value to measurement display
WPDIMA2	Assign temperature value to measurement display
WPDIMAUH	Assign ORP to measurement display
WPDIMA6	Assign rH value to measurement display
WPDIMATRT	Assign time to measurement display
RPDIMD	Measurement display: Query number of indicated pH digits
WPDIMD0	Display pH value with 1 digit behind decimal point (xx.x)
WPDIMD1	Display pH value with 2 digits behind decimal point (xx.xx)
RPDIMVA	Query viewing angle
WPDIMVA–*n*	Adjust viewing angle (n = –2 ... 0 ... +2)

Parameter Setting of Left Secondary Display

RPDISLA	Query process variable assigned
WPDISLA0	Display pH value
WPDISLA1	Display mV value
WPDISLA2	Display temperature
WPDISLA5	Display input current
WPDISLA6	Display rH value
WPDISLAUH	Display ORP
WPDISLAI1	Display output current 1

WPDISLAI2	Display output current 2 (only with option 350)
WPDISLARR	Display reference electrode impedance
WPDISLARG	Display glass electrode impedance
WPDISLATRT	Display time
WPDISLADRT	Display date
WPDISLATCA	Display calibration timer interval
WPDISLADCI	Display digital-controller setpoint (option 353 only)
WPDISLADCN	Display analog-controller setpoint (option 483 only)
WPDISLAYCI	Display digital-controller output (option 353 only)
WPDISLAYCN	Display analog-controller output (option 483 only)
WPDISLATM	Display manually adjusted temperature

Parameter Setting of Right Secondary Display

RPDISRA	Query process variable assigned
WPDISRA0	Display pH value
WPDISRA1	Display mV value
WPDISRA2	Display temperature
WPDISRA5	Display input current
WPDISRA6	Display rH value
WPDISRAUH	Display ORP
WPDISRAI1	Display output current 1
WPDISRAI2	Display output current 2 (only with option 350)
WPDISRARR	Display reference electrode impedance
WPDISRARG	Display glass electrode impedance
WPDISRATRT	Display time
WPDISRADRT	Display date
WPDISRATCA	Display calibration timer interval
WPDISRADCI	Display digital-controller setpoint (option 353 only)
WPDISRADCN	Display analog-controller setpoint (option 483 only)
WPDISRAYCI	Display digital-controller output (option 353 only)
WPDISRAYCN	Display analog-controller output (option 483 only)
WPDISRATM	Display manually adjusted temperature

Input Filter

RPIFM	Query marker
WPIFM0	Set marker ”Off”
WPIFM1	Set marker ”On”
RPIF	Query input filter
WPIF0	Disable input filter
WPIF1	Enable input filter

Calimatic® Buffer Set

RPCASM	Query marker
WPCASM0	Set marker ”Off”
WPCASM1	Set marker ”On”
RPCASA	Query Calimatic® buffer set
WPCASA0	Select customer specific buffer set (only with option 370 ... 379)
WPCASA1	Select buffer set Merck/Riedel
WPCASA2	Select buffer set Ingold
WPCASA3	Select buffer set DIN (*not* with option 370 ... 379)

Nominal Zero Point/Nominal Slope (Option 356)

RPCA0NM	Query marker
WPCA0NM0	Set marker ”Off”
WPCA0NM1	Set marker ”On”
RPCA0NZ	Query entered nominal zero point
WPCA0NZ*p*	Set nominal zero point
RPCA0NS	Query entered nominal slope
WPCA0NS*p*	Set nominal slope

pH Alarm

RPALF0S	Query settings
WPALF0S0	Disable alarm
WPALF0S1	Enable alarm
RPALF0FL	Query failure limit Lo
WPALF0FL*p*	Set failure limit Lo *p*
RPALF0WL	Query warning limit Lo
WPALF0WL*p*	Set warning limit Lo *p*
RPALF0WH	Query warning limit Hi
WPALF0WH*p*	Set warning limit Hi *p*
RPALF0FH	Query failure limit Hi
WPALF0FH*p*	Set failure limit Hi *p*

mV Alarm

RPALF1S	Query settings
WPALF1S0	Disable alarm
WPALF1S1	Enable alarm
RPALF1FL	Query failure limit Lo
WPALF1FL*p*	Set failure limit Lo *p*
RPALF1WL	Query warning limit Lo
WPALF1WL*p*	Set warning limit Lo *p*
RPALF1WH	Query warning limit Hi
WPALF1WH*p*	Set warning limit Hi *p*
RPALF1FH	Query failure limit Hi
WPALF1FH*p*	Set failure limit Hi *p*

Cal Timer Alarm

RPALFTS	Query settings
WPALFTS0	Disable alarm
WPALFTS1	Enable alarm
RPALFTWH	Query warning limit Hi
WPALFTWH*p*	Set warning limit Hi *p*
RPALFTFH	Query failure limit Hi
WPALFTFH*p*	Set failure limit Hi *p*

Slope Alarm

RPALFSS	Query settings
WPALFSS0	Disable alarm
WPALFSS1	Enable alarm
RPALFSFL	Query failure limit Lo
WPALFSFL*p*	Set failure limit Lo *p*
RPALFSWL	Query warning limit Lo
WPALFSWL*p*	Set warning limit Lo *p*
RPALFSWH	Query warning limit Hi
WPALFSWH*p*	Set warning limit Hi *p*
RPALFSFH	Query failure limit Hi
WPALFSFH*p*	Set failure limit Hi *p*

Zero Point Alarm

RPALFZS	Query settings
WPALFZS0	Disable alarm
WPALFZS1	Enable alarm
RPALFZFL	Query failure limit Lo
WPALFZFL*p*	Set failure limit Lo *p*

RPALFZWL	Query warning limit Lo
WPALFZWL*p*	Set warning limit Lo *p*
RPALFZWH	Query warning limit Hi
WPALFZWH*p*	Set warning limit Hi *p*
RPALFZFH	Query failure limit Hi
WPALFZFH*p*	Set failure limit Hi *p*

TC Process Medium

RPTCM	Query marker
WPTCM0	Set marker ”Off”
WPTCM1	Set marker ”On”
RPTCS	Query TC adjustment
WPTCS0	Disable TC
WPTCS1	Set TC ”ultrapure water”

Temperature Detection

RPTOMM	Query marker
WPTOMM0	Set marker ”Off”
WPTOMM1	Set marker ”On”
RPTOT	Query temperature probe
WPTOT1	Set Pt 1000 temperature probe
WPTOT2	Set Pt 100 temperature probe
RPTOMA	Query measuring temperature detection
WPTOMA0	Enable manual temperature detection
WPTOMA1	Enable automatic temperature detection
RPTMMV	Query manual temperature detection
WPTMMV*p*	Set manual measuring temperature *p*
RPTOCA	Query calibration temperature detection
WPTOCA0	Enable manual calibration temperature detection
WPTOCA1	Enable automatic calibration temperature detection
RPTMCV	Query manual calibration temperature
WPTMCV*p*	Write manual calibration temperature *p*

Temperature Alarm

RPALF2S	Query settings
WPALF2S0	Disable alarm
WPALF2S1	Enable alarm
RPALF2FL	Query failure limit Lo
WPALF2FL*p*	Set failure limit Lo *p*
RPALF2WL	Query warning limit Lo
WPALF2WL*p*	Set warning limit Lo *p*
RPALF2WH	Query warning limit Hi
WPALF2WH*p*	Set warning limit Hi *p*
RPALF2FH	Query failure limit Hi
WPALF2FH*p*	Set failure limit Hi *p*

Current Output 1

RPOC1M	Query marker
WPOC1M0	Set marker ”Off”
WPOC1M1	Set marker ”On”
RPOC1A	Query process variable assigned
WPOC1A0	Assign pH value as process variable
WPOC1A1	Assign mV value as process variable
WPOC1A2	Assign measuring temperature as process variable
WPOC1A6	Assign rH value as process variable
WPOC1AUH	Assign ORP value as process variable
RPOC1Z	Query operating mode 0 – 20mA / 4 – 20mA
WPOC1Z0	Set operating mode 0 – 20mA
WPOC1Z1	Set operating mode 4 – 20mA
RPOC1L	Query initial value
WPOC1L*p*	Set initial value *p*
RPOC1H	Query end value
WPOC1H*p*	Set end value *p*

Current Output 2 (only with Option 350)

RPOC2M	Query marker
WPOC2M0	Set marker ”On”
WPOC2M1	Set Marker ”Off”
RPOC2A	Query process variable assigned
WPOC2A0	Assign pH value as process variable
WPOC2A1	Assign mV value as process variable
WPOC2A2	Assign measuring temperature as process variable
WPOC2A6	Assign rH value as process variable
WPOC2AUH	Assign ORP value as process variable
RPOC2Z	Query operating mode 0 – 20mA / 4 – 20mA
WPOC2Z0	Set operating mode 0 – 20mA
WPOC2Z1	Set operating mode 4 – 20mA
RPOC2L	Query initial value
WPOC2L*p*	Set initial value *p*
RPOC2H	Query end value
WPOC2H*p*	Set end value *p*

Output 2/Controller (only with Option 483)

RPCNS	Query settings (current 2 or analog controller) (option 483 only)
WPCNS0	Set output 2 as control output (option 483 only)
WPCNS1	Set parameters for analog controller operation (option 483 only)

Glass Electrode Impedance Alarm

RPALFGS	Query Settings
WPALFGS0	Disable alarm
WPALFGS1	Enable alarm
RPALFGFL	Query failure limit Lo

WPALFGFL*p*	Set failure limit Lo *p*
RPALFGWL	Query warning limit Lo
WPALFGWL*p*	Set warning limit Lo *p*
RPALFGWH	Query warning limit Hi
WPALFGWH*p*	Set warning limit Hi *p*
RPALFGFH	Query failure limit Hi
WPALFGFH*p*	Set failure limit Hi *p*

Reference Electrode Impedance Alarm

RPALFRS	Query Settings
WPALFRS0	Disable alarm
WPALFRS1	Enable alarm
RPALFRFL	Query failure limit Lo
WPALFRFL*p*	Set failure limit Lo *p*
RPALFRWL	Query warning limit Lo
WPALFRWL*p*	Set warning limit Lo *p*
RPALFRWH	Query warning limit Hi
WPALFRWH*p*	Set warning limit Hi *p*
RPALFRFH	Query failure limit Hi
WPALFRFH*p*	Set failure limit Hi *p*

rH Measurement

RPREM	Query marker
WPREM0	Set marker ”Off”
WPREM1	Set Marker ”On”

RPREFS	Prompt ”Calculate rH with correction factor” set?
WPREFS0	Set ”Calculate rH with factor Off”
WPREFS1	Set ”Calculate rH with factor On”
RPREFV	Query correction factor
WPREFV*p*	Set correction factor *p*

RPRERT	Query reference electrode type
WPRERT0	Set type A silver chloride (Ag/AgCl, KCl 1 M)
WPRERT1	Set type B silver chloride (Ag/AgCl, KCl 3 M)
WPRERT2	Set type C Thalamid (Hg, Tl/TlCl, KCl 3.5 M)
WPRERT3	Set type D mercury sulfate (Hg/Hg_2SO_4, K_2SO_4 sat.)

rH Alarm

RPALF6S	Query settings
WPALF6S0	Disable alarm
WPALF6S1	Enable alarm
RPALF6FL	Query failure limit Lo
WPALF6FL*p*	Set failure limit Lo *p*
RPALF6WL	Query warning limit Lo
WPALF6WL*p*	Set warning limit Lo *p*
RPALF6WH	Query warning limit Hi
WPALF6WH*p*	Set warning limit Hi *p*
RPALF6FH	Query failure limit Hi
WPALF6FH*p*	Set failure limit Hi *p*

ORP Alarm

RPALFUS	Query settings
WPALFUS0	Disable alarm
WPALFUS1	Enable alarm
RPALFUFL	Query failure limit Lo
WPALFUFL*p*	Set failure limit Lo *p*
RPALFUWL	Query warning limit Lo
WPALFUWL*p*	Set warning limit Lo *p*
RPALFUWH	Query warning limit Hi
WPALFUWH*p*	Set warning limit Hi *p*
RPALFUFH	Query failure limit Hi
WPALFUFH*p*	Set failure limit Hi *p*

Alarm Settings

RPALM	Query marker
WPALM0	Set marker ”Off”
WPALM1	Set marker ”On”

NAMUR Contacts

RPCNM	Query marker settings
WPCNM0	Set marker ”Off”
WPCNM1	Set marker ”On”
RPCNUO	Query normally open/normally closed contacts
WPCNUO0	Set normally closed contacts
WPCNUO1	Set normally open contacts
RPCNUOTF	Query failure delay
WPCNUOTF*p*	Set failure delay *p*
RPCNUOTW	Query warning delay
WPCNUOTW*p*	Set warning delay *p*

Limit Contacts/Controller (Option 353 only)

RPCIM	Query marker
WPCIM0	Set marker ”Off”
WPCIM1	Set marker ”On”
RPCIS	Query setting (limit contacts or controller)
WPCIS0	Set limit contact operation
WPCIS1	Set controller operation

Limit Contact 1

RPLI1A	Query process variable assigned to limit 1
WPLI1A0	Assign pH as process variable for limit 1
WPLI1A1	Assign mV as process variable for limit 1

WPLI1A2	Assign measuring temperature as process variable for limit 1
WPLI1A5	Assign input current as process variable for limit 1
WPLI1A6	Assign rH as process variable for limit 1
WPLI1AUH	Assign ORP as process variable for limit 1
RPLI1D	Query effective direction limit 1
WPLI1D0	Set effective direction Min for limit 1
WPLI1D1	Set effective direction Max for limit 1
RPLI1V	Query limit 1
WPLI1V*p*	Set limit 1 *p*
RPLI1H	Query limit 1 hysteresis (deadband)
WPLI1H*p*	Set hysteresis (deadband) limit 1 *p*
RPLI1CN	Query limit contact 1
WPLI1CN0	Set limit contact 1 as normally closed
WPLI1CN1	Set limit contact 1 as normally open

Limit Contact 2

RPLI2A	Query process variable assigned to limit 2
WPLI2A0	Assign pH as process variable for limit 2
WPLI2A1	Assign mV as process variable for limit 2
WPLI2A2	Assign measuring temperature as process variable for limit 2
WPLI2A5	Assign input current as process variable for limit 2
WPLI2A6	Assign rH as process variable for limit 2
WPLI2AUH	Assign ORP as process variable for limit 2
RPLI2D	Query effective direction limit 2
WPLI2D0	Set effective direction Min for limit 2
WPLI2D1	Set effective direction Max for limit 2
RPLI2V	Query limit 2
WPLI2V*p*	Set limit *2 p*

RPLI2H	Query limit 2 hysteresis (deadband)
WPLI2H*p*	Set hysteresis (deadband) limit 2 *p*
RPLI2CN	Query setting of limit contact 2
WPLI2CN0	Set limit contact 2 as normally closed
WPLI2CN1	Set limit contact 2 as normally open

Digital Controller (Option 353, not with Option 483)

RPCITA	Query controller type
WPCITA0	Type A: Set pulse length controller
WPCITA1	Type B: Set pulse frequency controller

RPCIA	Query controlled variable
WPCIA0	Set pH as controlled variable
WPCIA1	Set mV as controlled variable
WPCIA2	Set measuring temperature as controlled variable
WPCIA6	Set rH as controlled variable
WPCIAUH	Set ORP as controlled variable
RPCID	Query setpoint
WPCID*p*	Set setpoint *p*
RPCINZ	Query neutral zone
WPCINZ*p*	Set neutral zone *p*
RPCILT	Query minimum ON time
WPCILT*p*	Set minimum ON time *p*
RPCILF	Query maximum pulse frequency
WPCILF*p*	Set maximum pulse frequency *p*
RPCIBV	Query ◀ beginning of control
WPCIBV*p*	Set ◀ beginning of control *p*
RPCIBX	Query ◀ corner point X
WPCIBX*p*	Set ◀ corner point X *p*

RPCIBY	Query ◀ corner point Y
WPCIBY*p*	Set ◀ corner point Y *p*
RPCIBT	Query ◀ reset time
WPCIBT*p*	Set ◀ reset time *p*
RPCIBP	Query ◀ period
WPCIBP*p*	Set ◀ period *p*
RPCIEV	Query ▶ end of control
WPCIEV*p*	Set ▶ end of control *p*
RPCIEX	Query ▶ corner point X
WPCIEX*p*	Set ▶ corner point X *p*
RPCIEY	Query ▶ corner point Y
WPCIEY*p*	Set ▶ corner point Y *p*
RPCIET	Query ▶ reset time
WPCIET*p*	Set ▶ reset time *p*
RPCIEP	Query ▶ period
WPCIEP*p*	Set ▶ period *p*

Analog Controller (Option 483, not with Option 353)

RPCNTA	Query controller type
WPCNTA0	Type A: Set 3-way mixing valve
WPCNTA1	Type B: Set straightway valve (< setpoint)
WPCNTA2	Type C: Set straightway valve (> setpoint)

RPCNA	Query controlled variable
WPCNA0	Set pH as controlled variable
WPCNA1	Set mV as controlled variable
WPCNA2	Set measuring temperature as controlled variable
WPCNA6	Set rH as controlled variable
WPCNAUH	Set ORP as controlled variable

RPCND	Query setpoint
WPCND*p*	Set setpoint *p*
RPCNNZ	Query neutral zone
WPCNNZ*p*	Set neutral zone *p*
RPCNBV	Query ◀ beginning of control
WPCNBV*p*	Set ◀ beginning of control *p*
RPCNBX	Query ◀ corner point X
WPCNBX*p*	Set ◀ corner point X *p*
RPCNBY	Query ◀ corner point Y
WPCNBY*p*	Set ◀ corner point Y *p*
RPCNBT	Query ◀ reset time
WPCNBT*p*	Set ◀ reset time *p*
RPCNEV	Query ▶ end of control
WPCNEV*p*	Set ▶ end of control *p*
RPCNEX	Query ▶ corner point X
WPCNEX*p*	Set ▶ corner point X *p*
RPCNEY	Query ▶ corner point Y
WPCNEY*p*	Set ▶ corner point Y *p*
RPCNET	Query ▶ reset time
WPCNET*p*	Set ▶ reset time *p*
RPCNZ	Query output 0/4 – 20 mA
WPCNZ0	Set output 0 – 20 mA
WPCNZ1	Set output 4 – 20 mA

Feed Time Alarm (Controller, Option 353 or Option 483)

RPALFYTS	Query settings
WPALFYTS0	Disable alarm
WPALFYTS1	Enable alarm

RPALFYTWH	Query warning limit Hi
WPALFYTWH*p*	Set warning limit Hi *p*
RPALFYTFH	Query failure limit Hi
WPALFYTFH*p*	Set failure limit Hi *p*

Current Input

RPICM	Query marker
WPICM0	Set marker ”Off”
WPICM1	Set marker ”On”
RPICZ	Query operating mode 0 – 20mA / 4 – 20mA
WPICZ0	Set operating mode 0 – 20 mA
WPICZ1	Set operating mode 4 – 20 mA
RPICA	Query application (only for option 352 probe rinsing)
WPICA0	Application as signal input (only for option 352 probe rinsing)
WPICA1	Application as control input for probe rinsing (only for option 352 probe rinsing)

Current Input Alarm

Not available with probe rinsing/InClean control enabled!

RPALF5S	Query settings
WPALF5S0	Disable alarm
WPALF5S1	Enable alarm
RPALF5FL	Query failure limit Lo
WPALF5FL*p*	Set failure limit Lo *p*
RPALF5WL	Query warning limit Lo
WPALF5WL*p*	Set warning limit Lo *p*
RPALF5WH	Query warning limit Hi
WPALF5WH*p*	Set warning limit Hi *p*
RPALF5FH	Query failure limit Hi
WPALF5FH*p*	Set failure limit Hi *p*

InClean Control (Option 404)

RPUCM	Query marker
WPUCM0	Set marker ”Off”
WPUCM1	Set marker ”On”
RPUCS	Query InClean setting
WPUCS0	Disable InClean
WPUCS1	Enable InClean
RPUCTI	Query interval
WPUCTI*p*	Set interval *p* [h]
RPUCT02	Query rinsing time (1)
WPUCT02*p*	Set rinsing time (1) *p* [s]
RPUCT03	Query cleaning time
WPUCT03*p*	Set cleaning time *p* [s]
RPUCT04	Query rinsing time (2)
WPUCT04*p*	Set rinsing time (2) *p* [s]
RPUCT05	Query measurement lead time
WPUCT05*p*	Set measurement lead time *p* [s]
RPUCT06	Query rinsing time (3)
WPUCT06*p*	Set rinsing time (3) *p* [s]
RPUCT07	Query rinsing time (4)
WPUCT07*p*	Set rinsing time (4) *p* [s]
RPUCTM	Query measurement time
WPUCTM*p*	Set measurement time *p* [s]
RPUCCS	Query sensor check
WPUCCS0	Disable sensor check
WPUCCS1	Enable sensor check
RPUCCT	Query check lead time
WPUCCT*p*	Set check lead time *p* [s]
RPUCCFL	Query sensor check failure limit Lo
WPUCCFL*p*	Set sensor check failure limit Lo *p*

RPUCCWL	Query sensor check warning limit Lo
WPUCCWL*p*	Set sensor check warning limit Lo *p*
RPUCCWH	Query sensor check warning limit Hi
WPUCCWH*p*	Set sensor check warning limit Hi *p*
RPUCCFH	Query sensor check failure limit Hi
WPUCCFH*p*	Set sensor check failure limit Hi *p*

Probe Rinsing (Option 352)

RPUCM	Query marker
WPUCM0	Set marker ”Off”
WPUCM1	Set marker ”On”
RPUCCN	Query probe contact
WPUCCN0	Set probe contact as normally closed
WPUCCN1	Set probe contact as normally open
RPUCS	Query probe rinsing
WPUCS0	Disable probe rinsing
WPUCS1	Enable probe rinsing
RPUCTI	Query interval
WPUCTI*p*	Set interval *p* [h]
RPUCT01	Query rinsing lead time
WPUCT01*p*	Set rinsing lead time *p* [s]
RPUCT02	Query first rinsing time
WPUCT02*p*	Set first rinsing time *p* [s]
RPUCT03	Query cleaning time
WPUCT03*p*	Set cleaning time *p* [s]
RPUCT04	Query second rinsing time
WPUCT04*p*	Set second rinsing time *p* [s]
RPUCT05	Query measurement lead time
WPUCT05*p*	Set measurement lead time *p* [s]

RS 485 Interface

RPINM	Query marker setting
WPINM0	Set marker ”Off”
WPINM1	Set marker ”On”
RPMSR	Query ready message
WPMSR0	Set: no return after write command
WPMSR1	Set: Send return after write command: the pH Transmitter 2500 sends a message terminator after executing the command (not with bus operation, only with point-to-point operation)
RPINWP	Query write protection
WPINWP0	Set write protection ”Off”
WPINWP1	Set write protection ”On”

Delta Function

RPFDM	Query marker setting
WPFDM0	Set marker ”Off“
WPFDM1	Set marker ”On“
RPFDA	Query delta function
WPFDAN	Set: ”Delta Function Off“
WPFDA0	Set: ”Delta Function pH“
WPFDA1	Set: ”Delta Function mV“
WPFDAUH	Set: ”Delta Function ORP“
WPFDA6	Set: ”Delta Function rH“
RPFDV	Query delta value
WPFDV*p*	Set delta value *p*

Automatic Device Diagnostics

RPTEM	Query marker
WPTEM0	Set marker ”Off“
WPTEM1	Set marker ”On”
RPTES	Query self test
WPTES0	Disable self test
WPTES1	Enable self test
RPTEI	Query interval
WPTEI*p*	Set interval *p* (h)

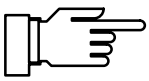
DEVICE Commands: Device Description

RDMF	Query manufacturer
RDUN	Query device type
RDUS	Query serial number
RDUV	Query software/hardware version: ”60;01” means ”software version 6.0, hardware version 1”
RDUP	Query option numbers

COMMAND Commands: Control Commands

The pH Transmitter 2500 can be controlled with the ”command” commands. ”Command” commands are write commands which call up functions or change device states.

With the first write command, the controlling computer (PC, SPS, ...) assumes control over the pH Transmitter 2500. Many safety prompts must then be implemented in the computer! With the “WCOMIN0” command (go to local), the computer returns control to the pH Transmitter 2500. The pH Transmitter 2500 restarts in the measuring mode.



When the write protection is switched on, any write attempts without switching off the write protection beforehand or with an invalid passcode are entered in the logbook. As delivered, write protection is switched off.

First Calibration

WCCASTI	Store present data set as First Calibration (blocked with InClean control enabled)

Automatic Calibration using Calimatic®

WCOU1	Freeze output currents and controller, disable limit values
WCCAA1	Calimatic® calibration with buffer 1
WCCAA2	Calimatic® calibration with buffer 2
WCOU0	Enable output currents, controller and limit values

Calibration by Manual Input of Buffer Values

WCOU1	Freeze output currents and controller, disable limit values
WCCAM1	Manual calibration with buffer 1
WCCAM2	Manual calibration with buffer 2
WCOU0	Enable output currents, controller and limit values

Calibration by Sampling

WCCAPT	Take sample
WCCAPC	Process sample

Device Diagnostics

WCTEA	Start device diagnostics (without display, keypad test)

Clock

WCRTT*hhmmss*	Set time *hhmmss*
WCRTD*ddmmyy*	Set date *ddmmyy*

Measurement Point Maintenance

WCOM08MA	Enable measurement point maintenance (output currents and controller frozen, limit values disabled)

InClean Controller (Option 404)

WCUCR	Start InClean program
WCOM08MA	Move InClean to ”Rinsing” position (output currents and controller output frozen limit values disabled)
WCOM00	Move InClean to ”Measurement” position

Probe Rinsing (Option 352)

WCUCR	Start rinsing cycle

Following commands only with measuring point maintenance enabled (WCOM08MA, RSP = 08):

WCUCCNR0	Open rinsing contact
WCUCCNR1	Close rinsing contact
WCUCCNC0	Open cleaning contact
WCUCCNC1	Close cleaning contact

Current Source Function

WCOM08CS	Enable current source function	
WCCSI1*p*	Set output current 1 to value *p*	
WCCSI2*p*	Set output current 2 to value *p*	(only with option 350)

Temperature Probe Adjustment

WCTFV*p*	Temperature probe adjustment: set process temperature *p*

Digital Controller (Option 353, not with Option 483)

WCOM08CI	Enable manual controller
WCCIM*p*	Set controller output (manipulated variable) to value *p*

Analog Controller (Option 483, not with Option 353)

WCOM08CN	Enable manual controller
WCCNM*p*	Set controller output (manipulated variable) to value *p*

Parameter Setting Administrator Level

WCOM01	Activate Parameter Setting menu (functional check active)
WCPZM0	Erase all markers
WCPZM1	Set all markers
WCOM00	Return to measuring mode

RS 485 Interface

WCOMIN0	Goto local, enable complete keypad Activate write protection if enabled
WCDIW0*aaaa...*	Write free text as display message: max. 40 characters, Can only be written on bottom display line during functions such as current source, maintenance, etc! *a* = ASCII character: blank, ”0” ... ”9”, ”A” ... ”Z”, ”–”, ”+”, ”/”
WCINPW*pppp*	Deactivate write protection, *pppp* = administrator passcode, required for writing parameters and control commands
WCINPD	Activate write protection

Interface Point-to-Point

When you have selected “Point-to-Point” coupling, the data are transmitted as ASCII characters. A checksum (CRC) is not required. Please observe the changeover of the data flow direction on the RS 485 (see Pg. 9–55).

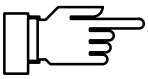
Query

PC → Transmitter:	R	V	2	<cr>	(ASCII)
	52	56	32	OD	(hexadecimal)

Response

Transmitter → PC:	2	5	.	3	<cr>	(ASCII)
	32	35	2E	33	OD	(hexadecimal)

Interface Bus Protocol



Applies only if you have selected BUS coupling!

The protocol is based on a master/slave relationship. The participants addressed by the master (host computer) are called **slave**. They have to execute the communication sequence as prescribed by the controlling **master**.

Each communication sequence between participants on the bus is basically determined by two sections, the command section and the response section:

In the *command section* the master defines meaning and function of the currently transferred message. The command information is accepted by the slave and correspondingly evaluated.

The *response section* shows the master if a bus transfer has been properly executed. It can also contain data, if required.

Data Format

Hardware: RS485 2-wire.

The data format is permanently set to **9600 bauds, 8 data bits, no parity**.

Each slave has a bus address that may be in the range 01...31.
Each slave on a bus system must have a unique address.

The address 00 is a broadcast address (message for ALL).

Structure of a Message

1 Byte	1 Byte	n Bytes	2 Bytes
slave address status flags	length: n + 2	ASCII message, as with point-to-point connection, but without message terminator	CRC16 according to CCITT–X.25

1st Field: Slave Address, Status Flags

7	6	5	4	3	2	1	0
”1”	master / slave	error	slave address 01...31, 00 = broadcast				

Bit 7: ”1” This bit must be set to logical One.

Bit 6: Master / Slave: ”1” means that the message was sent from master to slave. The slave address indicates the data sink. ”0” means that the message is a response from slave to master. Here, the slave address indicates the data source.

Bit 5: Error During transmission masterÕslave always ”1”. During response slaveÕmaster erased if an error has occurred. (e.g. syntax error; not for CRC error since in that case there won’t be a response).

Slave address 00 has a special function:

00 addresses all slaves. No slave may send a response. Therefore, the master does not know if the message was completely understood by all participants. Nevertheless, this function can be useful for synchronizing all participants (e.g. to set clock). Afterwards, each participant can be individually checked if it has successfully received the respective message.

2nd Field: Length

7	6	5	4	3	2	1	0
”0”	more	length of message field and CRC16					

The length field indicates the remaining message length, i.e. length of message block and CRC (message + 2 bytes). In the case of correct reception, exact *length* bytes must follow after having read the length.

Up to 63 bytes can be transmitted in each block (61 data bytes + 2 bytes CRC). Longer transmission strings must be divided into blocks.

The ”more” bit is set if another complete data block follows. In a block sequence, the ”more” bit of the last block is erased. If the ”more” bit is erased (normal case), the message is complete with this block.

3rd Field: ASCII Message

This message field contains the command to the pH Transmitter 2500. The message has the same structure as the string of the point-to-point connection (e.g. RV2). The message terminator is omitted. The message is immediately followed by CRC16.

All characters in this field must have bit 7 erased (as 7 data bits, space parity).

4th Field: CRC16

CRC16 (16–bit Cyclic Redundancy Check) is calculated according to CCITT–X.25.

Check polynominal according to CCITT–X.25 = $x^{16} + x^{12} + x^5 + 1$

CRC is the check sum of all transmitted bytes. CRC is transmitted as 2 binary bytes. First, the more significant bit and then the less significant bit is transmitted. The structure of the transmitted CRC16 is such that it always supplements the total CRC to 0000_{hex}. The completely received string is only valid and must be interpreted if CRC = 0000_{hex}. If not, the complete message must be ignored.

CRC16 has a **Hamming distance of 4** and is used in the bus protocols HDLC, SDLC and ADCP, among others.

Procedure for Generating a CRC:

To supplement the string to CRC = 0000_{hex}, the CRC in the string is first set to 0000_{hex}. The CRC calculated from this string (incl. CRC) is then entered into the string. Like this, the CRC supplements to the total CRC of 0000_{hex}.

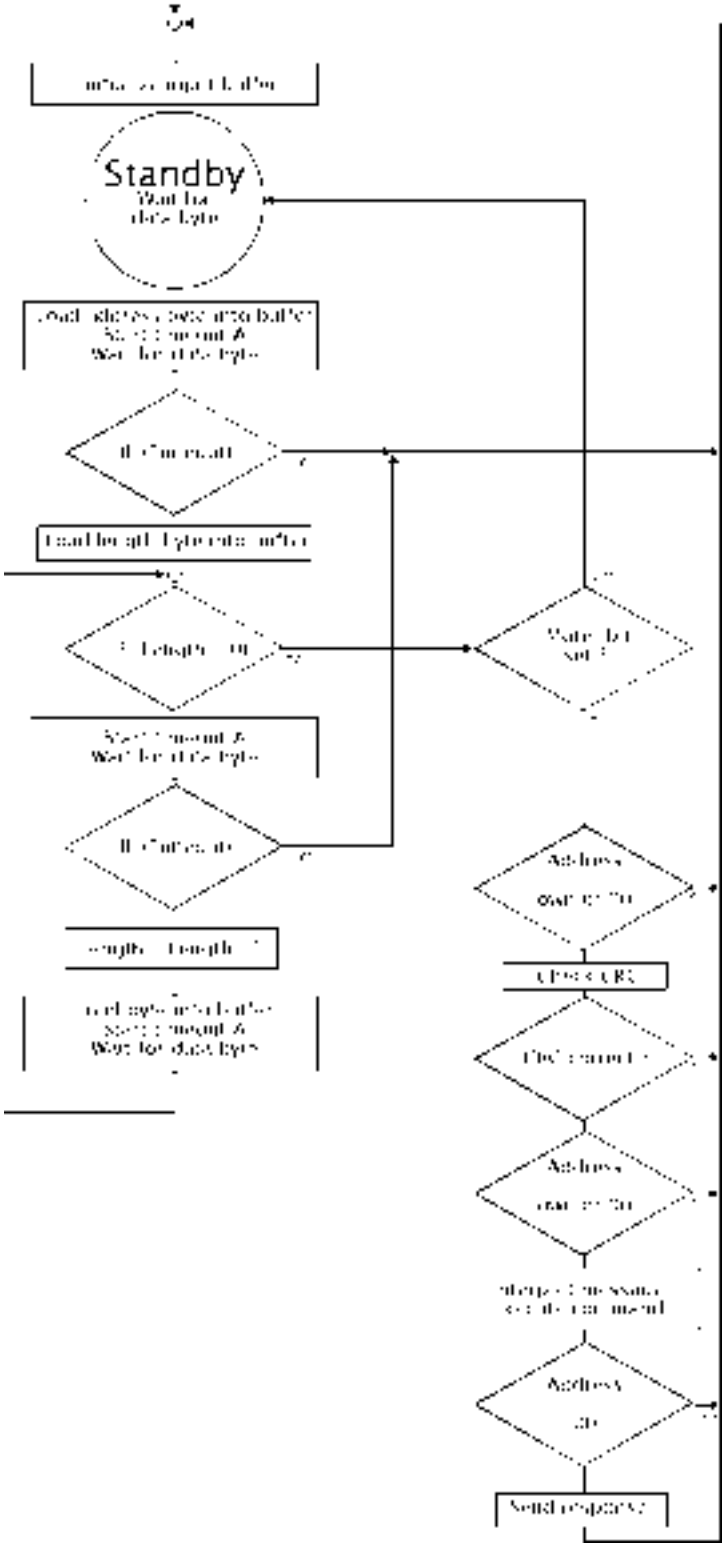
Calculating a CRC:

Variables:

BUFFER =	memory area of complete message incl. header and CRC field
BUFPOINTER =	pointer to character in BUFFER
LENGTH =	length of complete message (fields 1 to 4)
BYTE =	character in BUFFER being processed
FLAG =	temporary storage for most significant bit (MSB)
CRC =	CRC16

BEGIN crc
. CRC = 0000_{hex}
. BUFPOINTER = points at beginning of BUFFER
. WHILE (LENGTH != 0)
. . bitcounter = 0
. . BYTE = character the BUFPOINTER points at
. . BUFPOINTER to next character (increment)
. . DO
. . . FLAG = highest $bit_{Bit\ 15}$ of CRC
. . . shift CRC 1 bit to the left (CRC = CRC * 2)
. . . IF (highest $bit_{Bit\ 7}$ of BYTE == ”1”)
. . . . CRC = CRC + 1
. . . ENDIF
. . . shift BYTE 1 bit to the left (BYTE = BYTE * 2)
. . . IF (FLAG == ”1”)
. . . . CRC = CRC Exclusive Or 1021_{hex}
. . . ENDIF
. . . bitcounter = bitcounter + 1
. . WHILE (bitcounter < 8)
. . LENGTH = LENGTH – 1
. END WHILE
END crc

Interface Bus Protocol of Slave (pH Transmitter 2500)



Timeouts:

A = 3-byte transmission rates (approx. 3.1 ms at 9600 bauds)

Error States at Slave:

1) timeout A expired (approx. 3-byte transmission rates)

2) CRC error

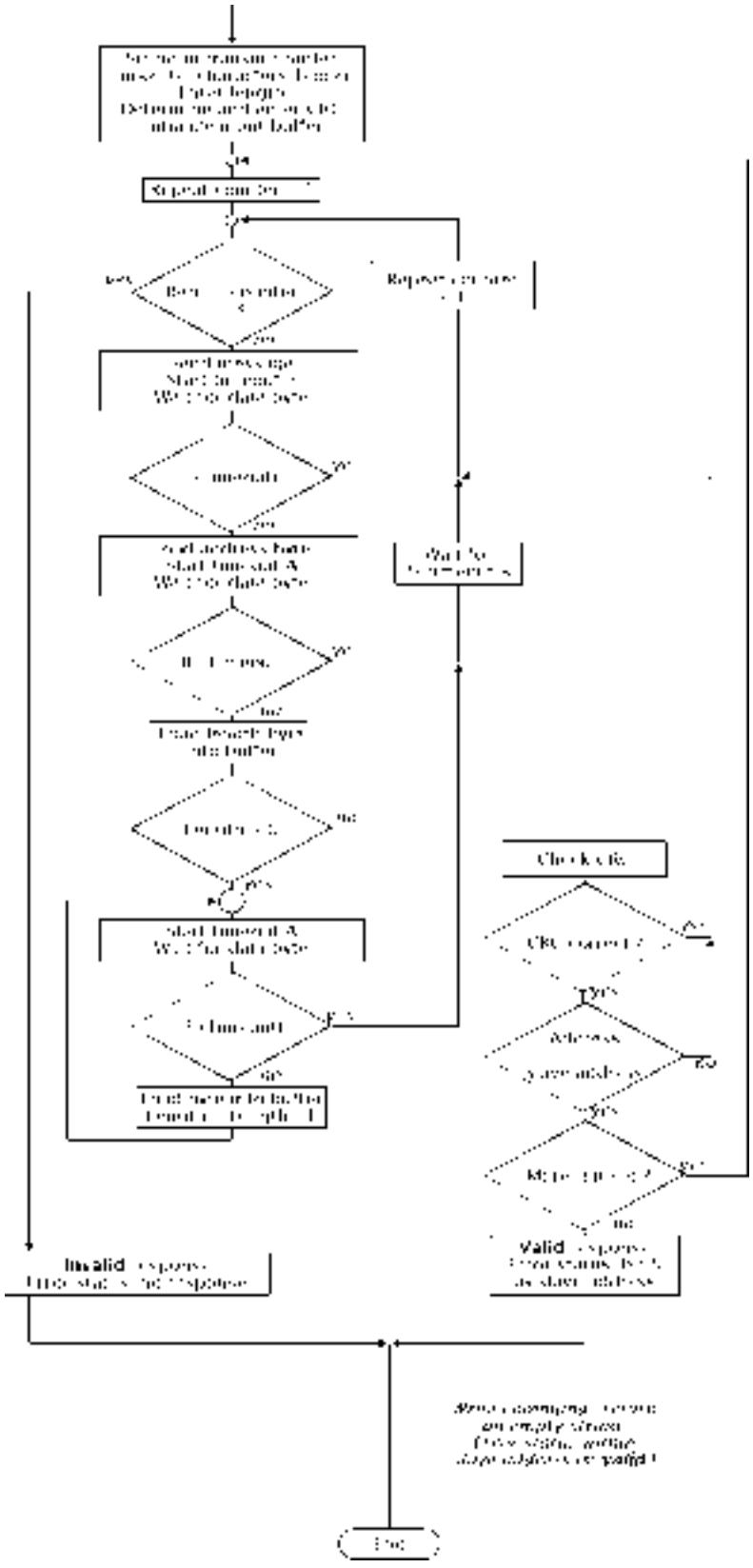
3) unknown target address (not addressed)

4) framing (UART) error

Reaction to Error:

Do not send response,
reject received string, return to standby mode,
wait for new receive characters.

Interface Bus Protocol of Master



Timeouts:

A = 3-byte transmission rates (approx. 3.1 ms at 9600 bauds)

B = approx. 1 s

13 Product Line and Accessories

Instrument	Ref. No.
pH Transmitter 2500	2500

Options

English display texts	348
French display texts	362
Second current output	350
Power supply 24 Vac/dc	298
Power supply 115 Vac	363
RS 485 interface	351
Probe rinsing	352
Digital controller function (not in combination with option 483)	353
Logbook	354
Nominal zero point and slope of electrode user defined	356
Buffer set to customer specifications	370 to 379
Ex II T6 (for hazardous locations Zone 2)	403
InClean function	404
Ciba (94) buffer set	458
Analog controller function (only with option 350, not in combination with option 353)	483

Mounting Accessories

Mounting plate (not required for direct wall mounting, see Fig. 10–2, page 10–2)	ZU 0126
Bracket kit (only with ZU 0126 mounting plate, see Fig. 10–2, page 10–2)	ZU 0125
Protective hood (only with ZU 0126 mounting plate, see Fig. 10–2, page 10–2)	ZU 0123
Protective polyester case, IP 65, protective panel made of Macrolon, complete with mounting kit, see Fig. 10–3, page 10–3	ZU 0124
Bracket kit for protective case (only with ZU 0124)	ZU 0128

Further Accessories

Input socket for combination or glass electrode with DIN plug	ZU 0160
Input socket for combination or glass electrode with Ingold SK 7 screwed plug and equivalent types	ZU 0161

14 Specifications

Inputs	1 input for pH or mV 1 input for ORP[1)] (oxidation-reduction potential) 1 current input with evaluation 0 to100% e.g. for limit monitoring In conjunction with power output complete 2-wire loop, e.g. for flow or level meter 1 input for Pt 100/Pt 1000 2- or 3-wire connection		
Ranges	pH/mV value	pH -2.00 to +16.00 -2000 to +2000 mV	
	ORP	-2000 to +2000 mV	
	rH value	0.0 to 42.5	
	temperature	-50.0 to +250.0 °C	
	current input	0(4) to 20 mA / 50 Ω (0 to 100 %)	
	glass impedance	0.1 to 2000 MΩ	
	reference impedance	0.1 to 200.0 kΩ	
Display	graphic LCD, 240 x 64 pixels with CFL[2)] backlighting		
	main display	character height approx. 25 mm	
	secondary display	character height approx. 6 mm	
	dialog display	7 lines, character height approx. 4 mm	
Display Options	Main Display	Secondary Display	
	pH value	pH value	[pH]
	mV value	mV value	[mV]
	ORP	ORP	[mV]
	rH value	rH value	[rH]
	temperature	temperature	[°C]
	time	time	[h,min]
		date	[d,m,y][*)]
		current output 1	[mA]
		current output 2	[mA]
		current input	[%]
		controller setpoint	
		controller output	[%]
		cal timer	[h]
		glass impedance	[MΩ]
		reference impedance	[kΩ]
		manual temperature	[°C]
Output 1[*)]	0 to 20 mA or 4 to 20 mA, max. 10 V, floating user defined for pH, mV, ORP, rH, °C error message if load is exceeded		
Output 2[*)] (Option 350)	0 to 20 mA or 4 to 20 mA, max. 10 V, floating user defined for pH, mV, ORP, rH, °C optionally as analog controller output (option 483) error message if load is exceeded		
Beginning/End of Scale[*)]	anywhere within pH, mV, ORP, rH, °C		
Spans[*)]	pH value	1.00 to 20.00	
	electrode potential	100 to 2000 mV	
	ORP	100 to 2000 mV	
	rH value	10.0 to 200.0	
	temperature	10.0 to 300.0 °C	

Electrode Standardization	Operating Modes*)		
	● Calimatic® automatic calibration with buffer recognition using three fixed buffer sets:		
	Ingold technical buffers	2.00/4.01/7.00/9.21	
	Merck/Riedel de Haën	2.00/4.00/7.00/9.00/12.00	
	techn. buf. DIN 19267	1.09/4.65/6.79/9.23/12.75	
	customer specific buffer sets (option 370 to 379)		
	● input of individual buffer values		
	● sample calibration		
	● input of premeasured calibration data		
Calibration Ranges	zero	pH 6 to 8	
	slope	50 to 61 mV/pH (25°C)	
	V_{iso}	-200 to +200 mV	
Nominal Zero Point and Slope of Electrode*) (Option 356)	zero	pH 0 to 14	
	slope	25 to 61 mV/pH	
	V_{iso}	-500 to +500 mV	
	e.g. for Pfaudler and Antimony probes		
Current Input	0(4) to 20 mA (0 to 100 %), input resistance 50 Ω overload 100 mA		
Temperature Input	Pt 100/Pt 1000 2- or 3-wire connection measuring current approx. 4 mA (Pt 100) or approx. 0.4 mA (Pt 1000) temperature probe adjustable		
Temperature Compensation*)	automatic	with Pt 100 or Pt 1000	
	manual	-50.0 to +250 °C	
Temperature Compensation according to medium*)	● without		
	● ultrapure water with traces of impurity		
Glass Electrode Input	input resistance	> $1*10^{12}$ Ω	
	input current (20 °C)3)	< $1*10^{-12}$ A	
	offset voltage	< 0.5 mV	
	TC of offset voltage	< 10 µV/K	
Reference Electrode Input	input resistance	> $1*10^{11}$ Ω	
	input current (20 °C)3)	< $1*10^{-10}$A	
	offset voltage	< 0.5 mV	
	TC of offset voltage	< 10 µV/K	
Measurement Error (± 1 count)	pH value	< 0.01	
	electrode potential	< 0.1 % of measured value	
	temperature	< 0.2 % of measured value, + 0.2 K	
	current input	< 1% of full scale	
Impedance Measurement Error	glass electrode	< 10 %	5 to 500 MΩ
		< 20 %	< 5 MΩ / > 500 MΩ
	reference electrode	< 10 %	0.5 to 50 kΩ
		< 20 %	< 0.5 kΩ / > 50 kΩ
Permissible Cable Capacitance	< 2 nF (length of measuring cable approx. 20 m, Mettler-Toledo cable, type ST-TRIAX 7)		
Permissible Voltage ORP + pH (mV)	± 2 V, terminals 1, 3 against terminal 4		
Current Source Function	0.00 mA to 20.50 mA, separately definable for current 1 and 2		
Output Current Error	< 0.25 % of measured value + 20 µA		

Switching Contacts*)	8 switching contacts, floating	
	contact ratings	ac < 250 V/5 A < 1250 VA resistive dc < 120 V/5 A <120 W
	NAMUR contacts4)	functional check warning (maintenance required) failure
	failure/warning:	delays separately definable
	limit/controller contacts (digital controller optional, option 353)	limit 1 limit 2
	cleaning contacts (option 352)	rinsing cleaning probe
PI Controller*) (Option 353)	quasi continuous switching controller via limit contacts user defined for pulse duration or pulse frequency control range user defined within pH/mV/ORP/rH/°C ranges	
Analog Controller*) (Option 483)	outputs manipulated variable proportionally as analog current via output 2 three-way mixing valve and straightway valve user defined control range user defined within pH/mv/ORP/rH/°C ranges	
Remote Interface*) (Option 351)	RS 485, galvanically isolated	
	baud rate	300/600/1200/9600
	data bit/parity	7/even, 7/odd, 8/no
	point-to-point connection or bus connection of up to 31 instruments	
Logbook (Option 354)	recording of	function activations, appearance and disappearance of warning and failure messages, with date and time
	memory capacity	200 entries available
	retrievable via	keypad/display or remote interface
Probe Rinsing*) (Option 352)	automatic sensor cleaning and rinsing via timer-controlled contacts, e.g. splash rinsing	
InClean Function*) (Option 404)	automatic control of InClean retractable probe	
Data Retention	parameters and settings:	> 10 years (EEPROM)
	clock and logbook, statistics:	> 1 year (battery backed)
Instrument Self Test	test of RAM, EPROM, EEPROM, display and keypad, record for quality management documentation (QM) to ISO 9000 data retrievable via display and remote interface	
Power Output	24 Vdc/30 mA, floating, short-circuit-proof typical applications: loop current for universal input, signal current for switching outputs or power supply for pH isolation amplifier	
Clock	real-time clock with date, self-contained	
Explosion Protection (Option 403)	Ex II T6 (Zone 2), TÜV Hannover Sachsen-Anhalt No. 1004/3	
RFI Suppression	to EN 50 081-1	
Immunity to Interference	to EN 50 082-2 and to NAMUR EMC recommendation for process and laboratory control equipment	

Protection to Electrical Shock	All inputs and outputs, except power supply input, are protected by functional extra-low voltage with protective separation according to DIN 57100/VDE 0100 Part 410 and DIN VDE 0106 Part 101. With option 298 ”Power Supply 24 Vac/dc”, this is only valid if also the power source meets these requirements. In that case power supply input is included.
Input Ratings	ac 230 V -15 % +10 % < 10 VA 48 to 62 Hz option 363 ac 115 V -15 % +10 % < 10 VA 48 to 62 Hz option 298 ac/dc 24V ac: -15 % +10 % < 10 VA dc: -15 % +25 % < 10 W
Class	II ⧈ overvoltage category III / I
Operating/Ambient Temperature[5)] Transport and Storage Temperature	-20 to +50 °C -20 to +70 °C
Enclosure	case with separate terminal compartment, suitable for outdoor mounting material: acrylonitrile butadiene styrene (ABS), front: polyester protection: IP 65
Cable Glands	10 Pg 13.5 threaded cable glands, IP 65 with cable diameter ≥ 6 mm (additional gaskets for cable diameters < 6 mm included)
Dimensions	refer to dimension drawing Fig.10–1, page 10–2
Weight	approx. 3 kg

*) user defined
1) oxidation/reduction potential
2) Cold Fluorescent Lamp
3) doubles every 10 K
4) German committee for measurement and control standards in chemical industry
5) With ambient temperatures below 0 °C, display readability can be restricted. This does *not* affect instrument functions.

15 Buffer Charts

”Mettler Toledo” Mettler Toledo technical trade buffers,
(equivalent to Ingold technical trade buffers)

°C	pH			
0	2.03	4.01	7.12	9.52
5	2.02	4.01	7.09	9.45
10	2.01	4.00	7.06	9.38
15	2.00	4.00	7.04	9.32
20	2.00	4.00	7.02	9.26
25	**2.00**	**4.01**	**7.00**	**9.21**
30	1.99	4.01	6.99	9.16
35	1.99	4.02	6.98	9.11
40	1.98	4.03	6.97	9.06
45	1.98	4.04	6.97	9.03
50	1.98	4.06	6.97	8.99
55	1.98	4.08	6.98	8.96
60	1.98	4.10	6.98	8.93
65	1.99	4.13	6.99	8.90
70	1.99	4.16	7.00	8.88
75	2.00	4.19	7.02	8.85
80	2.00	4.22	7.04	8.83
85	2.00	4.26	7.06	8.81
90	2.00	4.30	7.09	8.79
95	2.00	4.35	7.12	8.77

”Merck/Riedel” Merck buffers Titrisols and ready-to-use buffer solutions,
Riedel buffers Fixanals and ready-to-use buffer solutions

°C	pH				
0	2.01	4.05	7.13	9.24	12.58
5	2.01	4.04	7.07	9.16	12.41
10	2.01	4.02	7.05	9.11	12.26
15	2.00	4.01	7.02	9.05	12.10
20	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
25	2.00	4.01	6.98	8.95	11.88
30	2.00	4.01	6.98	8.91	11.72
35	2.00	4.01	6.96	8.88	11.67
40	2.00	4.01	6.95	8.85	11.54
45	2.00	4.01	6.95	8.82	11.44
50	2.00	4.00	6.95	8.79	11.33
55	2.00	4.00	6.95	8.76	11.19
60	2.00	4.00	6.96	8.73	11.04
65	2.00	4.00	6.96	8.72	10.97
70	2.01	4.00	6.96	8.70	10.90
75	2.01	4.00	6.96	8.68	10.80
80	2.01	4.00	6.97	8.66	10.70
85	2.01	4.00	6.98	8.65	10.59
90	2.01	4.00	7.00	8.64	10.48
95	2.01	4.00.	7.02	8.64	10.37

”DIN” technical buffer solutions to DIN 19 267

°C	pH				
0	1.08	4.67	6.89	9.48	13.95*
5	1.08	4.67	6.87	9.43	13.63*
10	1.09	4.66	6.84	9.37	13.37
15	1.09	4.66	6.82	9.32	13.16
20	1.09	4.65	6.80	3.27	12.96
25	1.09	4.65	6.79	9.23	12.75
30	1.10	4.65	6.78	9.18	12.61
35	1.10	4.65	6.77	9.13	12.45
40	1.10	4.66	6.76	9.09	12.29
45	1.10	4.67	6.76	9.04	12.09
50	1.11	4.68	6.76	9.00	11.98
55	1.11	4.69	6.76	8.96	11.79
60	1.11	4.70	6.76	8.92	11.69
65	1.11	4.71	6.76	8.90	11.56
70	1.11	4.72	6.76	8.88	11.43
75	1.11	4.73	6.77	8.86	11.31
80	1.12	4.75	6.78	8.85	11.19
85	1.12	4.77	6.79	8.83	11.09
90	1.13	4.79	6.80	8.82	10.99
95	1.13*	4.82*	6.81*	8.81*	10.89*

* extrapolated

”Ciba (94)” Ciba (94) buffers,
Nominal buffer values: 2.06, 4.00, 7.00, 10.00

°C	pH			
0	2.04	4.00	7.10	10.30
5	2.09	4.02	7.08	10.21
10	2.07	4.00	7.05	10.14
15	2.08	4.00	7.02	10.06
20	2.09	4.01	6.98	9.99
25	2.08	4.02	6.98	9.95
30	2.06	4.00	6.96	9.89
35	2.06	4.01	6.95	9.85
40	2.07	4.02	6.94	9.81
45	2.06	4.03	6.93	9.77
50	2.06	4.04	6.93	9.73
55	2.05	4.05	6.91	9.68
60	2.08	4.10	6.93	9.66
65	2.07_5	4.10_5	6.92_5	9.61_5
70	2.07	4.11	6.92	9.57
75	2.04_5	4.13_5	6.92_5	9.54_5
80	2.02	4.15	6.93	9.52
85	2.03	4.17_5	6.95	9.47_5
90	2.04	4.20	6.97	9.43
95	2.05*	4.22_5*	6.99*	9.38_5*

* extrapolated
$_5$ interpolated

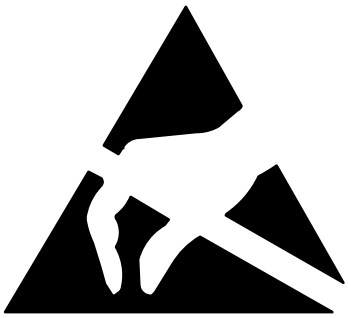
16 Appendix

Warning

Remember that the voltage across accessible parts of the open apparatus may be dangerous to life.

If opening the apparatus is inevitable, it shall first be disconnected from all voltage sources.
Make sure that the mains supply has been disconnected.

Operations on an opened apparatus shall be carried out only by a skilled person who is aware of the hazard involved.

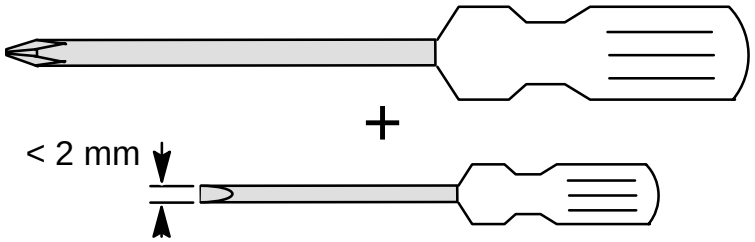


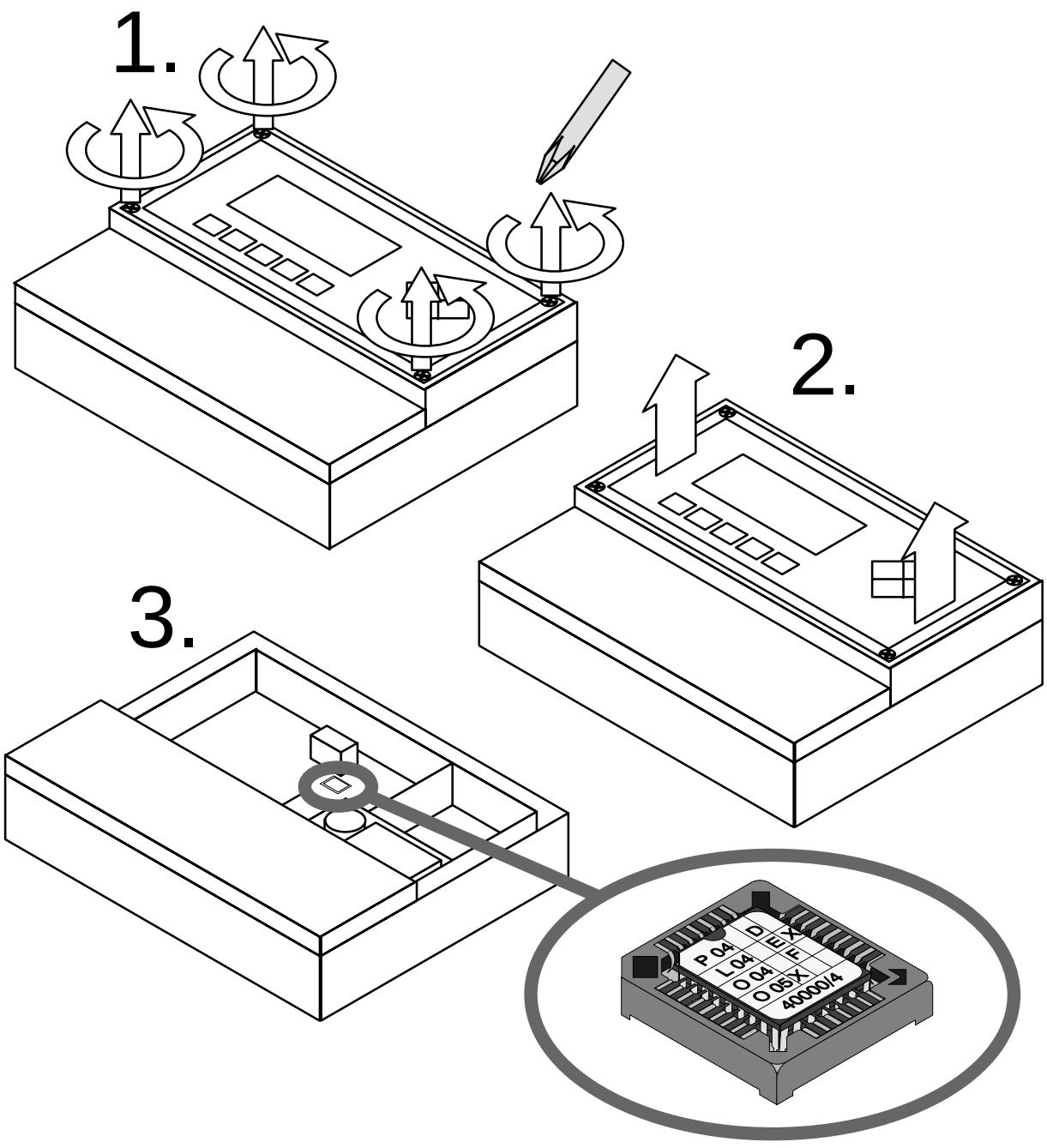
Caution

Observe the handling precautions for ESD sensitive components when acting on the opened apparatus!

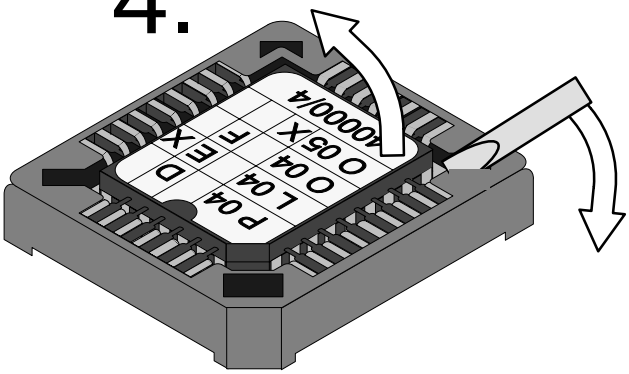
EPROM Replacement

You need:

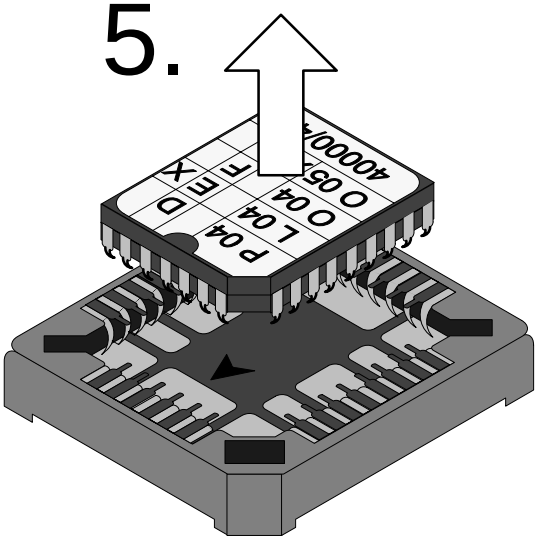




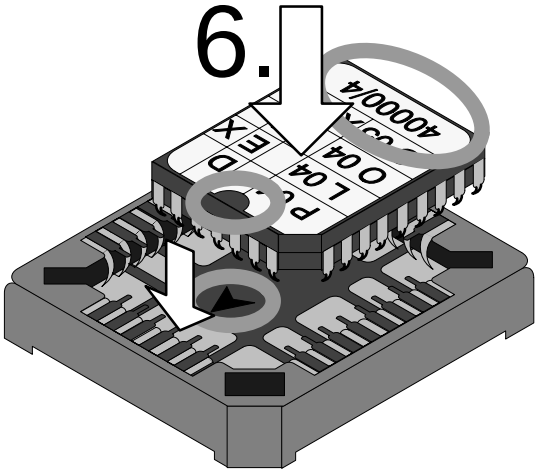
4.



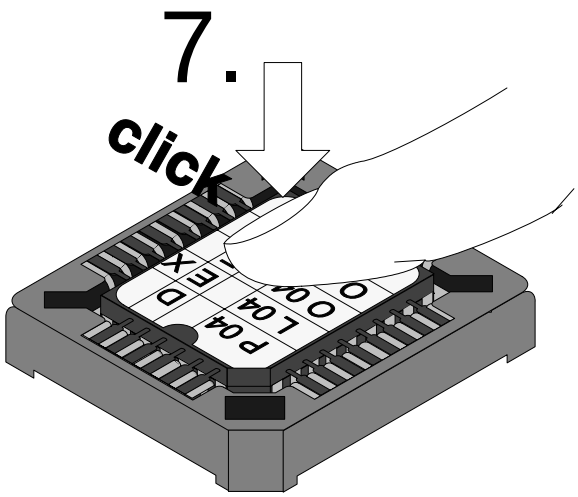
5.



6.



7.



8. Remount the instrument in reverse sequence.

Page left empty for technical reasons.

17 Technical Terms

3-wire connection	Connection of the Pt 100/Pt 1000 temperature probe with a (third) sense line to compensate for the lead resistances; required for exact temperature measurement with long leads
Administrator level	”adm” – menu level of parameter setting. All instrument settings and the passcodes can be edited.
administrator passcode	Protects access to Administrator level; can be edited on the Administrator level
alarm limit	For each process variable, you can define high and low warning and failure limits, respectively. Alarm can be activated individually for each variable. When an alarm limit is exceeded, an error message will be displayed and the corresponding NAMUR contact be activated.
auxiliary electrode	Metallic rod (e.g. platinum), required for monitoring the reference electrode impedance
buffer set	Contains a selection of buffer solutions for automatic calibration using Calimatic®. The buffer set must be entered.
cal	Menu key for Calibration menu
Calibration menu	Menu for calibrating the pH Transmitter
calibration passcode	Protects access to calibration; can be edited or disabled on the Administrator level
calibration record	The calibration record provides all relevant data of the last calibration for documentation according to GMP.
calibration sequence	From the Calibration menu, you can select four sequences: automatic calibration with Calimatic®, calibration with manual entry of buffer values, data entry of premeasured electrodes, sample calibration.
cal timer	Counts the time passed since the last calibration. Cal timer count can be monitored via alarm limits.
cleaning	User defined time during which the cleaning contact is closed during a rinsing cycle.
combination electrode	Glass and reference electrode combined into one package
controlled variable	User defined variable that acts on the controller

controller output	Controls limit contacts 1 and 2
current input	Processes an input current of 0 (4) to 20 mA. The current can be displayed (in % full scale) and monitored via alarm limits.
cursor keys	◀ and ▶ – select entry positions or digits during number entry.
delay time	User defined time until contacts ”warning” and ”failure” react to an alarm message
diag	Menu key for Diagnostics menu
Diagnostics menu	Displays all relevant information on instrument status
electrode statistics	The electrode statistics provide the electrode data of the last three calibrations and the First Calibration.
electrode slope	Specified in mV/pH; is different for each electrode and changes with age and wear
enter	Key for confirming entries
equipotential bonding electrode	Connects process solution to measuring circuit of pH Transmitter
failure	Alarm message and NAMUR contact; indicates that equipment does not function properly or that certain process parameters have reached a critical value. Failure is *not* enabled during ”functional check”.
feed time alarm	Monitors time during which the controller output is at 100 %
First Calibration	During First Calibration, the electrode data are stored as reference values for electrode statistics.
first rinsing	User defined time during which contact ”rinsing” is closed at the beginning of a rinsing cycle
functional check	NAMUR contact – always enabled when the pH Transmitter does *not* output the selected measured value
GLP	Good Laboratory Practice: guidelines for performance and documentation of measurements in the laboratory
GMP	Good Manufacturing Practice: guidelines for performance and documentation of procedures in manufacturing.
InClean	Retractable probe for automatically rinsing, cleaning and checking the pH electrode. Remote control by the pH Transmitter 2500 possible with Option 404.

information display

Information text for operator guidance or indication of instrument status; marked with **i** .

interval

Time from beginning of one rinsing cycle until beginning of the next rinsing cycle, user defined

limit contacts

Controlled by a user-defined measured value. Are activated when the value falls below or exceeds the limit, depending on the user-defined effective direction

logbook

The logbook shows the last 200 events with date and time, e.g. calibrations, warning and failure messages, power failure etc. This permits quality management documentation to ISO 9000.
Error messages are only recorded in the measuring mode.

main display

Large measurement display in measuring mode. You can select a process variable to be displayed.

maint

Menu key for Maintenance menu

Maintenance menu

The Maintenance menu comprises all functions for maintaining the sensors and adjusting connected measuring equipment.

maintenance passcode

Protects access to maintenance, can be edited or disabled on the Administrator level

manipulated variable

Controller output – controls limit contacts 1 and 2

meas

Menu key – allows return to measuring mode from all other menus.

measurement lead time

User defined time at the end of the rinsing cycle, after deactivation of contact ”probe”

measuring mode

When no menu function is activated, the instrument is in measuring mode. The selected measured value is output. Pressing **meas** always returns you to measuring mode.

measuring program

User-defined procedure for rinsing and cleaning the electrode with the InClean: the electrode is normally located in the rinsing chamber.

menu

Pressing a menu key (**cal**, **diag**, **maint**, or **par**) gives access to a menu, from which you can select the corresponding functions.

menu level

The menu is divided into several menu levels. You can switch between different levels by pressing the menu key or the cursor keys ◀ and ▶.

message list

The message list shows the number of currently activated messages and displays the individual warning or failure messages in plaintext.

mode selector	The mode selector on the InClean makes it possible to switch back and forth between ”Run” (normal operation) and ”Service” (probe in ”Rinsing” position, remote control switched off and electrode can be replaced).
NAMUR	German committee for measurement and control standards in chemical industry
NAMUR contacts	”functional check”, ”warning” and ”failure” – indicate status of process variable and pH Transmitter
Operator level	”opl” – menu level of parameter setting. You can edit the instrument settings that have been enabled on the Administrator level.
operator passcode	Protects access to the Operator level; can be edited or disabled on the Administrator level
ORP	Oxidation Reduction Potential – measured across reference electrode and an auxiliary (platinum) electrode
par	Menu key for Parameter Setting menu
Parameter Setting menu	The Parameter Setting menu is divided into three submenus: Viewing level (view), Operator level (opl) and Administrator level (adm).
passcode protection	The passcode protection protects access to calibration, maintenance, Operator and Administrator level. The passcodes can be edited or disabled on the Administrator level.
pH electrode system	A pH electrode system consists of glass and reference electrode. If the two electrodes are combined in a single package, they are called combination electrode.
point of measurement	Can be defined for identifying the pH Transmitter; can be displayed in the diag menu or read out via remote interface
response time	Time from start of a calibration step until stabilization of the electrode potential
retractable probe	See InClean
rinsing cycle	User defined sequence for cleaning the electrode or other sensors; controls contacts ”probe”, ”rinsing” and ”cleaning”
rinsing lead time	User defined time at the beginning of the rinsing cycle, after activation of contact ”probe”, before closing of contact ”rinsing”
rinsing program	User-defined procedure for rinsing and cleaning the electrode with the InClean: the electrode is normally in the process

scrolling key

▲ and ▼ – for selecting menu lines or entering numeric digits

secondary display

Two small displays that appear at the lower left and right sides of the main display during measuring mode. The process variables displayed can be selected using ▲ / ▼ and ◀ / ▶.

second rinsing

User defined time during which contact ”rinsing” is closed at the end of the rinsing cycle

sensor check

In the InClean program the measured value delivered by the pH electrode is compared with the defined limits during the ”Sensor check” step. If the warning or failure limits are exceeded or dropped below, an error message is output.

service position

The mode selector on the InClean has been set to ”Service” (probe in ”Rinsing” position, remote control switched off and electrode can be replaced).

InClean program

User-defined procedure for rinsing and cleaning the electrode: also see ”Measuring program” and ”Rinsing program”.

Viewing level

”view” – menu level of parameter setting; display of all configuration settings, no editing possible

wait position

Probe rinsing:
Position between ”Second Rinsing” and ”Measurement Lead Time” where the probe remains as long as a start current of 10 to 20 mA is applied to the current input (only when current input has been set as control input)
InClean:
Rest position of retractable probe in rinsing chamber

warning (maintenance required)

Alarm message and NAMUR contact;
means that measuring equipment still operates properly but should be maintained, or that certain process parameters have reached a value that requires intervention
Warning is *not* enabled during ”functional check”.

zero point

pH value at which the pH electrode delivers a voltage of 0. Zero point is different for each electrode and changes with age and wear.

Page left empty for technical reasons.

18 Index

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

X

Z