Transmitter 7500

Your Consultant:

02/99
52 120 435

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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 6.0

Process variable “Ω·cm” (resistivity)

Now, also the resistivity (Ω·cm) can be defined as process variable for the main display and can be used for adjusting the output current.

Coupling of display ranges to the cell constant

The display ranges and, consequently, the visible resolution are coupled to the cell constant. This assures that the display resolution corresponds to the technical resolution.

Extension of the permissible cell constant range

The range has been expanded from 0.0090 – 200.0 cm^{-1} to 0.0050 – 200.0 cm^{-1}.

Additional option for concentration measurement

The Option 382 is provided for determining the concentration of the substances HCl, NaOH, NaCl.

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.

Functional check also during sample calibration

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

Sample calibration with TC calculation

It can be defined whether sample calibration is to be performed with or without temperature compensation.

Manual selection of temperature probe

Automatic Pt 100/Pt 1000 recognition and selection is omitted.
The Option 355 (input for Ni 100 temperature probe) is not required any more.
Ni 100 temperature probes are supported as standard.

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 nameplate.

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 plug has been pulled out.

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 Part 1 shall be performed. This test should be carried out at our factory.

Installation and Commissioning

Installation of the Transmitter 7500 must be carried out only by specially trained personnel in accordance with the relevant regulations and this instruction manual. Make sure that the technical specifications and input ratings are observed.

For information on installation, refer to chapter 10.

Commissioning of the Transmitter 7500 must be carried out only by specially trained personnel in accordance with the relevant regulations and the instruction manual.
Before first start-up, a *complete parameter setting* procedure must be performed by a system administrator.

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

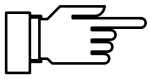
Real-time clock, logbook, cal record and sensor statistics are battery backed for approx. 1 year. After longer power outages these data can be lost. In that case the Process Unit displays ”Warn Time/ Date” and the date is reset to 01-01-1990. Time and date must be updated.

Information on Electromagnetic Compatibility

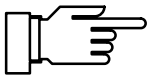
Compliance with Interference Immunity Requirements

All inputs and outputs of the Transmitter 7500 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 (Remote 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 Transmitter 7500 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 damage and completeness.
The package should contain:

- Transmitter 7500
- 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 Transmitter 7500
- how to operate the Transmitter 7500
- what you have to know for installation and mounting

Warning

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

Note

Notes call your attention to important information.

Conventions used

The keys of the Transmitter 7500 are represented as follows:

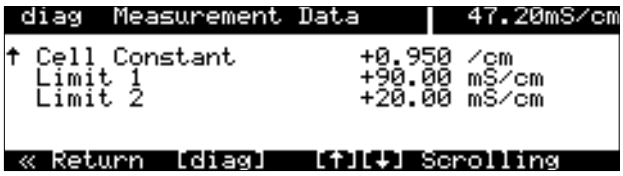
meas , **cal** , **maint** , **par** , **diag**

◄ , ► , ▲ , ▼ , **enter**

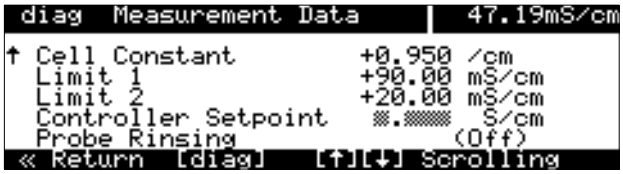
Bold print is used for terms explained in chapter 17: ”Technical Terms”.

Italics are used to emphasize certain information.

The representation of a menu in this manual can slightly differ from the display of your unit. This depends on the options your unit 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 (controller function).

Structure of this Manual

Like the Transmitter 7500, this manual is divided into three levels:

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

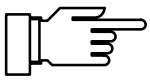
Refer to chapters 1 through 5

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

Refer to chapters 1 through 7

Administrator Level: You can set all parameters of the Transmitter 7500 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 unit differs from the description in this manual, check if the manual corresponds to the software version of your instrument: see page 3–4.

Overview of Transmitter 7500

Chapter **1** gives you an overview on the performance of the Transmitter 7500.

Operating the Transmitter 7500

Chapter **2** introduces you to the user interface and describes the keypad assignments. Selection of menu items and input of numerals is explained.

Diagnostics Menu

Chapter **3** describes how the Diagnostics menu provides you with information on the state of the conductivity sensor and instrument.

Maintenance Menu	Chapter **4** explains how the installation can be maintained.
Display of Settings	Chapter **5** explains how to read out instrument settings.
Calibration	Chapter **6** shows how to select the calibration sequence and how to perform a calibration.
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 Transmitter 7500	Chapter **9** gives a detailed description of the instrument 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 Transmitter 7500 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.
Calibration Solution Charts	Chapter **15** provides the temperature charts for the stored calibration solutions.
Appendix	Chapter **16** shows you 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 Transmitter 7500

Commissioning of the Transmitter 7500 must be carried out only by specially trained experts in accordance with the relevant regulations and the instruction manual.
All parameters must be set by a system administrator prior to first start-up.

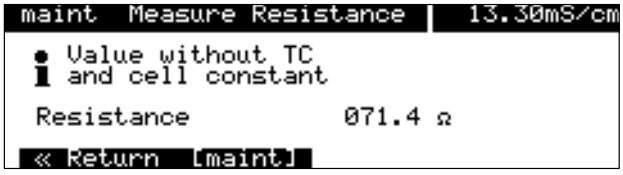
Instrument Concept

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 additional 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: conductivity, resistivity, concentration, measured and manually entered temperature, time, date, output current values 1 and 2, input current in %, manipulated variable (controller output).



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.

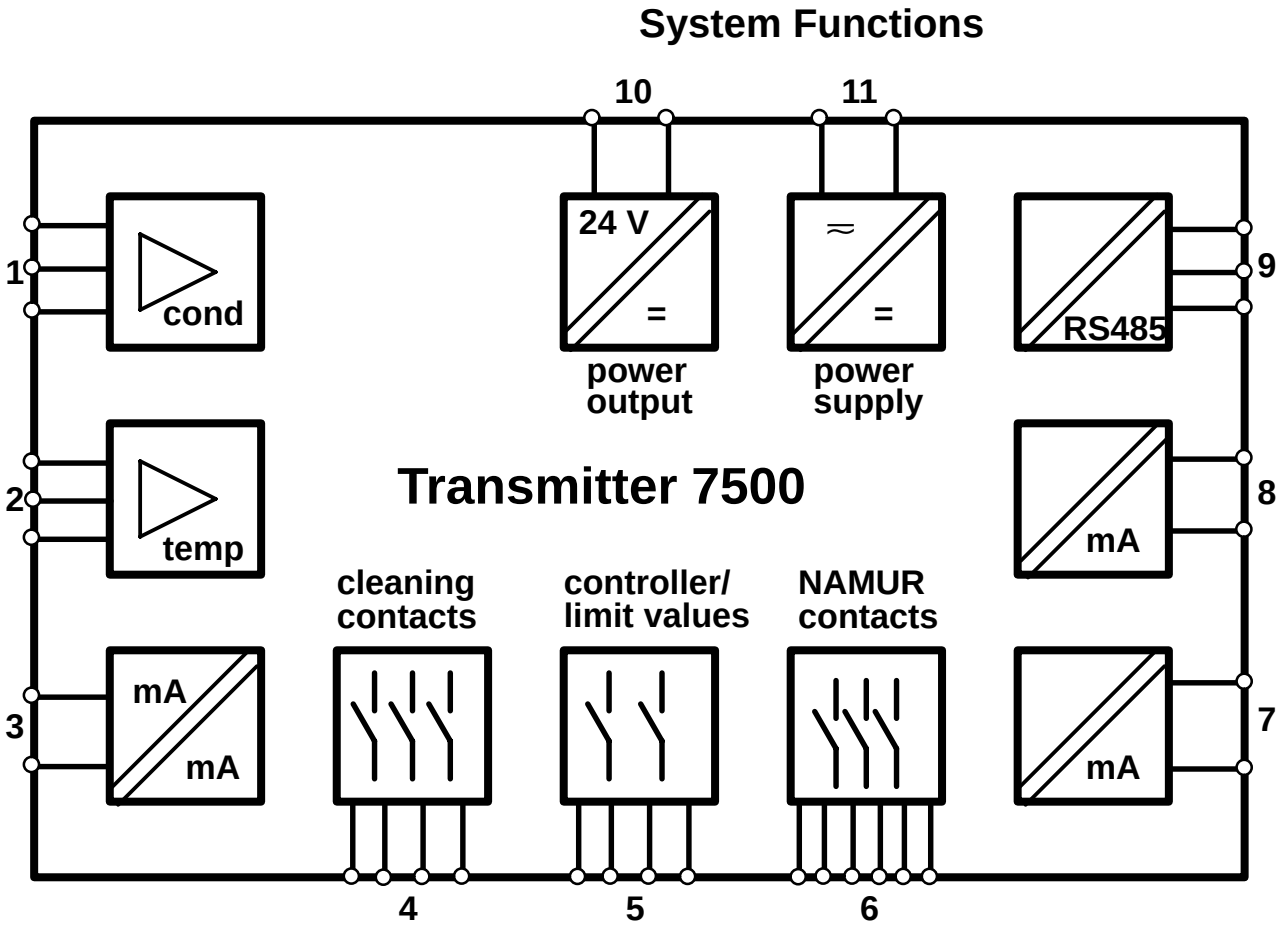


Fig. 1–1 System Functions Transmitter 7500

Fig. 1–1 shows the versatile system functions.

You can connect 2- or 4-electrode cells (1) and a temperature probe. (2)

The optional concentration function allows to calculate and display substance concentrations for certain test solutions.

Cell standardization is automatically performed by determining the cell constant, entering a known conductivity value, by directly entering the cell constant or through sample calibration.

Accuracy of conductivity measurement and concentration determination can be further increased by *compensating for the measured temperature.*

The instrument provides two galvanically isolated *standard current outputs* (0(4) to 20 mA) (7 and 8), which can each be assigned to conductivity, resistivity, concentration or temperature. As an option the 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) al-

lows 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 cell.

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.

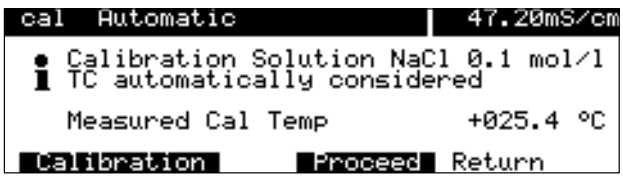
A menu is activated by pressing the corresponding key. At any time, also from a lower menu level, you can return to measuring mode by pressing **meas**.

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).

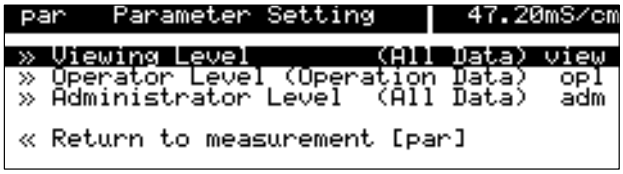
Individual Menus

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 the probe) 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 Transmitter.
Activated warning and failure messages are listed in plaintext in the **message list**.
Furthermore, you can retrieve the cell constant.

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 Transmitter 7500

Commissioning of the Transmitter 7500 must be carried out only by specially trained experts in accordance with this instruction manual.
All parameters must be set by a system administrator prior to first start-up.

Transmitter in Measuring Mode

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

The symbol ▲▼ indicates that the additional 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:

- conductivity
- concentration (only with option 359, 360 or 382)
- resistivity
- Pt / Ni measured temperature (°C)
- MAN manual temperature (°C)
- I– INP input current

- OUTP1 output current 1
- OUTP2 output current 2 (only with option 350)
- CTL–Y controller output (only with option 353 or option 483)
- TIME time
- DATE date

Alarm Messages

If the user defined limits (e.g. of measured conductivity) 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 3–2.)
For setting the warning and failure message limits, refer to chapter 9, page 9–26.

Limit Contacts Active

If the defined **limit values** are exceeded, e.g. for conductivity, ”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 3–2.)
For setting the limit values, refer to chapter 9, page 9–28.

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.

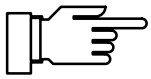
All entries are accepted by pressing **enter**.

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. ”Alarm Settings”) 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**.

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

Menu Structure

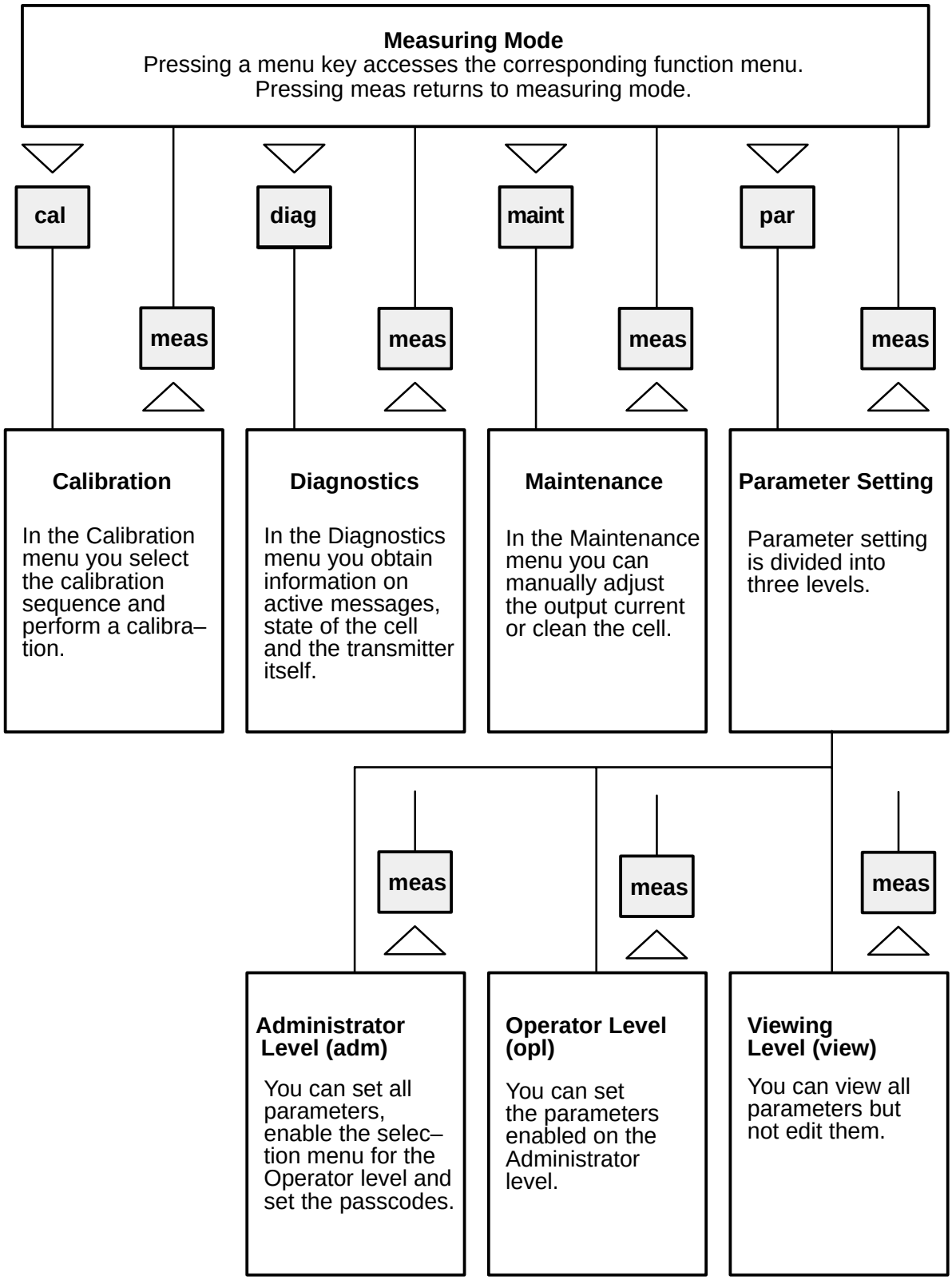
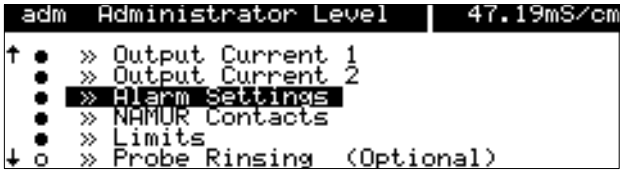


Fig. 2–1 Menu Structure

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.



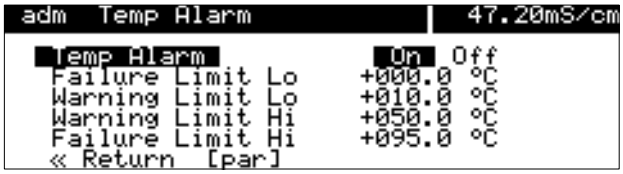
The arrows "↑" and "↓" indicate that more lines can be accessed by scrolling.

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

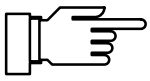
≫ Pressing ► or **enter** accesses the next (lower) menu level.

≪ 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

Press **enter** to store the new parameter (e.g. "On"). Flashing stops.

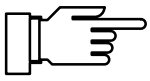
How to keep the old setting

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

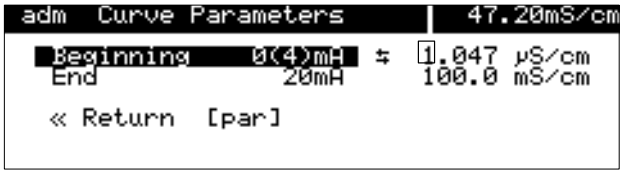
How to enter numerical values

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

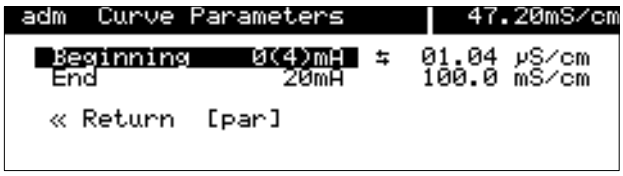
Select the entry position using **cursor keys ◄ or ►**.



When you edit *conductivity values and cell constants,* the symbol ⇆ appears to the left of the numerical value.
Now you can change the input range (decimal point and unit symbol) using the cursor keys.

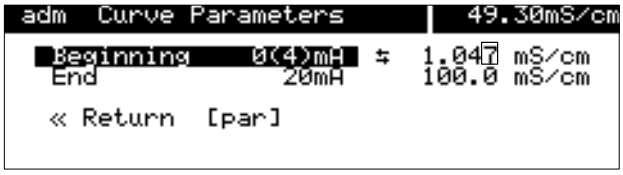


When the cursor is on the first digit, ◄ increases the input range by one decade.

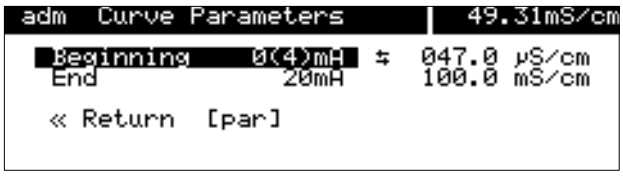


Input range changes to 00.00 – 99.99 mS/cm.

The sequence ”104” remains on the display, shifted by one decimal position. The last digit (”7”) is erased.



When the cursor is on the last digit, ► decreases the input range by one decade.



Input range changes to 000.0 – 999.9 µS/cm.

The sequence ”047” remains on the display, shifted by one decimal position. The first digit (”1”) is erased.

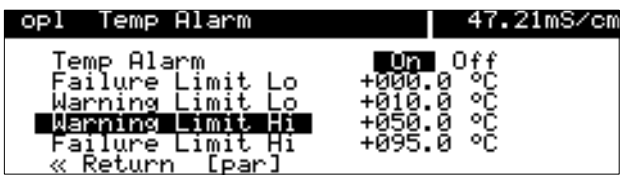
The digits that are shifted out of the display are erased (set to zero). That is, only the displayed 4-digit value is edited.
Pressing **par** restores the old value if you have not yet pressed **enter**.

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 ”–”.

An Example



In this *example* we want to change the temperature alarm ”Warning Limit Hi” from 50 to 67 °C.

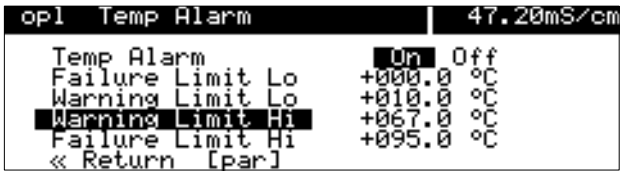
Press ► twice until the flashing cursor is on digit ”5”.

Press ▲ once (”6”).
Press ► once: The flashing cursor is on digit ”0”.
Press ▼ three times (”7”).

How to keep the old setting

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

Pressing **enter** stores the new value.



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3 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 19227/ ISO 3511), the limit values, the controller setpoint (with option 353), and if probe rinsing is activated.

- 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 instrument model, serial number and options of the Transmitter 7500.

- The device diagnostics
  allows comprehensive tests to check the function of the Transmitter 7500.
  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

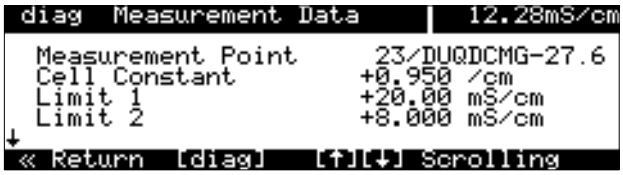
Press ▶ or **enter** to access the ”Message List”.

All currently active failure and warning messages are displayed.

For description of messages, refer to chapter 11.

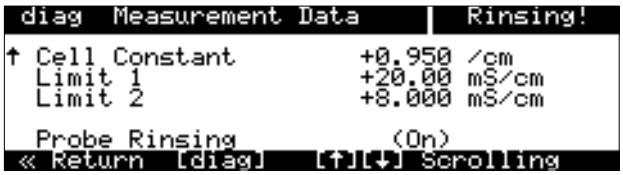
Press **diag** to return to the Diagnostics menu.

Measurement Data

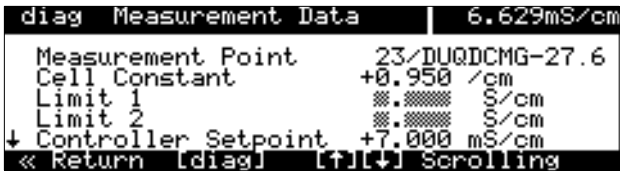


Press ▼ and **enter** to access the ”Measurement Data”.

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

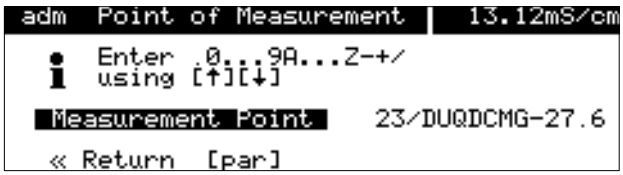


If the Transmitter is equipped with option 352 (probe rinsing), you can see if probe rinsing is activated.



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

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



How to enter the point of measurement

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

You can select . 0...9 A...Z – + / using the scrolling keys.
Enter the point of measurement using scrolling and cursor keys (see page 2–5) and confirm your entry with **enter**.

Logbook

You can only make use of the logbook if your 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, cell constant
- 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 instrument is equipped with option 351 (remote interface) (refer to page 9–47), the logbook contents can be read out and automatically documented.

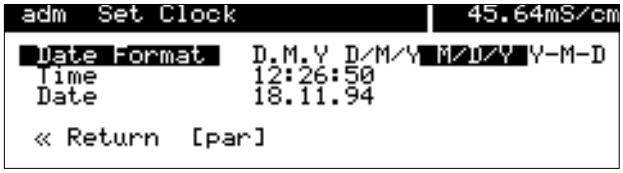
How to display the logbook entries

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

Press the scrolling keys to display all entries.

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

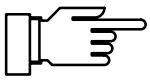
How to set time, date and date format



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

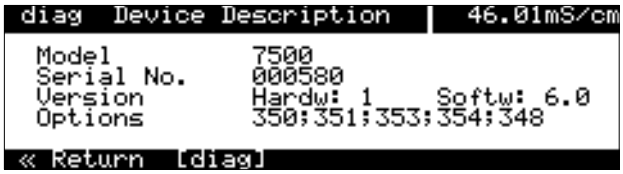
Select date format, time or date using ▼ and **enter**.

Enter time and date using scrolling and cursor keys (see page 2–5) 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 additional display, time also on the measurement display. (see page 2–1).

Device Description

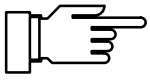


Select ”Device Description” using ▼ and **enter**.

You read:

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

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



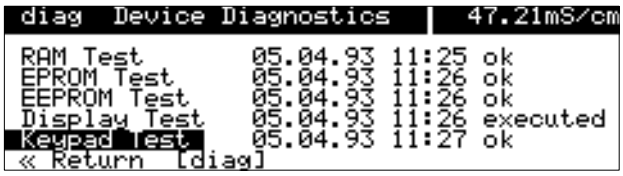
The software version must correspond to the version indicated at the bottom right of the second page of this manual.
The options for *power supply* are *not* displayed. They are indicated on the nameplate (between the Pg cable glands).

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 Transmitter 7500.
This permits quality management documentation to ISO 9000.
Instrument settings and parameters are not affected.

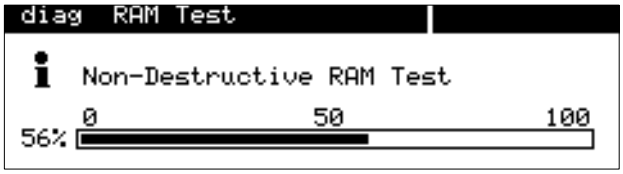
How to perform device diagnostics



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

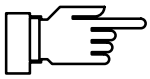
You see when each test was performed and what the result was.

Memory Test



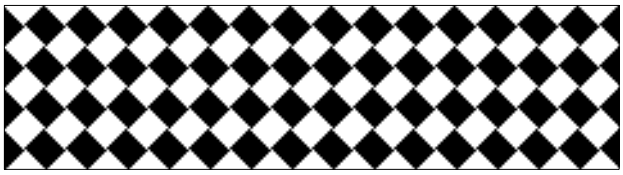
Select ”RAM Test”, ”EPROM Test” or ”EEPROM Test” using ▼ and **enter**.

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 Transmitter must be returned to the manufacturer for repair.

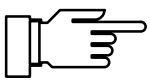
Display Test



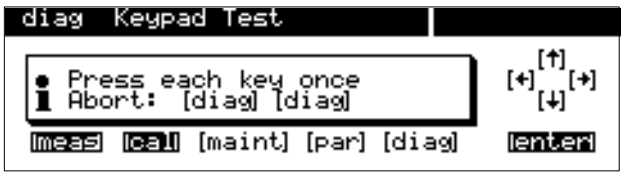
Select ”Display Test” using ▼.

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 Transmitter 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 Transmitter to the manufacturer for repair.

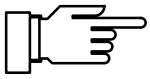
Press **diag** to return to the Diagnostics menu.

4 Maintenance Menu

What you can do in the Maintenance menu

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

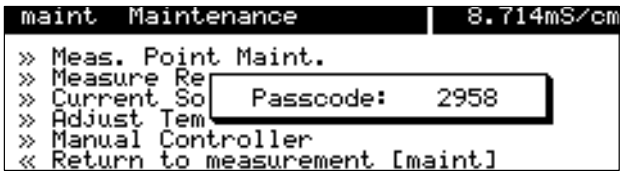
- Measurement point maintenance allows to dismount the cell.
- The probe rinsing function (option 352) permits automatic rinsing and cleaning of the cell: see page 9–42.
- Resistance measurement permits direct display of the ohmic resistance at the measuring input.
- The current source allows to manually 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 the temperature probe to increase accuracy of conductivity measurement (only effective with test medium TC enabled).
- If the Transmitter is equipped with a controller function (option 353), controller output Y (manipulated variable) can be entered manually.



Only with option 352: In the submenu ”Measurement Point Maintenance” contact ”probe” is active. A timer controlled rinsing cycle will not be started. (see page 9–42).

How to access the Maintenance menu

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

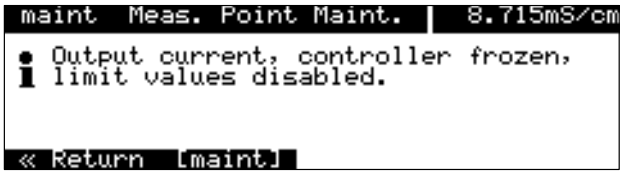


If you are prompted for a passcode, you must know the **maintenance passcode**:

Enter the maintenance passcode using scrolling and cursor keys (see page 2–5) and confirm your entry with **enter**.

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

Measurement Point Maintenance

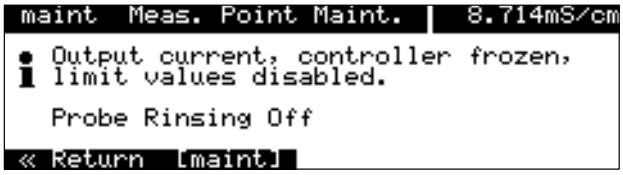


Press ▶ or **enter** to select ”Measurement Point Maintenance”.

Now you can remove the cell for cleaning or replacement.
Output current (1 and 2) and controller output are frozen at their last values, limit contacts are disabled.

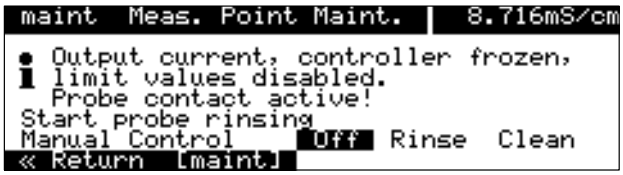
Transmitter with probe rinsing function (option 352)

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

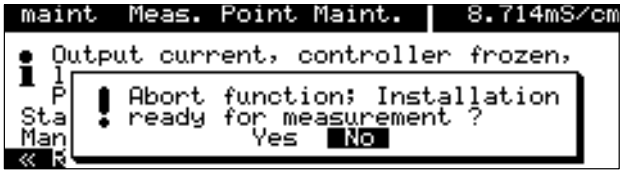


Probe rinsing has been disabled during parameter setting.

For further information, refer to page 9–42.

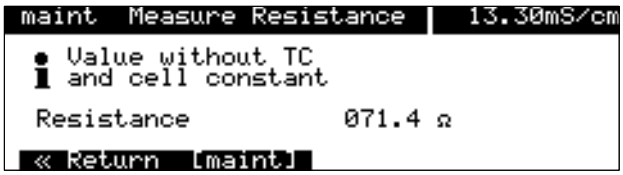


Probe rinsing is enabled.
You can start a **rinsing cycle**:
Press ▲ to select ”Start probe rinsing” and confirm with **enter** . *When the rinsing cycle is terminated, the Transmitter will go to measuring mode.*



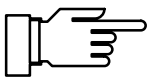
Press **maint** to return to the Maintenance menu, or press **meas** to return to measuring mode. In this case, you will be prompted to confirm your decision to exit the function. If you really want to, press ◀ to select ”Yes” and confirm with **enter**.

Resistance Measurement



Press ▲ and **enter** to select ”Measure Resistance”.

The resistance connected to the measuring input will be displayed directly. This allows you to check the installation by connecting a known ohmic resistor instead of the cell, for example.



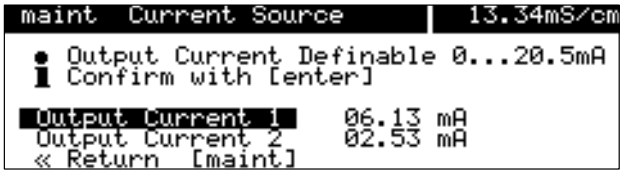
Cell constant and TC are not taken into account for the displayed resistance value!
The output current (1 and 2) is frozen.

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

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.

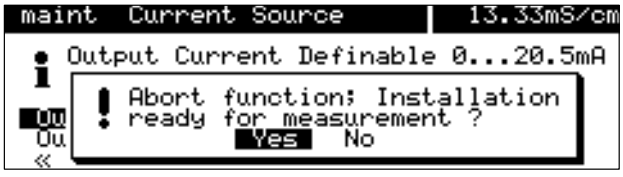
Therefore, you must be sure that the connected peripherals (control room, controller, indicator) will not interpret the current value as measured value!



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 2–5) and confirm your entry with **enter**.



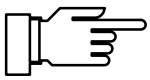
Press **maint** to return to the Maintenance menu, or press **meas** to return to measuring mode. In this case, you will be prompted to confirm your decision to exit the function. If you really want to, press ◄ to select ”Yes” and confirm with **enter**.

Temperature Probe Adjustment

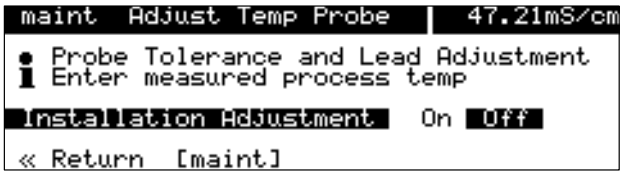
This function allows you to compensate for the individual temperature probe tolerance and the influence of the lead resistances to increase accuracy of temperature measurement.
Thus, accuracy of displayed conductivity and – above all – of concentration determination is increased with test medium TC enabled.

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 conductivity value!

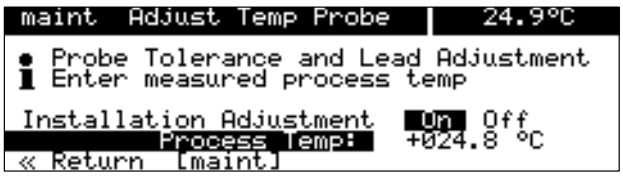


To make adjustment easier, set
”Measurement Display: Meas Variable °C”
(see page 9–10).



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

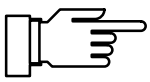
If measurement display has been set correspondingly, the *temperature measured by the temperature probe* is now read in the upper right corner of the display.



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 2–5) 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 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.

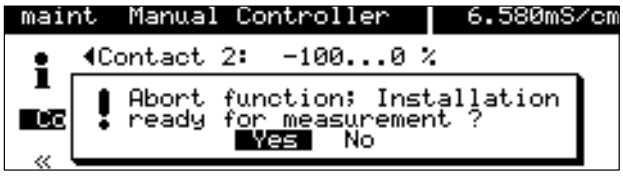
If you manually adjust the controller output, *automatic control* of the controlled variable *stops!*

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 % to check connected actuators, for example.

Enter the desired controller output using scrolling and cursor keys (see page 2–5) 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**.

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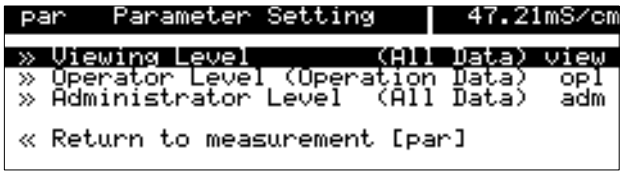
5 Display of Settings

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 ▶:

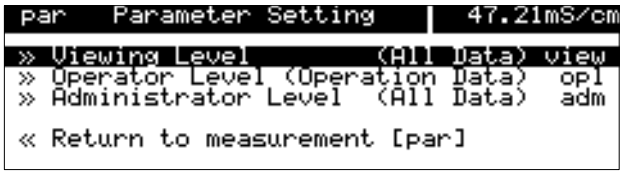
≫ Pressing ▶ or **enter** accesses the next (lower) menu level.

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

An Example

You want to read out the settings for temperature alarm.

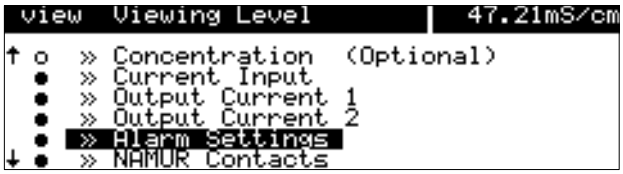
Press **par** to open the Parameter Setting menu.



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

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

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

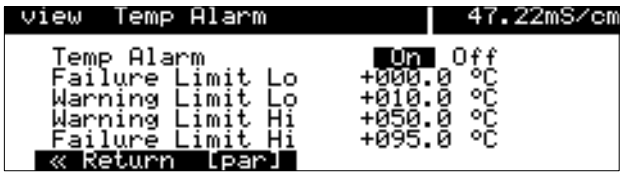


≫ Press ▶ or **enter** to access the next (lower) menu level.

Select ”Temp 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 temperature alarm will be displayed.

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

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

6 Calibration

Why do you have to calibrate?

Every **cell** has its individual **cell constant**. Depending on the cell construction, the cell constant can vary over a broad range. Since the conductivity value is calculated from measured conductance and cell constant, the Transmitter 7500 must know the cell constant.

For **calibration** or **cell standardization**, you either enter the known (stamped on) cell constant of the cell in use in the Transmitter 7500, or automatically determine the constant by measuring a calibration solution of known conductivity.

Without calibration, every conductivity meter delivers a wrong output value!
Especially after replacing the cell, you should perform a calibration if the difference between the cell constants of the two cells is too high for the required accuracy.

Monitoring Functions for Calibration

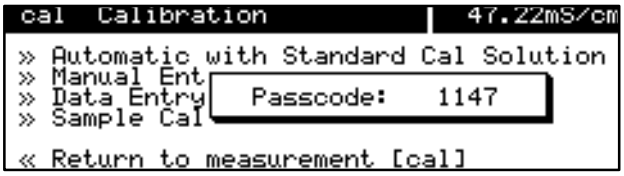
The Transmitter 7500 provides comprehensive functions for monitoring correct calibration performance and electrode system state. This allows documentation for quality management to ISO 9000 and **GLP/GMP**.

- The **logbook** provides time and date stamped records of calibrations performed within the last 200 events. (See page 3–3.)
- For the cell constant, you can define limits for a **warning** and a **failure message**. (See page 9–26.) This permits automatic monitoring of the cell constant value determined during calibration.

How to access the Calibration menu

Pressing **cal** activates the Calibration menu.

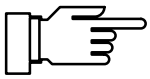
Pressing **meas** exits the Calibration menu.



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

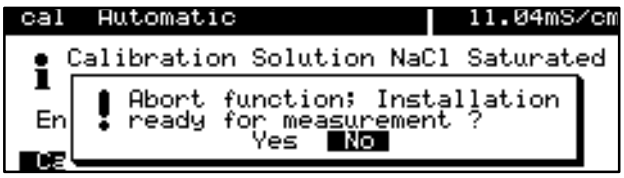
Enter the calibration passcode using scrolling keys ▲ / ▼ and cursor keys ◀ / ▶ (see page 2–5) and confirm your entry with **enter**.

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** or entering the calibration passcode) activates NAMUR contact ”functional check”. It is deactivated when you exit the menu.
When you select a calibration sequence (Automatic, Manual or Data Entry), contact ”probe” will be activated for the duration of the calibration (only with option 352 probe rinsing, see page 9–42).
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 having performed a calibration, 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 cell constant remains valid.

How to select a calibration sequence

You can choose between four different calibration sequences:

- automatic determination of cell constant with standard calibration solution
- automatic determination of cell constant by manually entering the conductivity value of the calibration solution
- entry of premeasured cell constant
- calibration by sampling

When you press **cal**, the 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 Transmitter 7500 during calibration and on the selected calibration solution, and it guides you through operation.

Temperature Detection during Calibration

Why Temperature Detection?

The temperature of the calibration solution must be determined because its conductivity is temperature dependent:

- For automatic calibration, the temperature of the calibration solution must be known to select the correct conductivity value from the chart (see chapter 15).
- For manual calibration and sampling, you must enter the *temperature-corrected* conductivity value.

During parameter setting, you define if calibration temperature is automatically measured or must be entered manually (see page 9–13).

Automatic Temperature Detection

For automatic cal temp detection, the Transmitter 7500 detects calibration solution temperature using a Pt 100, Pt 1000 or Ni 100 temperature probe.

For automatic temperature detection, there *must* be a temperature probe in the calibration solution. This probe must be connected to the temperature input of the Transmitter 7500!
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”, ”Calibration Temperature” is read in the menu.

Manual Temperature Input

Calibration solution temperature must be entered manually:

Measure the calibration solution temperature, e.g. using a glass thermometer.
Place the cursor in the Calibration menu on the value for calibration temperature using ▲ and ▶.
Enter the measured temperature using scrolling and cursor keys (see page 2–5) and confirm your entry with **enter**.

Automatic Calibration with Standard Calibration Solution

For automatic calibration, the cell is immersed in a standard calibration solution.
From the measured conductance and temperature, the Transmitter 7500 *automatically* calculates the cell constant.
Temperature dependence of the calibration solution's conductance is taken into account by the Transmitter.

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

What you have to know for calibration

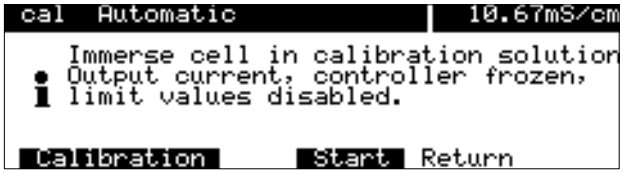
Use only fresh calibration solutions!
The calibration solution must be selected during parameter setting (see page 9–11).
Accuracy of calibration depends on exact detection of the calibration solution's temperature: Using the measured or entered temperature, the Transmitter 7500 determines the setpoint for the calibration solution from a stored chart.
Note the response time of the temperature probe! For exact determination of the cell constant, wait until the temperatures of temperature probe and calibration solution have balanced.

How to perform an automatic calibration

Remove cell
Select submenu ”Automatic”
Press enter

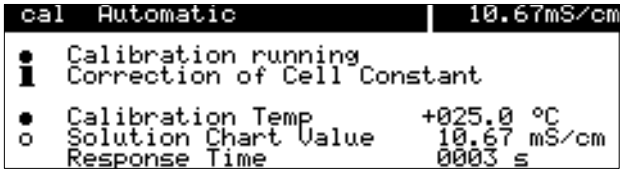
Press **cal**, ▲ (if required) and **enter** to open the ”Automatic” submenu.

The selected calibration solution is displayed.



Immerse the cell in the calibration solution and confirm ”Calibration Start” with **enter**.

Immerse cell in calibration solution
Press enter



From the **response time,** you see how long it takes for the measured value to stabilize.

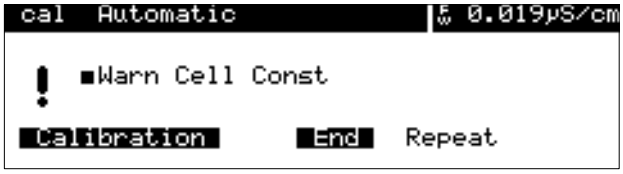
If measured conductance or measured temperature strongly fluctuate, calibration is stopped after 2 min.

The new, calculated cell constant is displayed.

Press **enter** or **cal** to return to the Calibration menu, or
press **meas** to activate measuring mode.

Press enter
Rinse cell 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 Manual Entry of Conductivity Value

For calibration by manual entry of the calibration solution's conductivity, the cell is immersed in the calibration solution.
The Transmitter 7500 determines a pair of conductivity/calibration temperature values.
Then you have to enter the *temperature corrected conductivity value* of the calibration solution.
To do so, look at the TC chart of the calibration solution and enter the conductivity belonging to the displayed temperature. For intermediate temperature values, you must interpolate. Then the Transmitter 7500 *automatically* calculates the cell constant.

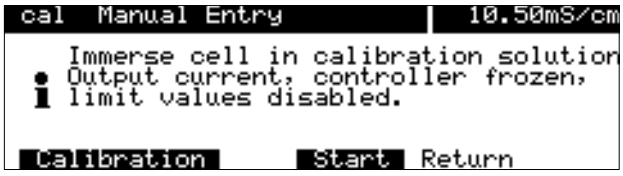
During calibration, output current (1 and 2) and controller output are frozen at their last values, limit contacts are disabled, contact "probe" is enabled (only with option 352).

Use only fresh calibration solutions!
For exact determination of the cell constant, wait until the temperatures of temperature probe and calibration solution have balanced.

How to perform a calibration by entry of conductivity value

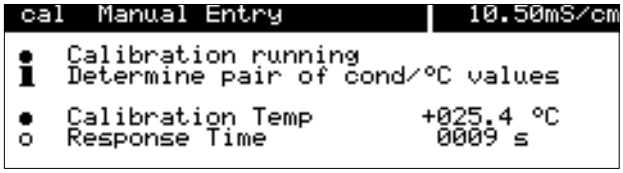
Select submenu "Manual Entry"
Press enter

Press **cal**, ▼/▲ (if required) and **enter** to open the "Manual Entry" submenu.



Immerse the cell into the calibration solution and press **enter** to confirm "Calibration Start".

Immerse cell in calibration solution
Press enter



From the **response time,** you see how long it takes for the measured value to stabilize.

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

After a successful calibration, the measured conductivity is displayed.

Enter the conductivity of the calibration solution

Now enter the conductivity of the calibration solution using scrolling and cursor keys (see page 2–5) and confirm your entry with **enter**.

The new, calculated cell constant is displayed.

Press **enter** or **cal** to return to the Calibration menu, or
press **meas** to activate measuring mode.

Press enter
Rinse cell 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.

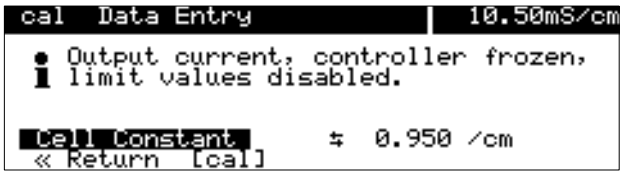
Calibration by Entry of Premeasured Cell Constant

You can directly enter the cell constant of the cell in use. Usually, the cell constant is stamped on the cell.
The specified cell constant varies due to the manufacturing process. With some cells, it can also change depending on the installation conditions. *For accurate measurements, you should therefore calibrate each cell individually* (Automatic, Manual or Sampling).

The InPro® 7000 cells *must* be calibrated by direct entry of the cell constant since calibration solutions in the µS/cm range are not stable.

During calibration, output current (1 and 2) and controller output are frozen, limit contacts are disabled, contact ”probe” is enabled (only with option 352).

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 2–5) and confirm your entries with **enter**.

Calibration by Sampling

If the cell cannot be removed (e.g. for reasons of sterility in biotechnical processes), the cell constant can be determined by ”sampling”.

To do so, the Transmitter 7500 stores the currently measured process value.
Immediately afterwards you take a sample from the process. The sample value is measured in the laboratory.
The laboratory value is entered into the Transmitter 7500 which calculates the cell constant from the difference between measured value and laboratory value.

During calibration, output current (1 and 2) and controller output are frozen, limit contacts are disabled, contact ”probe” is enabled (only with option 352).

How to perform calibration by sampling

Press **cal** and **enter** to open the ”Sample Cal” submenu.
The measured sample temperature and the currently measured value of the process medium are displayed and stored.
In addition, you can see whether calibration is to be performed with or without TC correction (for parameter setting, see Pg. 9–15).
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 Transmitter expects entry of the laboratory value. Until that, it uses the old cell constant for measurement.
(If the Transmitter is in remote status during interface operation, the display ”Sample” is covered by ”Remote”.)

Without TC correction

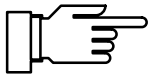
Take a sample from the process and measure the value of the sample at the temperature at which the sample has been taken (“Sample Temp”, see display). To do so, it may be necessary to thermostat the sample correspondingly in the lab. Temperature compensation at the comparison meter must be turned off (TC = 0 %/K).

With TC correction
T_{ref} = 25 °C

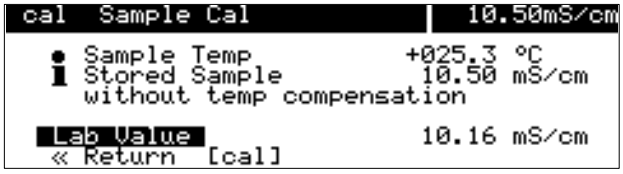
Take a sample from the process. The sample value can be measured on site using a portable conductivity meter or in the lab. Be sure that the same values are set for reference temperature and temperature coefficient in the comparison meter and in the Transmitter 7500. Furthermore, the measuring temperature should correspond to the sample temperature (see display). Therefore, you should transport the sample in an insulated container (Dewar).

With TC correction
$T_{ref} \neq$ 25 °C

Take a sample from the process. The sample value can be measured using a second Transmitter 7500 (installed in the lab), for example. Be sure that the same values are set for reference temperature and temperature coefficient in the comparison meter and in the Transmitter 7500. Furthermore, the measuring temperature should correspond to the sample temperature (see display). Therefore, you should transport the sample in an insulated container (Dewar).



Sample calibration can only be performed if the process medium is stable. That means, for example, that there are no chemical reactions which have an effect on the process conductivity.
At higher temperatures, the sample value can also be invalidated due to evaporation.



When the sample value has been determined, open the “Sample Cal” submenu again.
The measured sample temperature and the stored value are displayed.
Furthermore, you can see whether calibration is performed with or without TC correction.
Enter the measured sample value (“Lab Value”).
The new cell constant is now automatically calculated and stored.

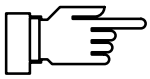
Pressing **enter** or **cal** returns you to the calibration menu.

Pressing **meas** accesses the measuring mode.

Calibrating the Cells

Cells of the InPro® 7000 Series (2-Electrode Cells)

The cell constant of the cells of the InPro® 7000 series is independent of the installation geometry and is nominally 0.1 cm^{-1}. The pre-calibrated cell constant M is printed on the cell and can be entered directly in the Transmitter. The cell generally requires no further calibration.



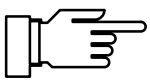
Through pre-calibration at the factory and the installation-independent design of these cells, an extremely high measuring accuracy can be achieved.

Calibration solutions are unstable within the measuring range (µS/cm) of the InPro® 7000 cells and are not recommended.

Cells of the InPro® 7100 Series (4-Electrode Cells)

The cell constant of the cells of the InPro® 7100 series is nominally 0.6 cm^{-1}.
The cell constant of the cells is dependent on the installation geometry. If the minimum distances (see Pg. 14–10) are not observed during installation, the cell must be calibrated while installed, as the cell constant has changed.
Select “Sample Calibration” as the calibration sequence.

For free installation of the cell (minimum distances exceeded), the cell constant M printed on the cell can be entered directly into the measuring unit. Due to production-dependent tolerances, the exact value of the cell constant may differ from the nominal value by up to 10%.



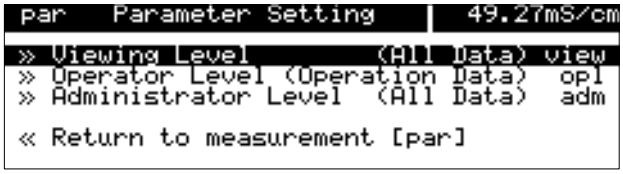
Calibration solutions for the measuring range of these cells are available on the market, or the operator can prepare them himself/herself. For example, 0.1 mol/l NaCl solution is suitable for calibration.
Watch the minimum distances and installation geometry during calibration.

7 Parameter Setting on the Operator Level

What you can do on the Operator level

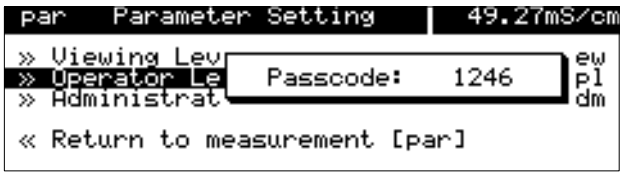
On the Operator level you can edit certain parameters (menu items) of the Transmitter.
Access to the Operator level can be protected by a passcode.

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 2–5) 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.

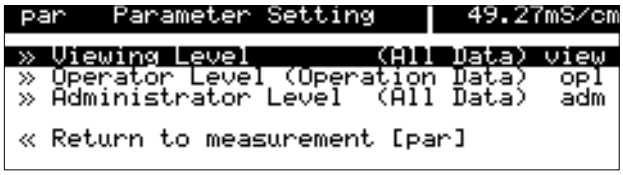
The symbols ≪ and ≫ at the beginning of the display line indicate that you can access another menu level by pressing cursor key ◀ or ▶:

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

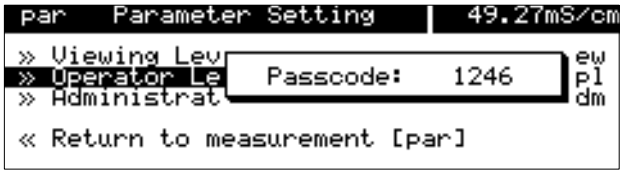
≪ Pressing ◀ or **par** accesses the previous (higher) menu level.

An Example

You want to change the settings for the input filter.



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

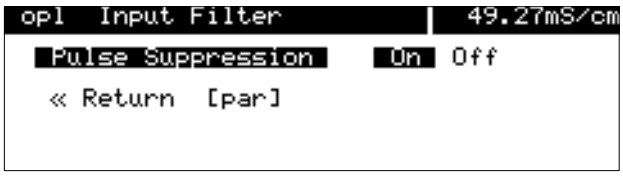


Press ▼ and **enter** to select "Operator Level (Operation Data)".

Enter the **operator passcode** using scrolling and cursor keys (see page 2–5) 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 commissioning the Transmitter 7500, a *complete parameter setting* procedure must be performed by a system administrator.

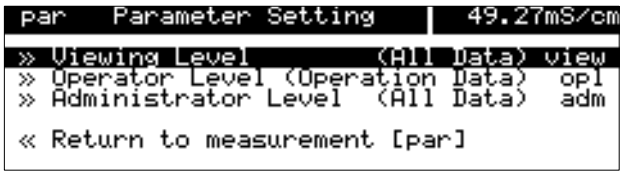
What you can do on the Administrator level

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.

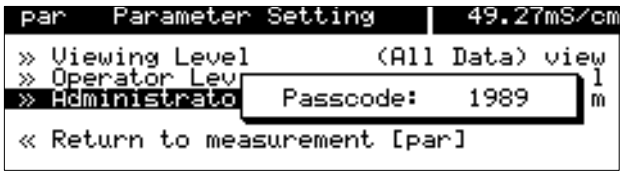
Access to the Administrator level is protected by a passcode.

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 2–5) 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 is enabled: 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.

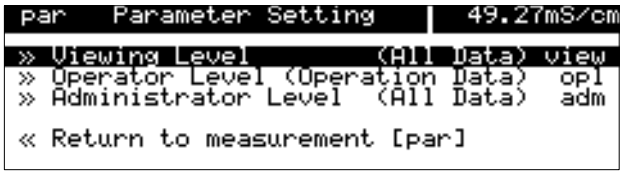
The symbols ≪ and ≫ at the beginning of the display line indicate that you can access another menu level by pressing cursor key ◀ or ▶:

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

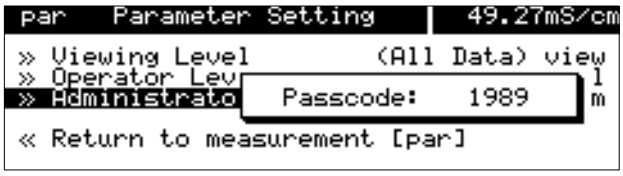
≪ Pressing ◀ or **par** accesses the previous (higher) menu level.

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 2–5) 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 Transmitters.
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 2–5) 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 2–5) 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
8902 Urdorf
Switzerland
Phone: +41–1–736 2214
Telefax: +41–1–736 2210

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

Edit the administrator passcode using scrolling and cursor keys (see page 2–5) 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 incorrect measured value outputs!

Factory Set Passcodes

The Transmitter 7500 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 Transmitter 7500

Commissioning of the Transmitter 7500 must be carried out only by specially trained experts in accordance with the relevant regulations and this instruction manual.
All parameters must be set by a system administrator prior to first start-up.

Overview

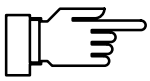
The Transmitter 7500 provides a great variety of features and capabilities.
This chapter describes

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

Power Supply for the Transmitter 7500

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 nameplate:

- 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 Conductivity Measurement

Fig. 9–1, page 9–3 shows how the Transmitter 7500 is configured for simple conductivity measurement with automatic temperature detection and conductivity signal evaluation by a connected recorder.

You can connect **2-electrode cells** or **4-electrode cells** to the Transmitter 7500. Cell selection depends on the measurement range:

- For measuring low conductivity values, you should use 2-electrode cells (e.g. Models InPro® 7000 or InPro® 7001, see page 14–4)
- For measuring high conductivity values, you should use 4-electrode cells (e.g. Model InPro® 7100 or InPro® 7104, see page 14–6)

Especially for 2-electrode cells, the range not only depends on the cell constant but also on the electrode surface. For information on selection of suitable cell constants, refer to EN 27888, for example.

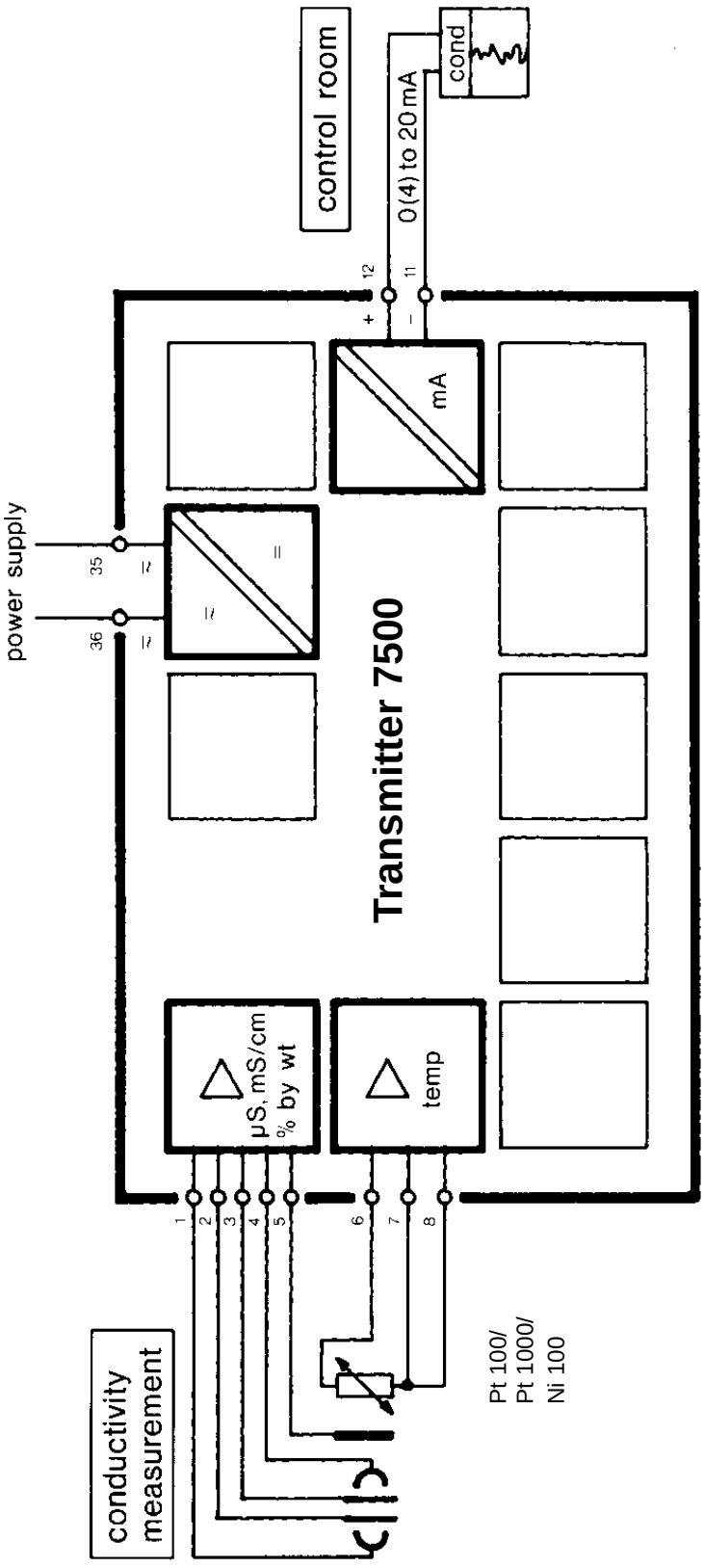
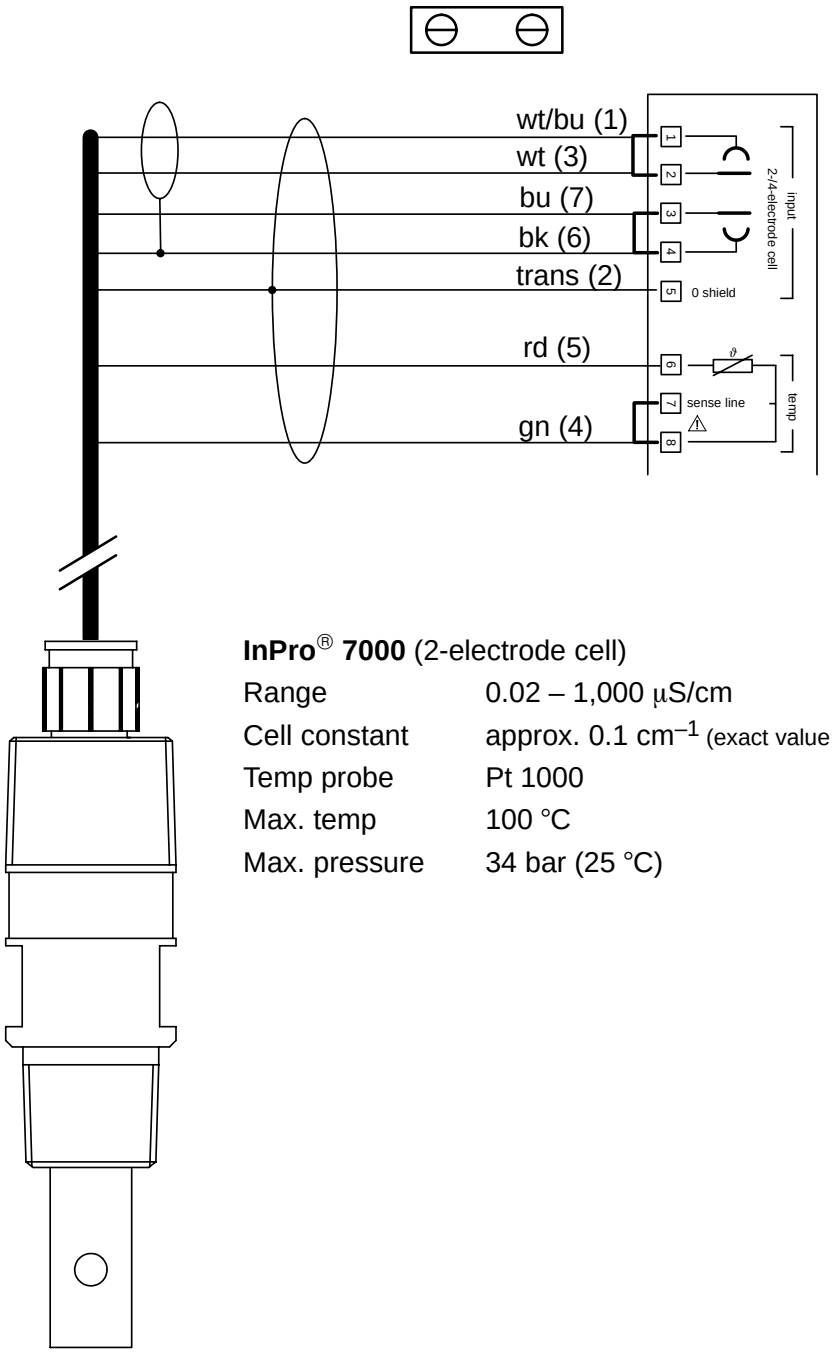


Fig. 9–1 Conductivity Measurement with Recorder Evaluation

Typical wirings

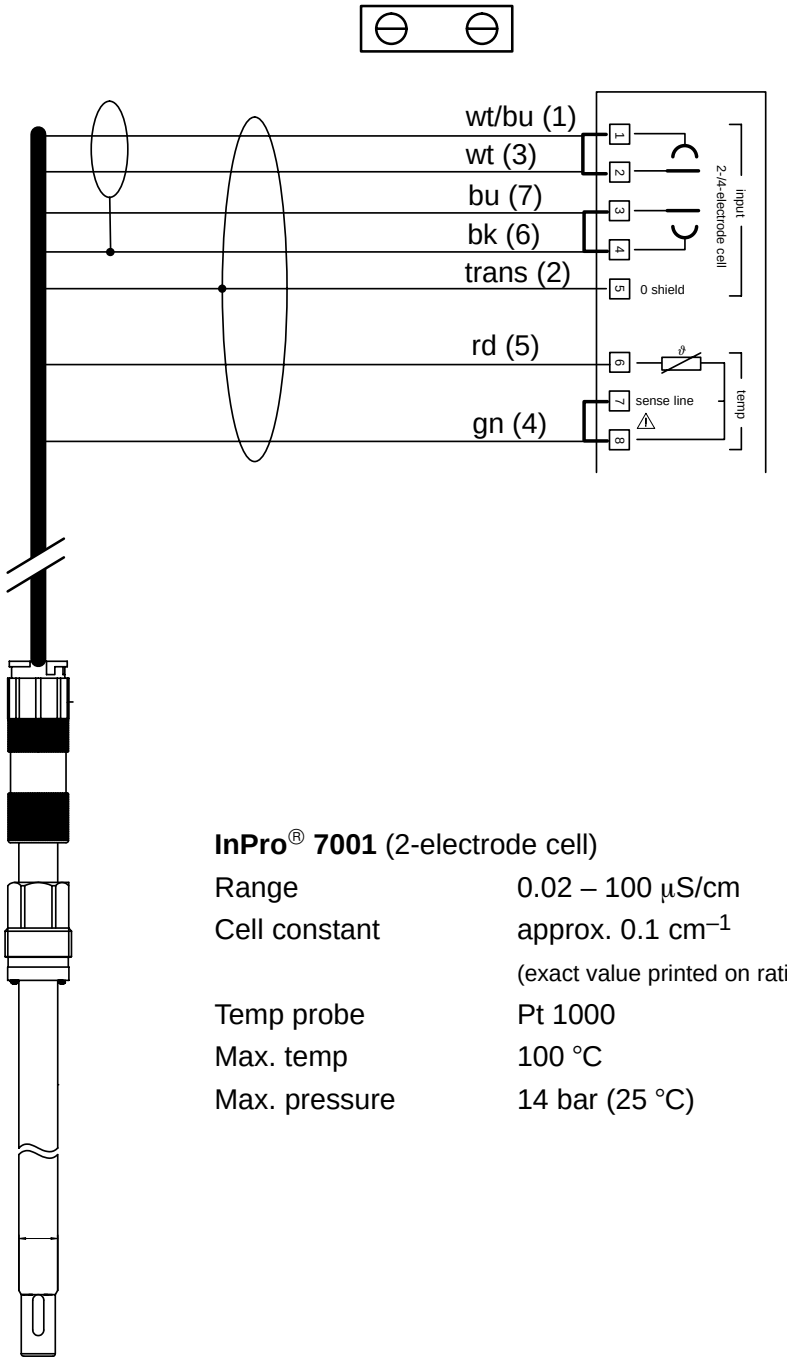
Conductivity Measurement with InPro® 7000 2-Electrode Cell



InPro® 7000 (2-electrode cell)

Range	0.02 – 1,000 µS/cm
Cell constant	approx. 0.1 cm^{-1} (exact value on rating plate)
Temp probe	Pt 1000
Max. temp	100 °C
Max. pressure	34 bar (25 °C)

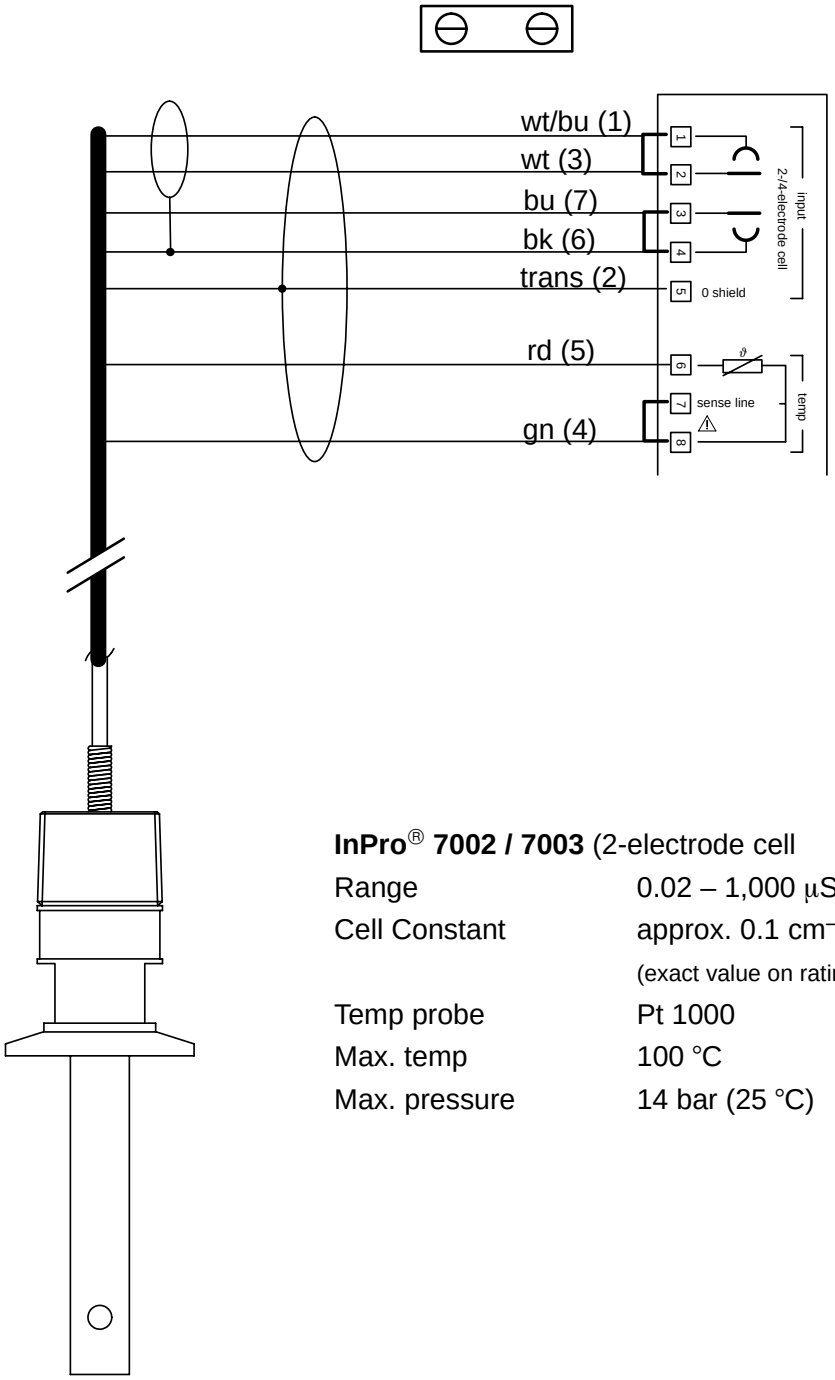
Conductivity Measurement with InPro® 7001 2-Electrode Cell



InPro® 7001 (2-electrode cell)

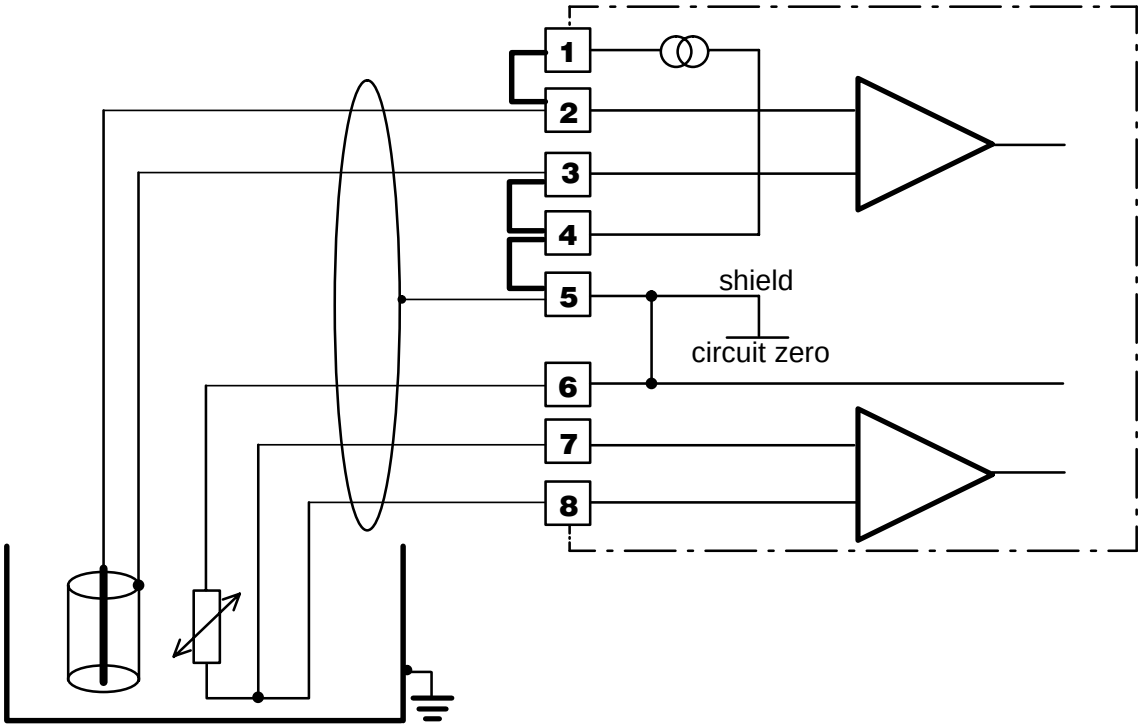
Range	0.02 – 100 µS/cm
Cell constant	approx. 0.1 cm^{-1}
	(exact value printed on rating plate)
Temp probe	Pt 1000
Max. temp	100 °C
Max. pressure	14 bar (25 °C)

Conductivity Measurement with InPro® 7002, 7003 2-Electrode Cells



InPro® 7002 / 7003 (2-electrode cell

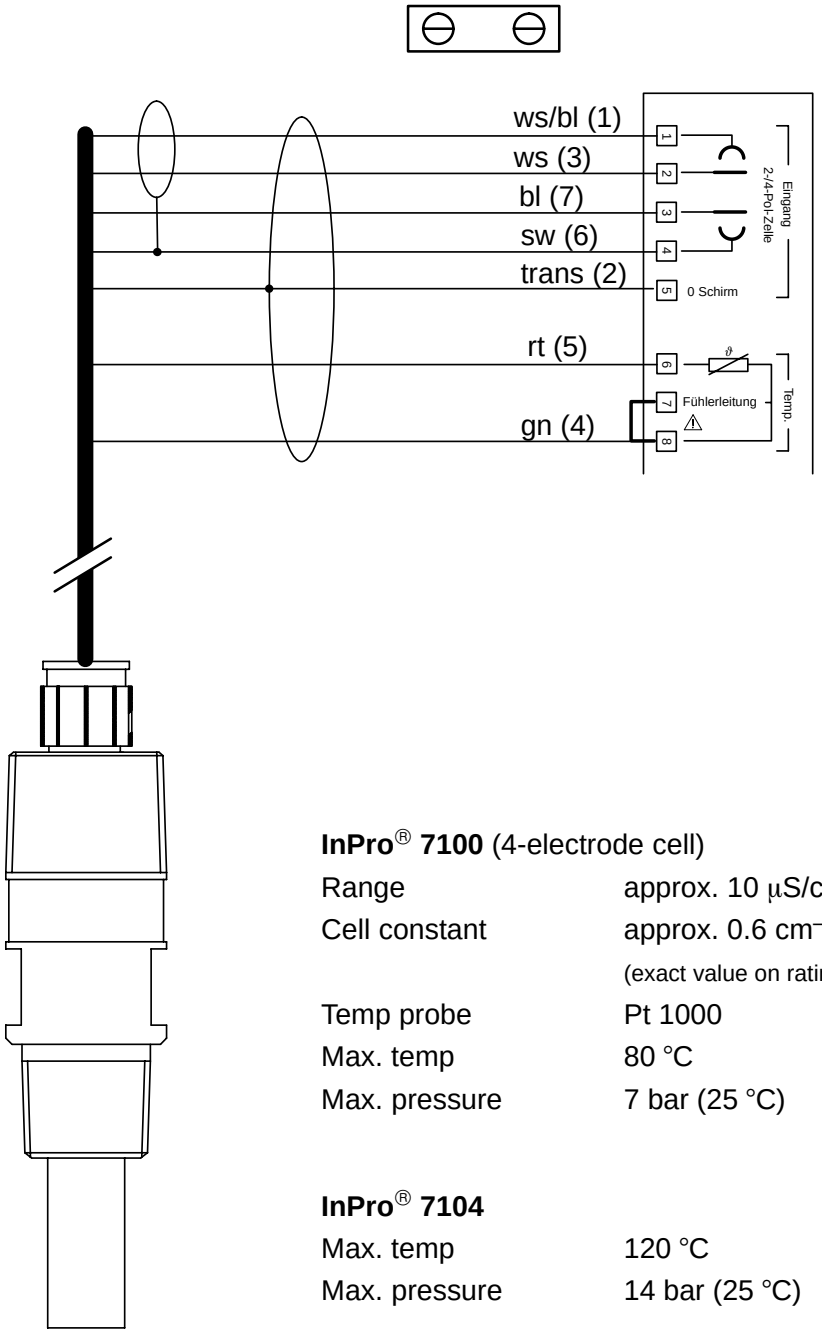
Range	0.02 – 1,000 µS/cm
Cell Constant	approx. 0.1 cm^{-1} (exact value on rating plate)
Temp probe	Pt 1000
Max. temp	100 °C
Max. pressure	14 bar (25 °C)



With a coaxial 2-electrode cell, the outer electrode can simultaneously be used for equipotential bonding. Then, terminals 3, 4 and 5 must be jumpered.

Fig. 9–2 Wiring example for other 2-electrode coaxial cells

Conductivity Measurement with InPro® 7100, 7104 4-Electrode Cells



InPro® 7100 (4-electrode cell)

Range	approx. 10 µS/cm – 300 mS/cm
Cell constant	approx. 0.6 cm^{-1}
	(exact value on rating plate)
Temp probe	Pt 1000
Max. temp	80 °C
Max. pressure	7 bar (25 °C)

InPro® 7104

Max. temp	120 °C
Max. pressure	14 bar (25 °C)

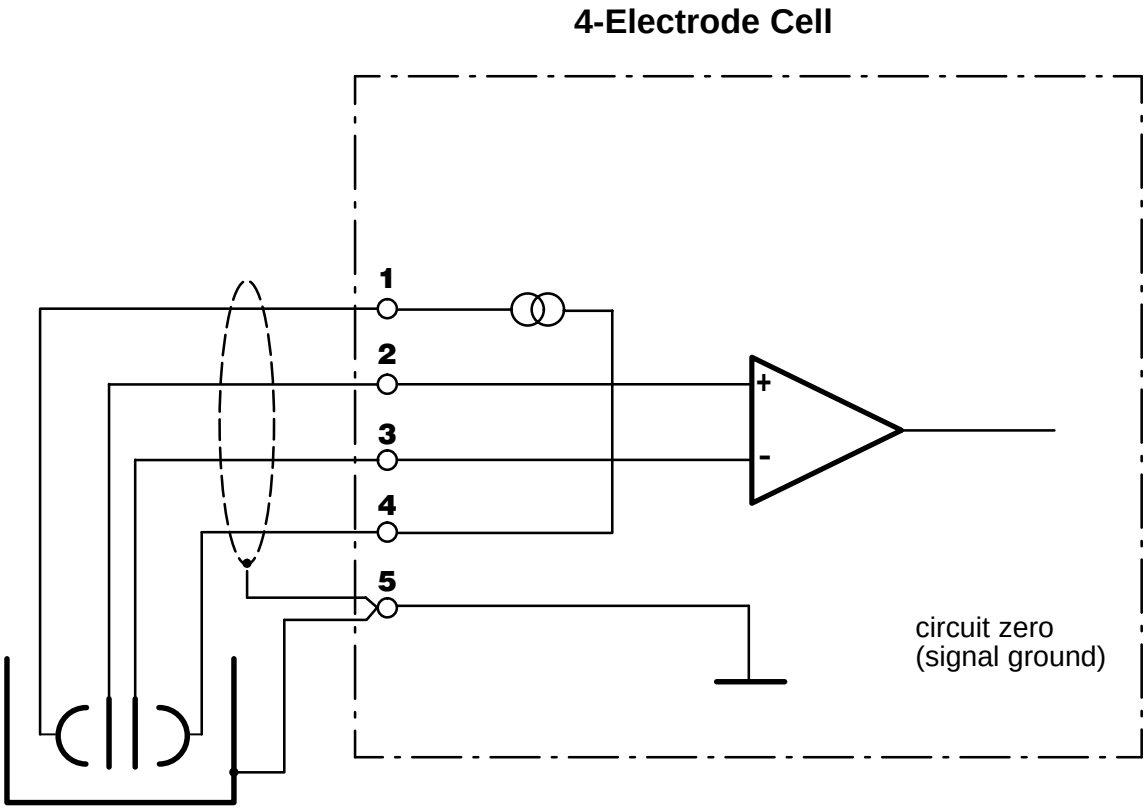


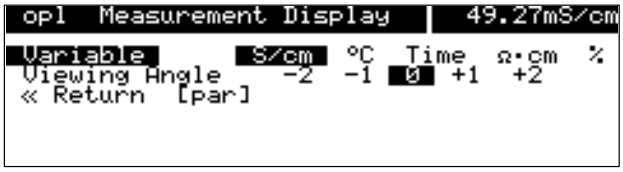
Fig. 9–3 Connection of the Transmitter 7500 with a 4-electrode cell and equipotential bonding

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:

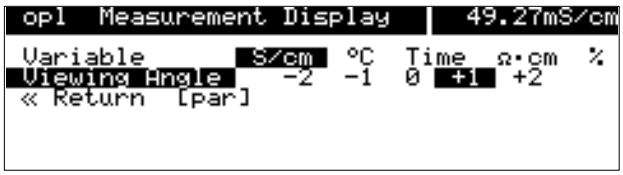
- conductivity value
- resistivity
- measured temperature (°C)
- time
- concentration (only with options 359, 360, 382)

How to set the measurement display parameters



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

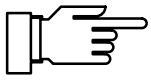
Select the measured variable you want to have displayed during measuring mode using ◀ and ▶ and confirm your choice with **enter**.
The corresponding measured value will be read in the upper right corner of the display.



The menu item ”Viewing Angle” allows you to adjust the viewing angle of the display.
When the 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.

Input Filter

For conductivity 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

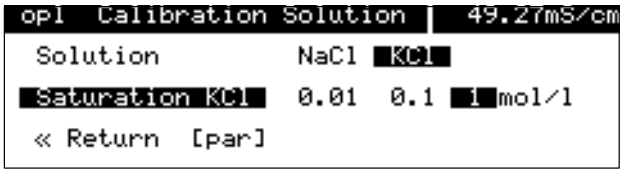
Open the Parameter Setting menu (adm or opl level resp.), press ▼ to select ”Input Filter”, and confirm with **enter**.

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

Calibration Solution for Automatic Calibration

For automatic cell calibration, you must define the calibration solution you want to use.

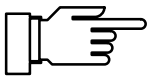
How to define the calibration solution



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

Select the calibration solution using ◄ and ► and confirm your choice with **enter**.

Select the concentration of the calibration solution using ◄ and ► and confirm your choice with **enter**.



For temperature charts of the calibration solutions refer to chapter 15.

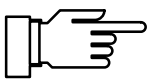
Temperature Detection

Why Temperature Detection?

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

- Compensation of the measured solution’s temperature dependence:
  The conductivity of the measured solution is temperature dependent. By entering a temperature coefficient for the measured solution and a reference temperature, all conductivity values can be calculated for the reference temperature.

- The conductivity of the calibration solution is temperature dependent. Therefore, the calibration solution temperature must be known for calibration to determine the temperature-corrected conductivity from the chart stored by the instrument.



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 Transmitter 7500 detects the process temperature using a Pt 100, Pt 1000 or Ni 100 temperature probe.

For automatic temperature compensation, there *must* be a temperature probe in the process medium. This probe must be connected to the temperature input of the Transmitter 7500!
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 Transmitter 7500 in **3-wire configuration**. 3-wire configuration of the 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/Ni 100 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 (not by the manually adjusted temperature).

You must enter the process temperature:

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

Enter the measured temperature using scrolling and cursor keys (see page 2–5) and confirm your entry with **enter**.

How to define calibration temperature detection

Calibration temperature can be manually compensated if the temperature probe remains in the process medium while the cell is dismounted 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 6–4.

Temperature Compensation for the Process Medium

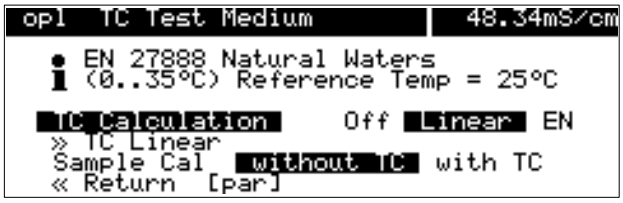
The conductivity of the measured solution is temperature dependent. By entering a temperature coefficient for the measured solution and a reference temperature, all conductivity values can be calculated for the reference temperature. During parameter setting, you can choose the type of temperature compensation:

- No temperature compensation
- Linear temperature compensation with entry of temperature coefficient and reference temperature.

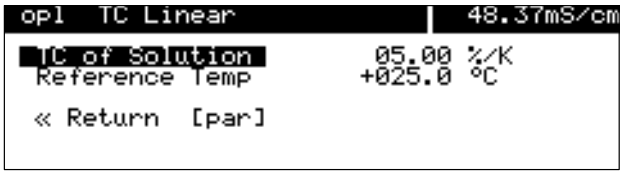
Temperature dependence of the conductivity is more or less nonlinear. Therefore, the reference temperature should be near the process temperature. Here, the linearly compensated measured value is closest to the ”true” conductivity value.

- Temperature compensation for natural waters to EN 27888. Compensation is effective in the range 0 to 35 °C. Reference temperature is 25 °C.
- Additionally with option 392: Temperature compensation for ultrapure water with traces of impurity (e.g. boiler feed water) down to ultrapure H_2O with 0.055 µS/cm (25 °C). Compensation is effective in the range of 0 to 158 °C. Reference temperature is 25 °C.
  Depending on the existing traces of impurity you can choose between:
  – ammoniacal ultrapure water(NH_3) for ordinary boiler feed water or condensate, for conductivity measurement **without** cation filter
  – acidic ultrapure water (HCl), for conductivity measurement **behind** cation filter
  – neutral ultrapure water (NaCl), for conductivity measurement during water treatment behind gravel bed filter
  – alkaline ultrapure water (NaOH)

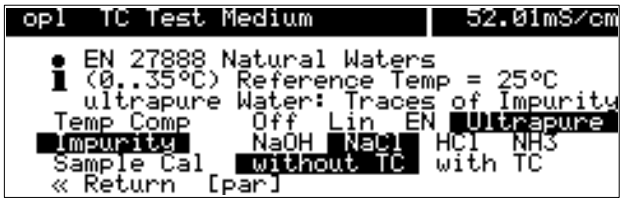
How to define temperature compensation



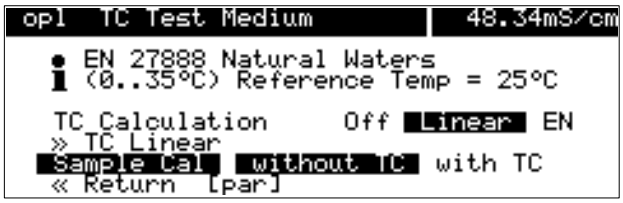
Press ▼ to select ”TC Test Medium” from the Parameter Setting menu (opl or adm).
Press ▶ to select ”TC Calculation Off”, ”Linear” or ”EN” (with opt. 392 also ”Ultrapure”) and confirm with **enter**.



If you have selected ”TC Calculation Linear”, press **enter**.
You can now enter the TC of the solution and the reference temperature using scrolling and cursor keys (see page 2–5). Confirm your entries with **enter**.



If you have selected ”TC Calculation Ultrapure” (only with opt. 392), press **enter**.
Now you can select the type of impurity and confirm your choice with **enter**.



If one of the above mentioned types of TC correction has been set, the menu line “Sample Cal” is displayed.
Here, you can select whether sample calibration is to be performed with or without TC correction (see Pg. 6–10).

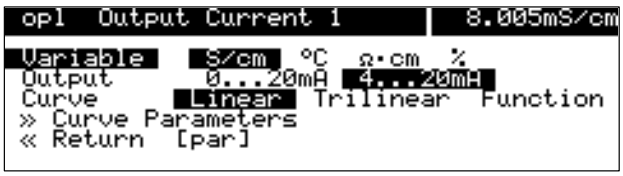
Current Output

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:

- conductivity value
- measured temperature (°C)
- concentration (only with options 359, 360, 382)

Output current will be frozen at its last value:

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



Output Curves of the Current Output

You can choose between three output curves for the current output:

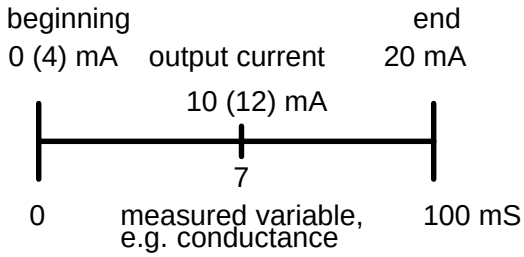
- linear
- trilinear (or bilinear)
- function

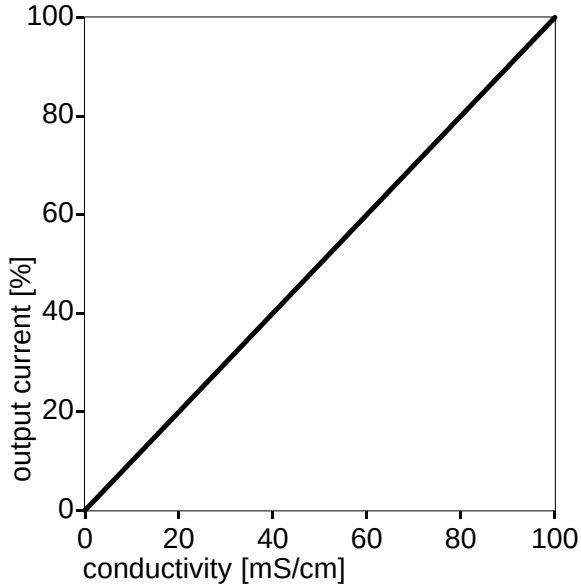
If the initial value is lower than the end value, a rising output curve will result.
To define a *falling output curve,* set the lower value as end value and the higher value as initial value.

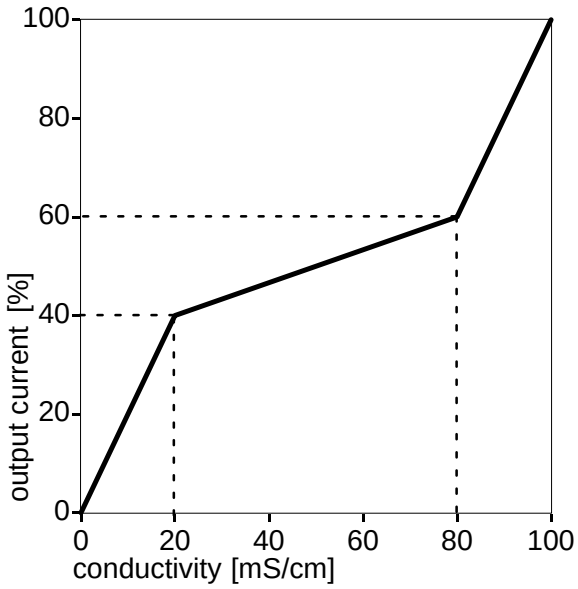
Linear Output Curve

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.





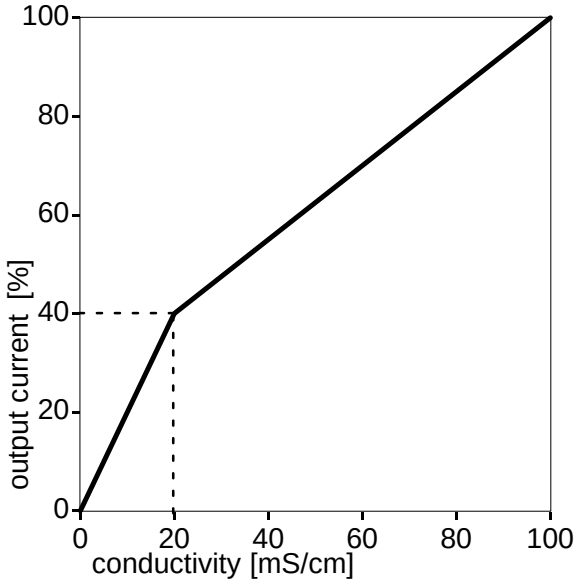


Trilinear Output Curve

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

In addition, you can define *two corner points*. They divide the output curve into three regions of different slopes.

Example:	
beginning:	0 mS
1st corner X:	20 mS/cm
1st corner Y:	40 %
2nd corner X:	80 mS/cm
2nd corner Y:	60 %
end:	100 mS



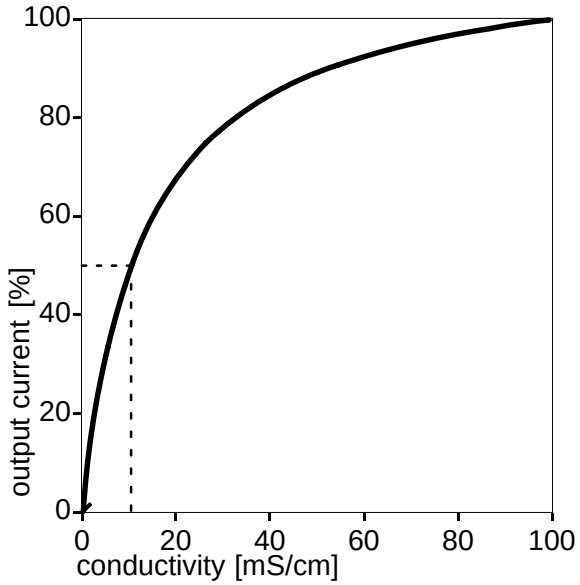
Bilinear Output Curve

To define a bilinear output curve, set the same X and Y values for the two corner points of a trilinear curve.

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

In addition, you can define a *corner point*. It divides the output curve into two regions of different slopes.

Example:	
beginning:	0 mS
1st corner X:	20 mS/cm
1st corner Y:	40 %
2nd corner X:	20 mS/cm
2nd corner Y:	40 %
end:	100 mS



Output Curve ”Function”

Especially when measuring low conductivities, it is useful to measure over several decades while at the same time maintaining a high resolution.
The output curve ”function” allows for a nonlinear output current characteristic. By defining a 50 % point, you can spread the beginning and compress the end of the range as required.
This allows you to create a good approximation of a *logarithmic output curve*.

To determine the span corresponding to current range 0 (4) to 20 mA, set an initial and an end value for the measured variable. In addition, you can define a 50 % point (at 10 or 12 mA, resp.).

Between initial and end value the output current is calculated from the following equations:

output current (0 to 20 mA) =

$$\frac{(1 + C) * x}{1 + C * x} * 20\ mA$$

output current (4 to 20 mA) =

$$\frac{(1 + C) * x}{1 + C * x} * 16\ mA + 4\ mA$$

$$C = \frac{E + I - 2 * X50\%}{X50\% - I}$$

$$x = \frac{M - I}{E - I}$$

I:	initial value at	0 (4) mA
X50%:	50% value at	10 (12) mA
E:	end value at	20 mA
M:	measured value	

Example:
logarithmic output curve over one decade

Approximation of a logarithmic output curve in the range 10 to 100 µS/cm (one decade):

beginning:	10.0 µS/cm
50 % point:	31.6 µS/cm
end:	100.0 µS/cm

Example:
logarithmic output curve over two decades

Approximation of a logarithmic output curve in the range 1 to 100 µS/cm (two decades):

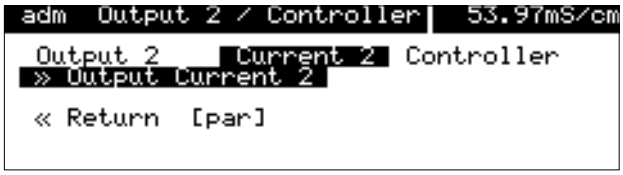
beginning:	1.00 µS/cm
50 % point:	10.0 µS/cm
end:	100.0 µS/cm

2nd Current Output

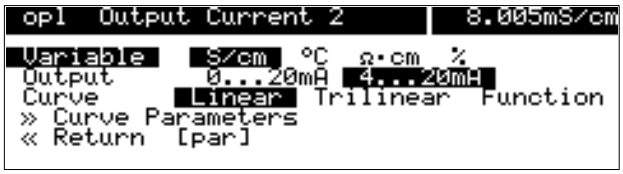
If your Transmitter is equipped with option 350, you can simultaneously output a second process variable via the second current output (cf. Fig. 9–4, page 9–24).
If the Transmitter does not provide a 2nd current output, the Parameter Setting menu reads ”Output Current 2 (Optional)”.

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 Transmitter 7500 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. 9–30.



Select the process variable you want to assign to the output current using ◀ and ▶, 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**.

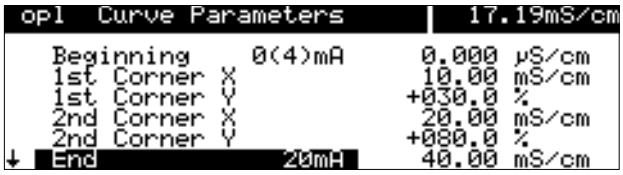
Press ▼ to select ”Curve”.
Press ◀ or ▶ to determine if the curve shall be linear, trilinear or a function and confirm with **enter**.

Press ▼ to select ”Curve Parameters” and confirm with **enter**.

linear

Enter the initial value (corresponding to 0/4 mA) and the end value (corresponding to 20 mA) for the process variable using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

trilinear



Enter the initial value (corresponding to 0/4 mA) and the end value (corresponding to 20 mA) for the process variable, as well as the corner points using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

bilinear

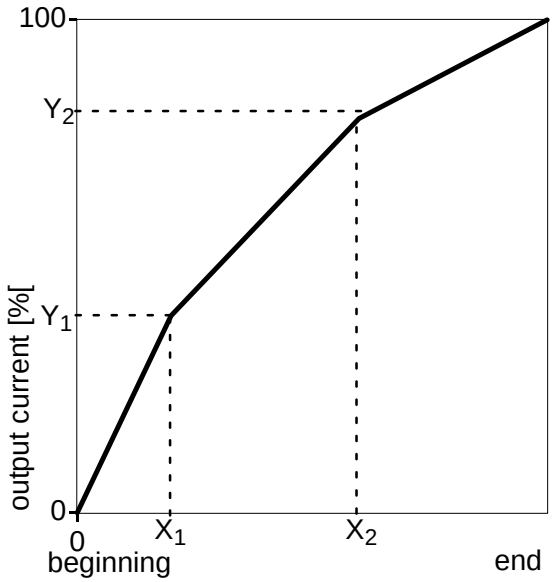
Enter the initial value (corresponding to 0/4 mA) and the end value (corresponding to 20 mA) for the process variable, as well as the corner points using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.
Enter the same values for 1st and 2nd corner X and for 1st and 2nd corner Y.

”function”

Enter the initial value (corresponding to 0/4 mA) and the end value (corresponding to 20 mA) for the process variable, as well as the 50 % point using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

Error Messages for Current Output Settings

The output current is linearly output (only determined by initial and end value). The alarm message ”Warn Current Param” is generated if the settings fulfil one of the following conditions:

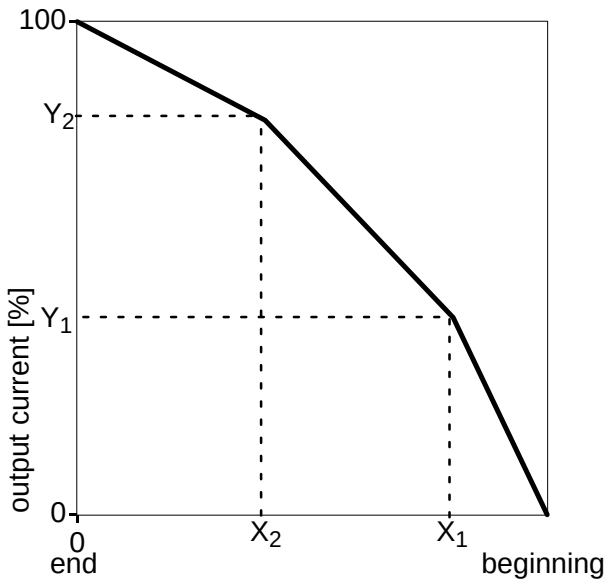


Trilinear (Bilinear) Curve
(rising, beginning < end):

- 1st corner X ≤ beginning
- 2nd corner X ≥ end
- 1st corner X > 2nd corner X
- 1st corner Y < 0(4) mA
- 2nd corner Y > 20 mA
- 1st corner Y > 2nd corner Y

Bilinear Curve (rising, beginning < end):

- 1st corner X = 2nd corner X and
  1st corner Y ≠ 2nd corner Y



Trilinear (Bilinear) Curve
(falling, beginning > end):

(Beginning always at 0 %
End always at 100 %
1st corner X always at beginning
2nd corner X always at end)

- 1st corner X ≥ beginning
- 2nd corner X ≤ end
- 1st corner X < 2nd corner X
- 1st corner Y ≤ 0 %
- 2nd corner Y ≥ 100 %
- 1st corner Y < 2nd corner Y

Bilinear Curve (falling, beginning > end):

- 1st corner X = 2nd corner X and
  1st corner Y ≠ 2nd corner Y

Curve ”Function” (rising, beginning < end):

- 50% point ≤ beginning
- 50% point ≥ end

Curve ”Function” (falling, beginning > end):

- 50% point ≥ beginning
- 50% point ≤ end

Concentration Determination

You can only make use of concentration determination if your Transmitter is equipped with option 359, 360 or 382. Without these options, the menu reads ”Concentration (Optional)”. The line cannot be selected.

The Transmitter 7500 determines the substance concentration from the measured conductivity and temperature values in percentage by weight (% by wt.) for H_2SO_4, HNO_3, HCl (Opt. 359) or HCl, NaOH, NaCl (Opt. 382) (with option 360: customer-specific substance mixtures).

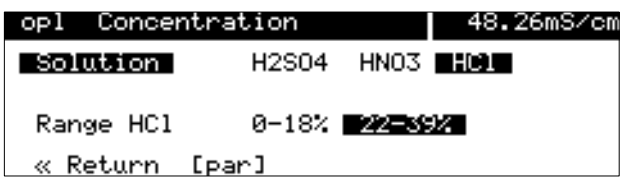
Requirements for Concentration Determination

The following conditions (among others) are required for reliable concentration determination:

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

Especially for concentration determination, you should adjust the temperature probe to increase accuracy (see page 4–4).

How to set the parameters for concentration determination



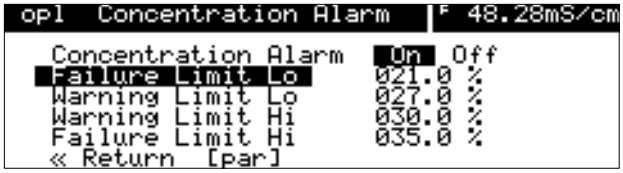
Open the Parameter Setting menu (adm or opl, resp.), select ”Concentration” using ▼ and confirm with **enter**.

Press ◀ or ▶ to select the solution and confirm your choice with **enter**.

Press ◀ or ▶ to select the concentration range and confirm your choice with **enter**.

Concentration Alarm

You can define limits for **warning** and **failure messages** for the concentration value (see page 9–25).



Open the submenu ”Alarm Settings”, select ”Concentration Alarm” using ▼ and confirm with **enter**.

Enter the warning and failure limits using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

Concentration determination not used

Only if concentration alarm is enabled, the range limits (0 – 100 %) for concentration determination of the Transmitter 7500 are also monitored.

If you have a Transmitter with option 359, 360 or 382 but *do not make use* of concentration determination, you should turn off concentration alarm, since otherwise certain conductivity values (e.g. > 800 mS/cm) would generate the error message ”Failure Concentration”.

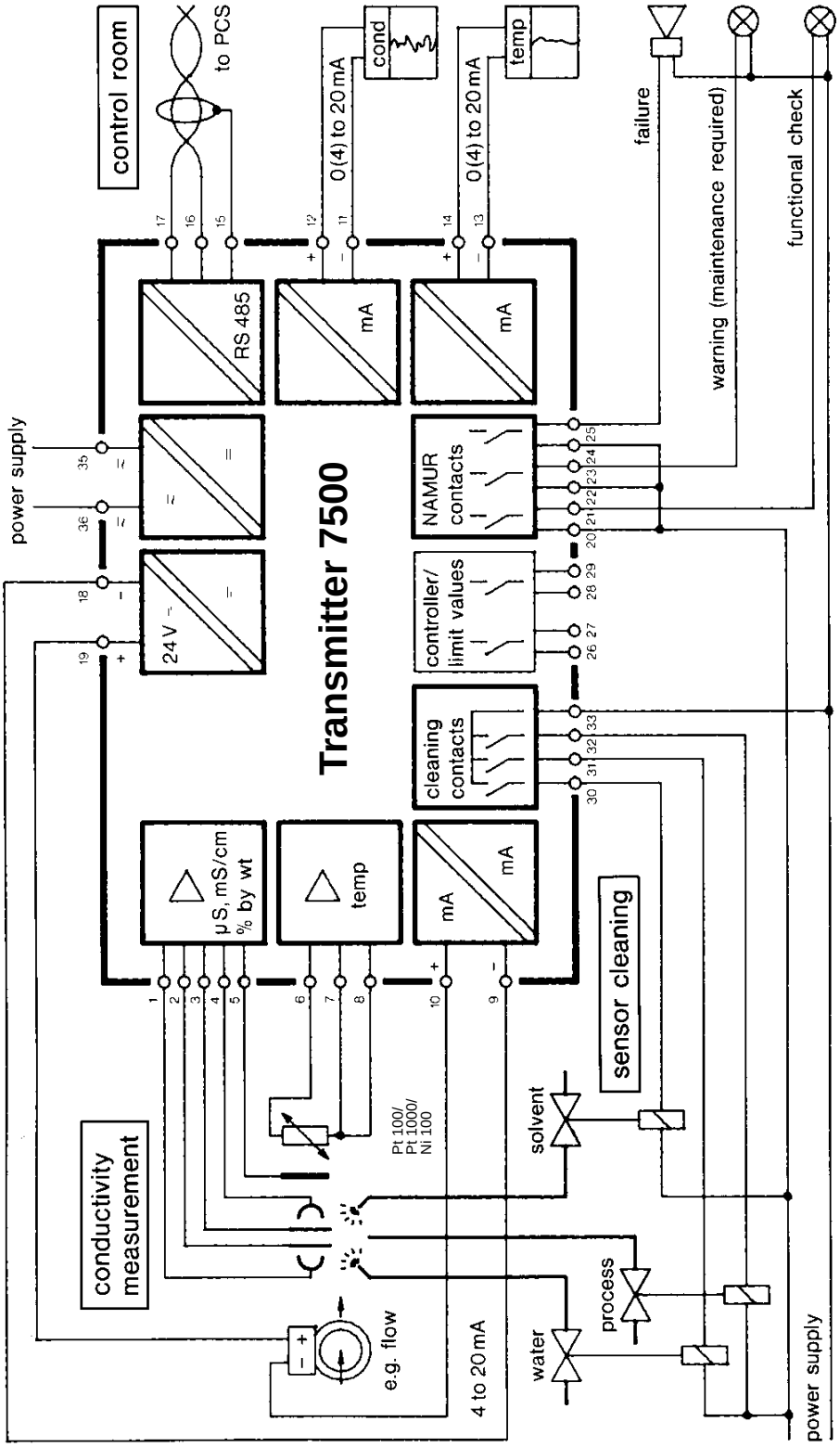


Fig. 9–4 Measurement with Flow Monitoring, Control, Sensor Cleaning, Computer Connection, Recorder Evaluation of Conductivity and Temperature, and Monitoring via NAMUR Contacts

Complete Installation using all Functions

Fig. 9–4, page 9–24 shows how to connect the Transmitter 7500 if you want to make use of all measurement and control capabilities.

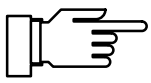
Alarm Settings

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

- conductivity
- concentration (only with option 359, 360, 382)
- measured temperature
- cell constant
- 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 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 3–2).

Furthermore, you can enable or disable the alarm messages for each measured variable. The alarm

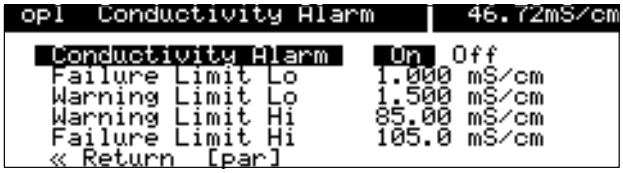
limits remain stored even if the message is disabled.

To define alarm messages for temperature, you must set ”Measuring Temp Auto” (see page 9–12) and enable alarm.

Only if concentration alarm is enabled, the range limits (0 – 100 %) for concentration determination of the Transmitter 7500 are also monitored.

If you have a Transmitter with option 359, 360, 382 but *do not make use* of concentration determination, you should turn off concentration alarm, since otherwise certain conductivity values (e.g. > 800 mS/cm) would generate the error message ”Failure Concentration”.

Example: Settings for Conductivity Alarm



Meas Value [mS/cm]		Message
≤	1.000	Fail Lo conductivity and Warn Lo conductivity
	1 – 1.500	Warn Lo conductivity
	1.501 – 84.99	
	85.00 – 104.9	Warn Hi conductivity
≥	105.0	Fail Hi conductivity and Warn Hi conductivity

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. ”Cell Constant Alarm”) and confirm with **enter**.

Enter the warning and failure limits using scrolling and cursor keys (see page 2–5) 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, meas. point maintenance,
  during parameter setting (**par**) on the Operator level (opl) and the Administrator level (adm),
  or during an automatic rinsing cycle.

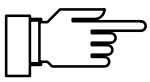
- *Warning* (maintenance required) is activated if a value has exceeded (or fallen below, resp.) a preset ”Warning Limit Hi” or ”Warning Limit Lo”, or if other warning messages have been activated.
  That means that the measuring installation is still functioning properly but should be maintained, or 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 Transmitter 7500have 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 2–5) and confirm your entries with **enter**.

Limit Contacts

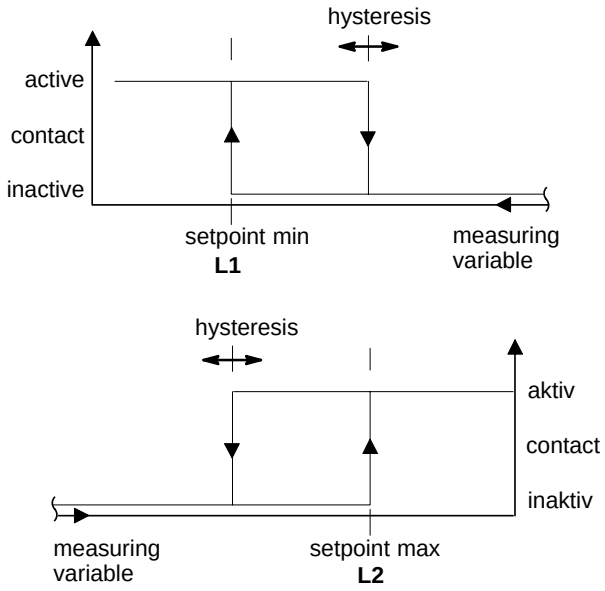
Two limit contacts are provided as standard. The limit contacts can be controlled by the following process variables:

- conductivity
- resistivity
- concentration (only with option 359, 360, 382)
- measured temperature value (°C)
- input current at current input

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

- The *measured 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* 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).

Limit Values and Hysteresis

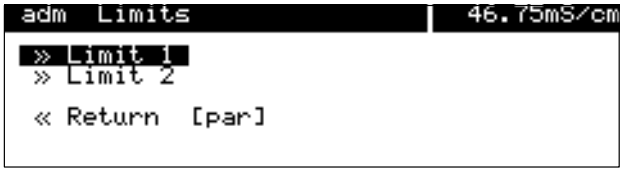


If the measured value exceeds the preset limits, ”L1” and/or ”L2” will appear in the upper right corner of the display.
Contact 1 and/or contact 2 are active.

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

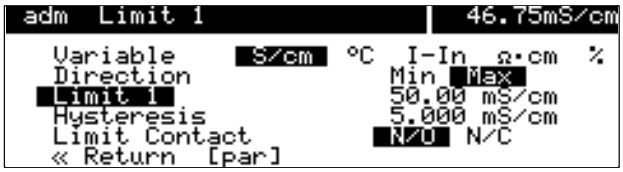
As delivered, the relay contacts are suitable for low signal currents (down to approx. 1 mA).
If currents above approx. 100 mA are switched, the gold plating is destroyed during the switching process. *After that, the contacts will not reliably switch low currents.*

How to set the limit contacts



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

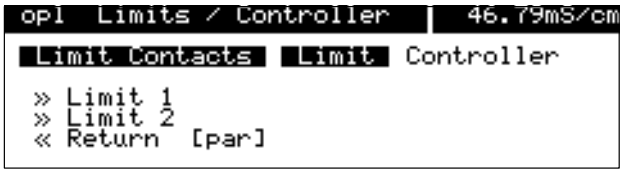
Press ▼ or ▲ to select ”Limit 1” or ”Limit 2” and confirm with **enter**.



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 2–5) and confirm your entries with **enter**.

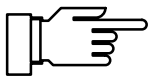
Press **par** to return to menu level ”Limits”. Repeat the procedure for the other limit value.

If your 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



The controller function can only be used if the 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 (cycled) control.
Two controller types can be selected:

- Type A: Pulse length controller (see Pg. 9–35)
- Type B: Pulse frequency controller (see Pg. 9–35)

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. 9–36)
- Type B: Straightway valve (< setpoint) (see Pg. 9–37)
- Type C: Straightway valve (> setpoint) (see Pg. 9–38)

Controlled Variables

You can define as **controlled variables**:

- conductivity
- resistivity
- measured temperature (°C)

Since the relationship between conductivity and concentration is strongly nonlinear and partially ambiguous, concentration cannot be selected as controlled variable.

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

For test purposes, the controller output Y can be manually entered in the Maintenance menu (see page 4–5).

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. 9–5 shows the characteristic of the controller in the Transmitter 7500. 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 process characteristics, 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 can be manually entered in the Maintenance menu (see page 4–5).

Controller Output

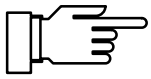
The method for determining the controller output (manipulated variable) is the same for the digital and the analog controller. However, output of the manipulated variable at the limit contacts or at output 2 differs as follows:

Digital Controller

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

- Limit contact 1
  operates in the controller output range of
  0 to +100 % (controlled variable < setpoint)
- Limit contact 2
  operates in the controller output range of
  0 to -100 % (controlled variable > setpoint)

The contacts can control valves of feeding pumps, for example. Contact ON time or switching frequency, resp., vary according to 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 of
  -100 to +100 %
- Controller type B (straightway valve)
  operates in the controller output range of
  0 to +100 % (controlled variable < setpoint)
- Controller type C (straightway valve)
  operates in the controller output range of
  0 to -100 % (controlled variable > setpoint)

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

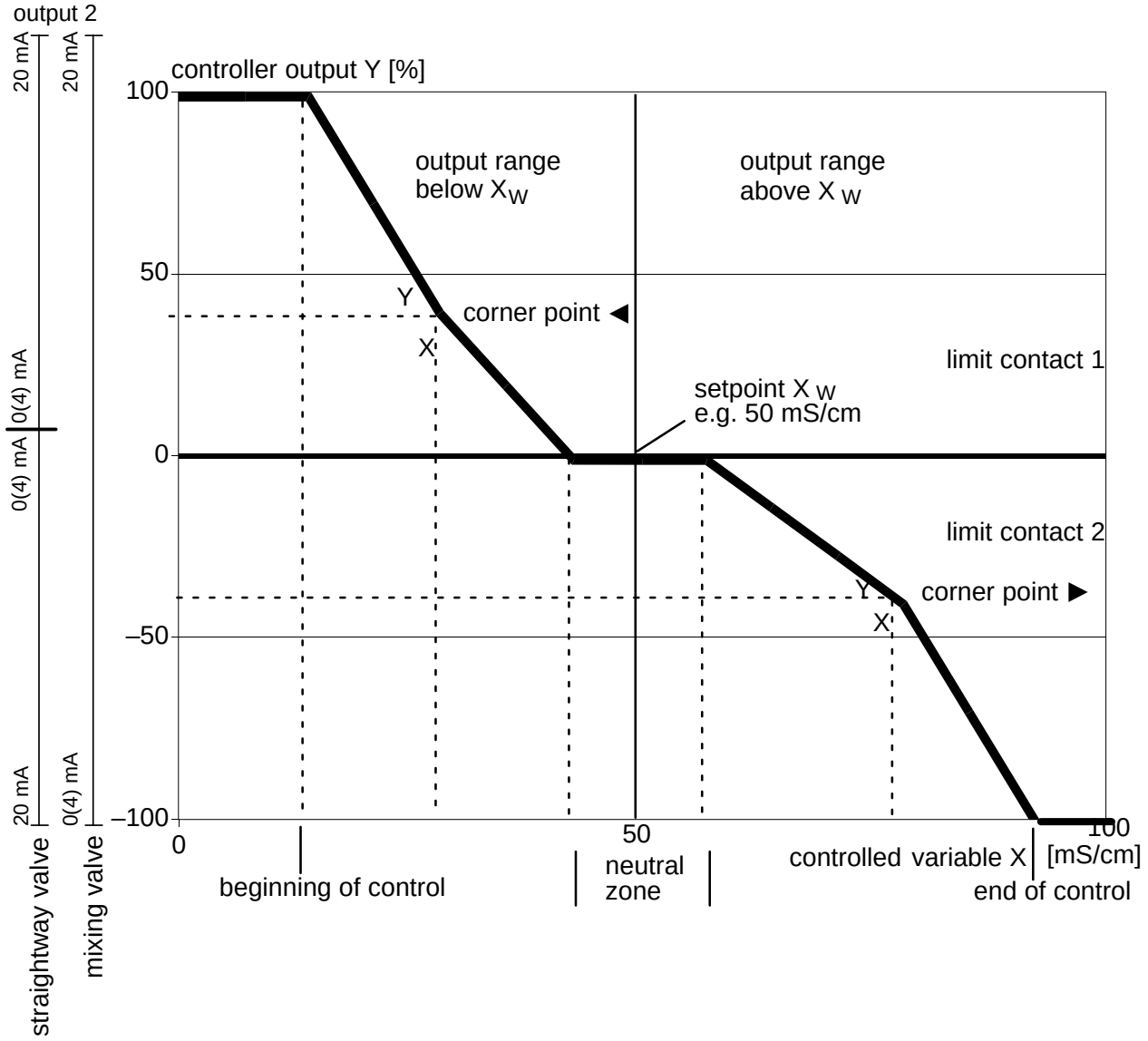
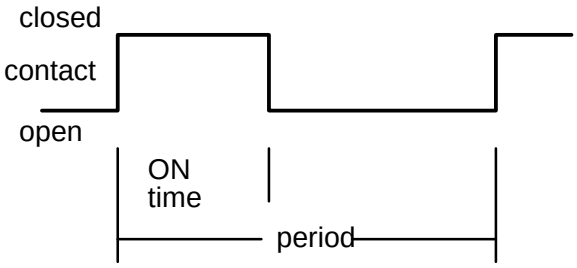


Fig. 9–5 Control Characteristic

Pulse Length Controller
(Option 353 only)

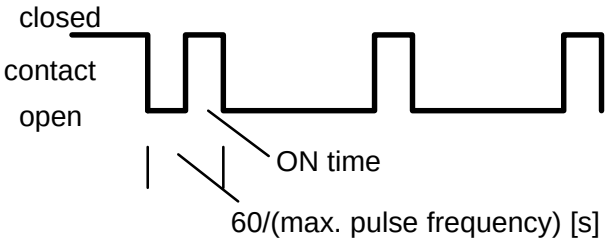
The pulse length controller controls valves used as actuators.



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 you define a minimum ON time of 0 s, for technical reasons a minimum ON time of 0.25 s is effective.

Pulse Frequency Controller
(Option 353 only)

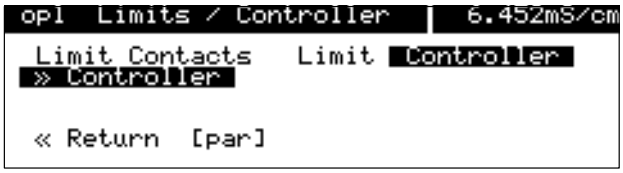
The pulse frequency controller controls (frequency controlled) feeding pumps used as actuators.



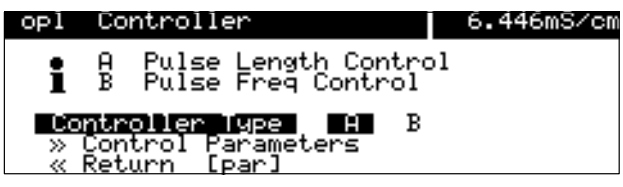
The pulse frequency controller varies the frequency at which the contacts are switched on.
You can define a maximum pulse frequency [p/min]. It depends on the feeding pump in use.
The maximum value to be entered is 120 p/min.
ON time is constant.
It is automatically calculated from the user-defined maximum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

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

How to set the parameters of the digital controller



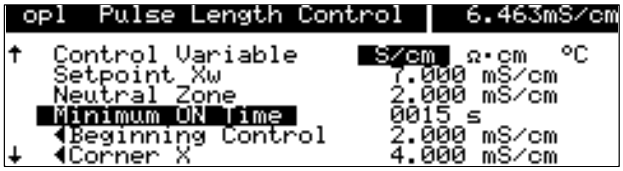
Open the Parameter Setting menu (opl or adm level, resp.), select ”Limits/Controller” using ▼, and confirm with **enter**.
Press ▶ to select ”Controller” and confirm with **enter**.
Press ▶ or **enter** to open the submenu ”Controller”.



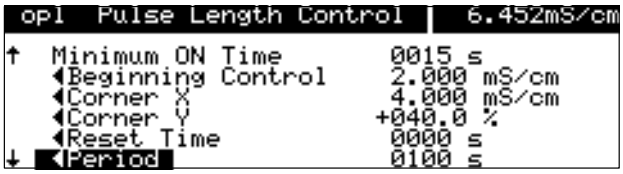
Press ◀ or ▶ to select the controller type and confirm with **enter**.
To set the control parameters, press ▶ or **enter** to open the submenu ”Control Parameters”.

The information text shows the contact assignment:
Contact 2 operates in the controller output range of 0 to -100 %.
Contact 1 operates in the controller output range of 0 to +100 %.

Type A: Pulse Length Controller



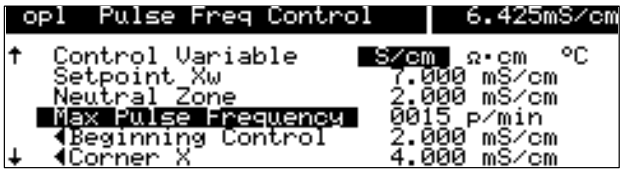
Select the controlled variable using ◀ and ▶. Enter the setpoint, neutral zone and minimum ON time using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.



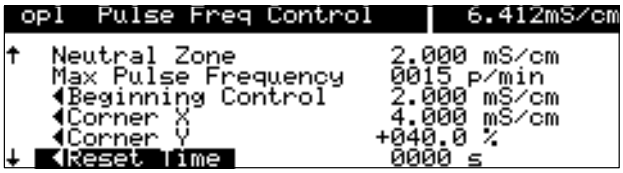
Enter beginning of control, corner X, corner Y, reset time and period for the left control range (◀: controlled variable < setpoint).

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

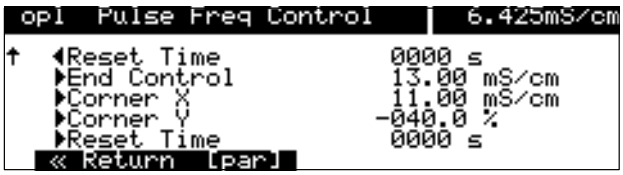
Type B: Pulse Frequency Controller



Select the controlled variable using ◀ and ▶. Enter the setpoint, neutral zone and minimum ON time using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

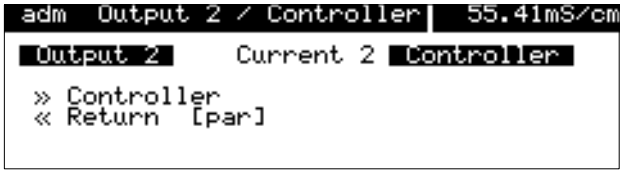


Enter beginning of control, corner X, corner Y, reset time and period for the left control range (◀: controlled variable < setpoint).

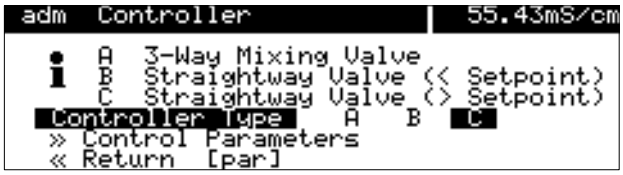


Enter end of control, corner X, corner Y, reset time and period for the right control range (▶: controlled variable > setpoint).

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



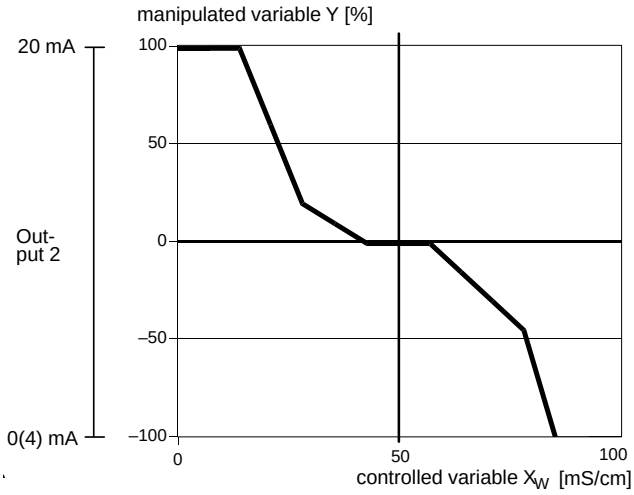
Select the menu item “Output 2 / Controller” with ▼ in the Parameter Setting menu and confirm with **enter**.
Move to “Controller” with ▶ and confirm with **enter**.
To open the submenu ≫ “Controller”, press ▶ or **enter**.



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.

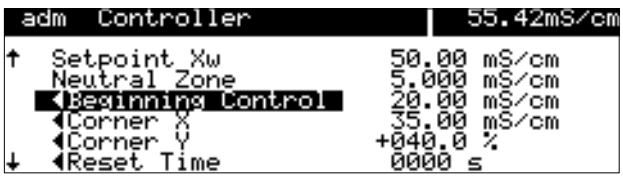
Type A: 3-way mixing valve



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) to 20 mA

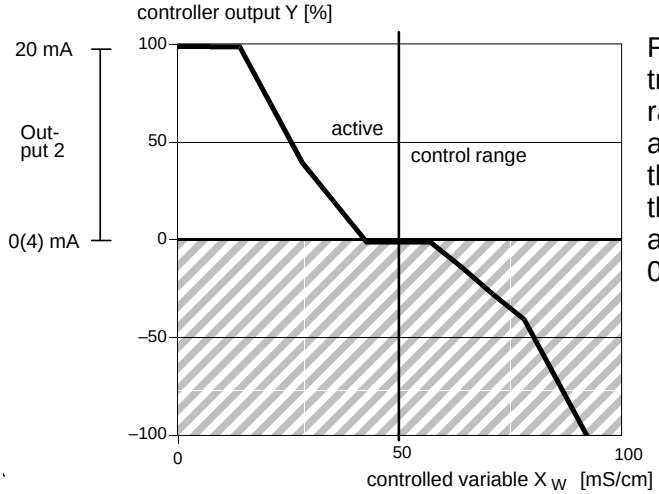
The parameters of the controlled variable which acts on the controller are set with ◀ and ▶. Press ▲ or ▼ to select the individual control parameters. Enter each of the control parameters with the scrolling keys and the cursor keys (see page 2–5) and confirm the entries with **enter**.



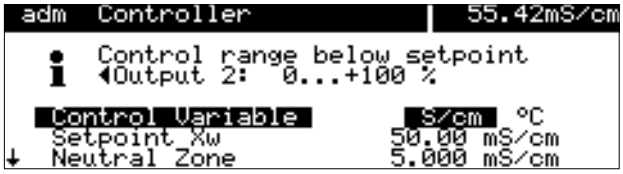
Enter Beginning Control, Corner X, Corner Y and Reset Time for the left control range (◀: controlled variable < setpoint).

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

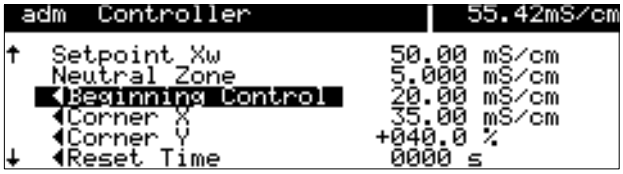
Type B: Straightway valve (< setpoint)



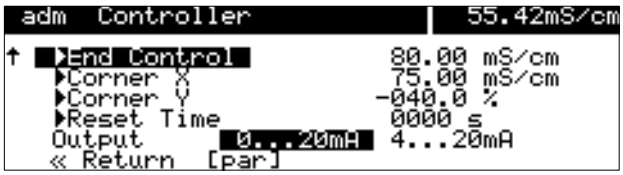
For the straightway valve Type B the analog controller output operates in the manipulated variable range 0 to +100 %. Here +100 % corresponds to a current of 20 mA. The controller only outputs the manipulated variable for the selected side. On the other side of the setpoint the manipulated variable cannot 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 ▲ or ▼ to select the individual control parameters. Enter each of the control parameters with the scrolling keys and the cursor keys (see page 2–5) and confirm the entries with **enter**.



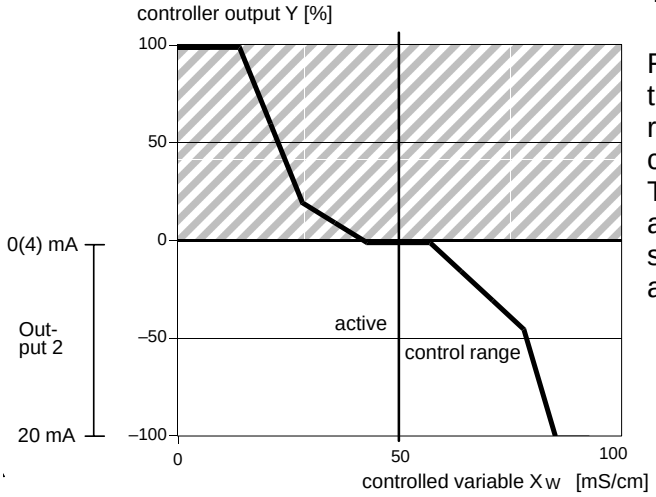
Enter Beginning Control, Corner X, Corner Y and Reset Time for the left control range (◀: controlled variable < setpoint).



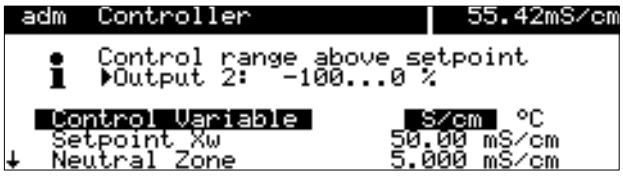
For a pure P-controller (reset time = 0 s), only the parameters for the control range used must be set. However, for the unused range realistic parameters must be entered, as otherwise the error message “Warn Control Parameter” is output.

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.

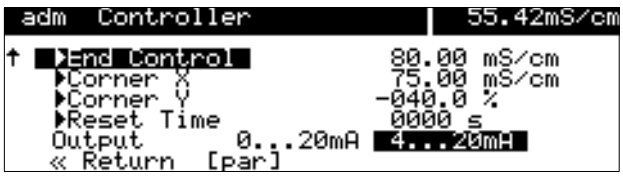
Type C: Straightway valve (> setpoint)



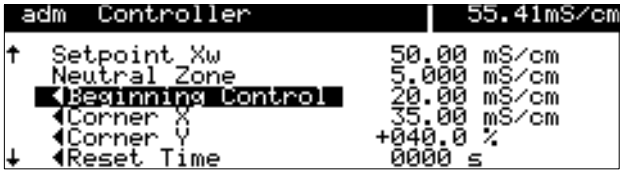
For the straightway valve Type C the analog controller output operates in the manipulated variable range 0 to -100 %. Here -100 % corresponds to a current of 20 mA.
The controller only outputs the manipulated variable for the selected side. On the other side of the setpoint the manipulated variable cannot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



The parameters of the controlled variable which acts on the controller are set with ◀ and ▶. Enter setpoint and neutral zone each using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

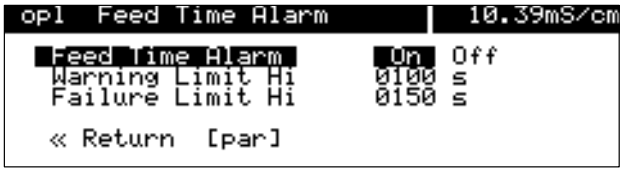


Enter Beginning Control, Corner X, Corner Y and Reset Time for the right control range (▶: Control variable > setpoint).



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**.

Enter the values for warning message (Warning Limit Hi) and failure message (Failure Limit Hi) using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

Error Messages for Controller Settings

The controller will be turned off 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 Transmitter 7500 provides a floating, short-circuit-proof power output (as standard).
With this power output, you can, for example, supply sensors or switching contacts with 24 Vdc, 30 mA (see Fig. 9–4, page 9–24).

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

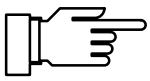
Current Input

The Transmitter 7500 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 9–25). 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.



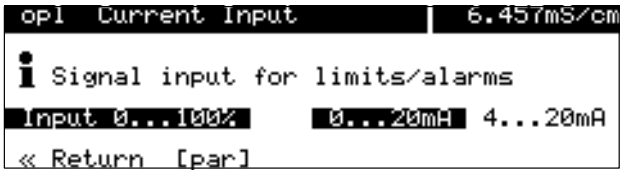
The currently active alarm messages can be read out in the Diagnostics menu ”Message List” (see page 3–2).

Typical Application

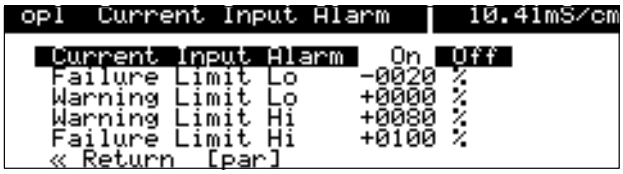
The application example in Fig. 9–4, page 9–24 shows the connection of a 2-wire flow transmitter. During a bypass measurement, for example, the flow transmitter can be used to monitor if the flow of the measured medium is sufficient.
The flow transmitter is supplied from the power output.
The current 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 Transmitter 7500 is equipped with option 352 and probe rinsing has been enabled during parameter setting, the current input controls the rinsing cycle (see below).
The menu item ”Current Input Alarm” is not displayed.



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**.

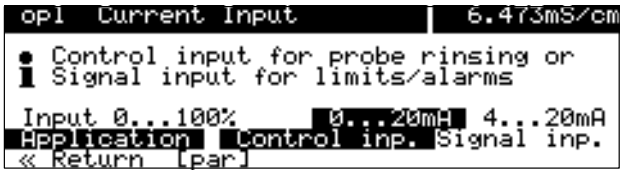


To monitor the current input via alarm limits, return to the Parameter Setting menu and select ”Alarm Settings”, submenu ”Current Input Alarm”.
Enter the alarm limits using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

Input current can also be controlled via the limit contacts. For setting procedure, refer to page 9–29.

Current input as control input for probe rinsing

If your Transmitter 7500 is equipped with option 352 probe rinsing, the current input can be used for remote control of probe rinsing (see page 9–45).
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).

Probe Rinsing

You can only make use of the probe rinsing function if your Transmitter 7500 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 conductivity cell.
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 9–44) at the current input (if current input has been set as control input, see page 9–41),
- remote-controlled via interface (see page 9–47).

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.

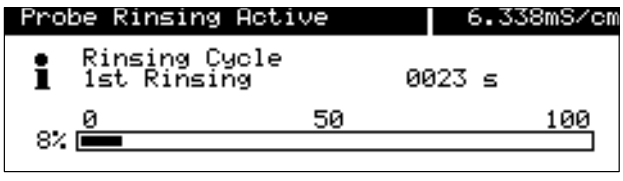
To turn off the automatic rinsing cycle, set the interval to ”000.0 h”.

Before starting a rinsing cycle, you must enter the individual step durations on the Parameter Setting level, menu item ”Probe Rinsing” (see page 9–45)!

A rinsing cycle comprises the following steps:

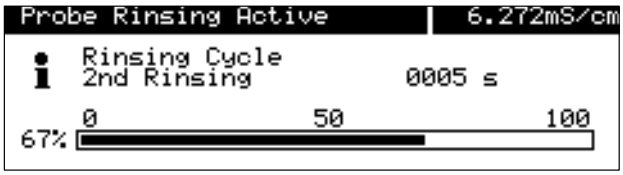
- Start of Rinsing Cycle:
  NAMUR contact ”functional check” and contact ”probe” are activated, output current 1 (and 2) and controller output are frozen, limits are disabled, **maint** and **cal** menus are locked, the interval timer is reset.

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

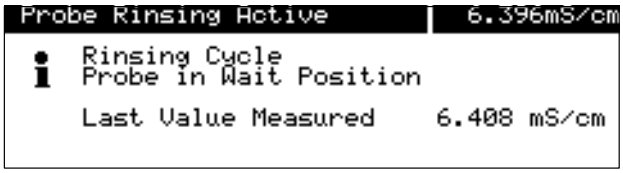


- First Rinsing:
  The contact ”rinsing” is closed for the (user defined) duration of first rinsing.

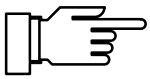
- Cleaning:
  The contact ”cleaning” is closed for the (user defined) duration of cleaning.



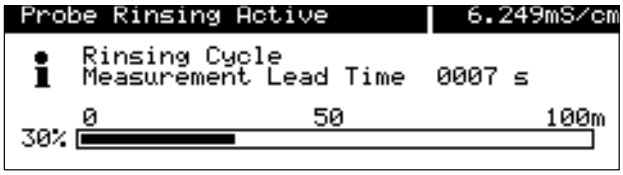
- Second Rinsing:
  The contact ”rinsing” is closed for the (user defined) duration of second rinsing.



- 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.

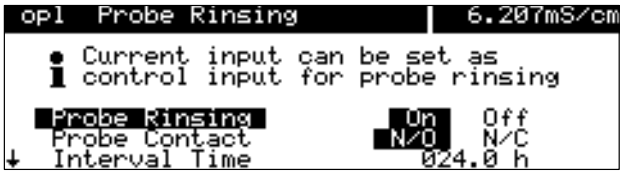
If the Transmitter 7500 is equipped with option 352 probe rinsing, the **current input** is used for remote control of the rinsing cycle (see page 9–41):

- 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.

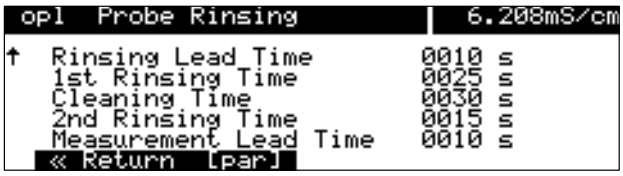
- > 20 mA (lock):
  A current in this range *locks* start of a rinsing cycle independent of the user defined interval.

How to set the rinsing cycle parameters



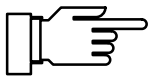
Open the Parameter Setting menu (opl or adm, resp.), select ”Probe Rinsing” and confirm with **enter**.

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



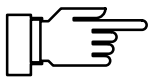
Enter interval and step durations using scrolling and cursor keys (see page 2–5) and confirm your entries with **enter**.

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.

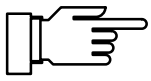
Tips for Application



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).



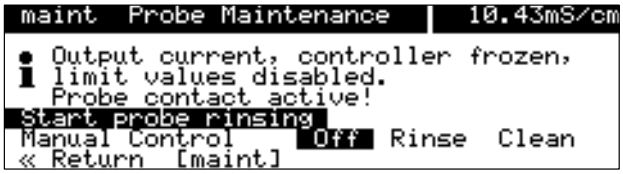
After a power failure the interval timer is reset. Then the next automatic start is only performed after a complete interval has been expired.

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

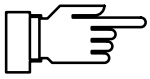
Open the **maint** menu and press ▶ or **enter** to select ”Meas. Point Maintenance”.



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.

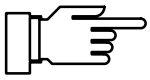


As delivered, the relay contacts are suitable for low signal currents (down to approx. 1 mA).
If currents above approx. 100 mA are switched, the gold plating is destroyed during the switching process. *After that, the contacts will not reliably switch low currents.*

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 Transmitter 7500 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 Transmitter 7500 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 instrument 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
  (Transmitter 7500connected 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 Transmitter 7500.

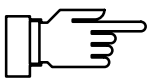
Parity (transmission error recognition):
The parity is an additional bit that supplements the data bits in such a way that an even number (parity even) or an odd number (parity odd) of logical “ones” is transmitted. In the case of a parity error, the error message “Warn Interface” appears.

Data bit (data width):
The Transmitter 7500 transmits a data width of either 7 bits or 8 bits. The Transmitter 7500 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.

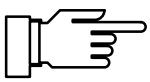
The baud rate can be defined as
300, 600, 1,200 or 9,600 baud,
and the transmission formats as
“7 Bit/Parity Even”,
“7 Bit/Parity Odd” or
“8 Bit/No Parity“

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 12–29). 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.

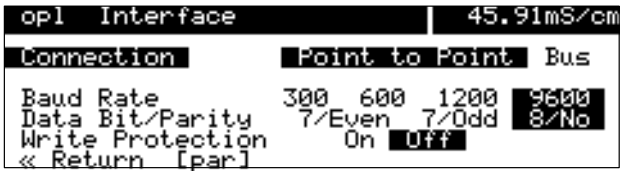


With write protection enabled, all attempts to write without previous disabling of write protection or by using a wrong passcode will be recorded in the logbook.



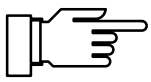
As supplied, write protection is disabled.

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 Transmitter 7500 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 the Transmitter 7500 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.*

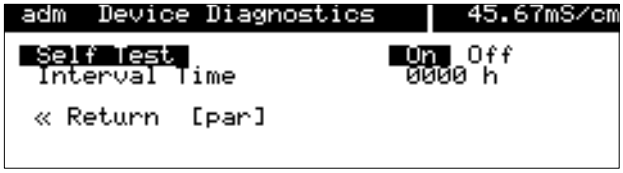
Some converters (e.g. W&T Type 86000) can operate in ”Automatic Mode”. Here, the driver will be automatically disabled after a short period. However, this can cause bus timing errors if the automatic turn-off time does not correspond to the baud rate used. The W&T converter has automatic turn-off times for the baud rate 115200 bauds.

According to experience, operating the Transmitter 7500 in this case at the highest possible baud rate (9600 Baud) will offer the best results.

Device Diagnostics

The Transmitter 7500 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



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 scrolling and cursor keys and confirm with **enter**.

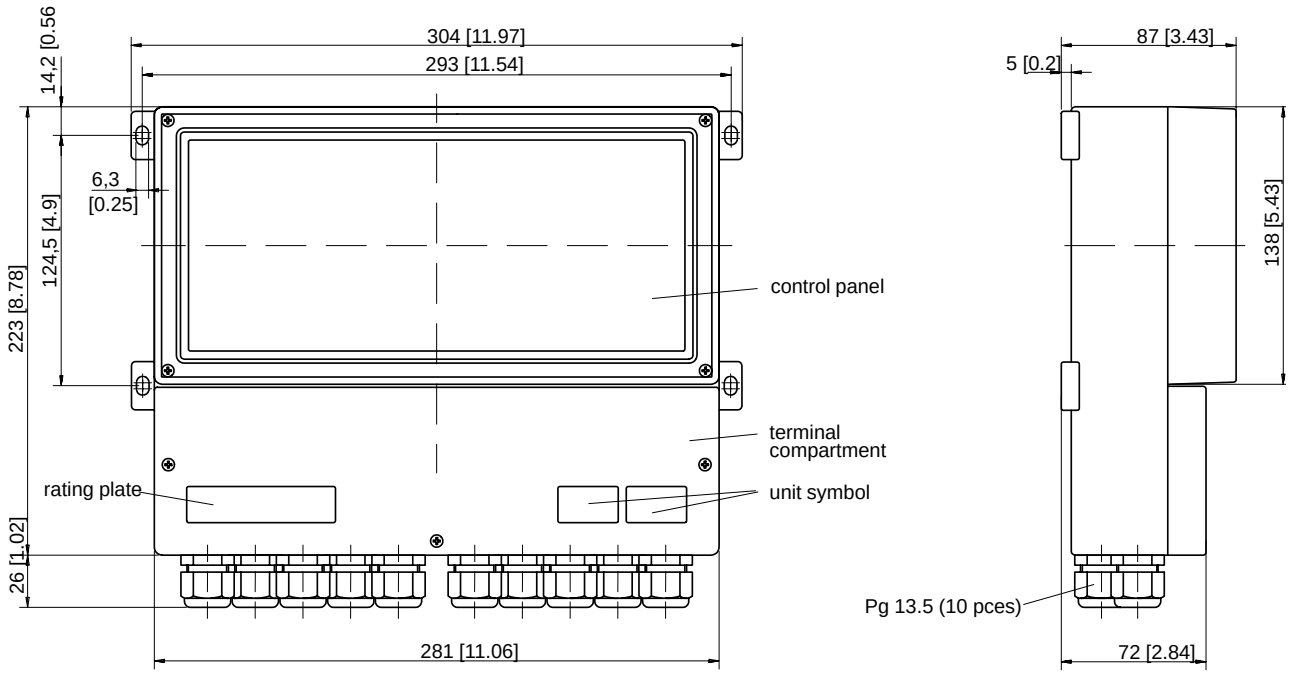
10 Information on Mounting, Installation and Maintenance

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.

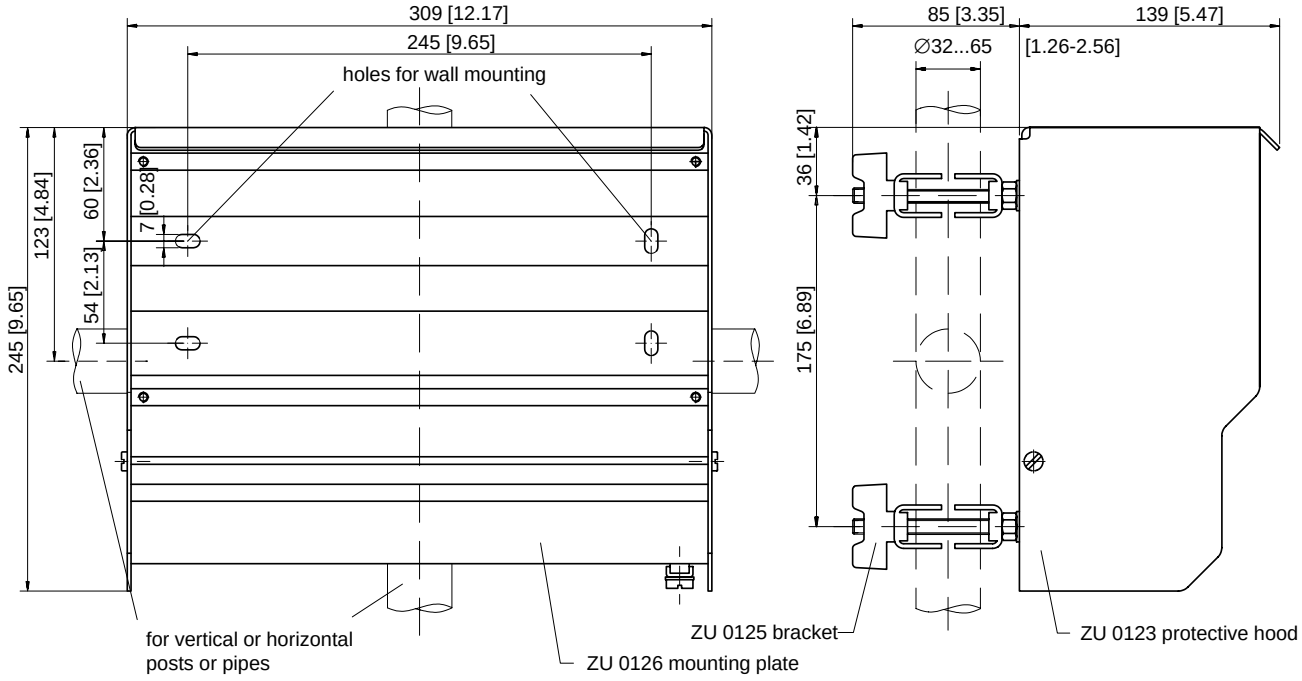
- ZU 0123 protective hood provides additional protection against direct weather exposure and mechanical damage. For dimension drawing, see Fig. 10–2.
  For mounting the protective hood, you require ZU 0126 mounting plate.

- 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.



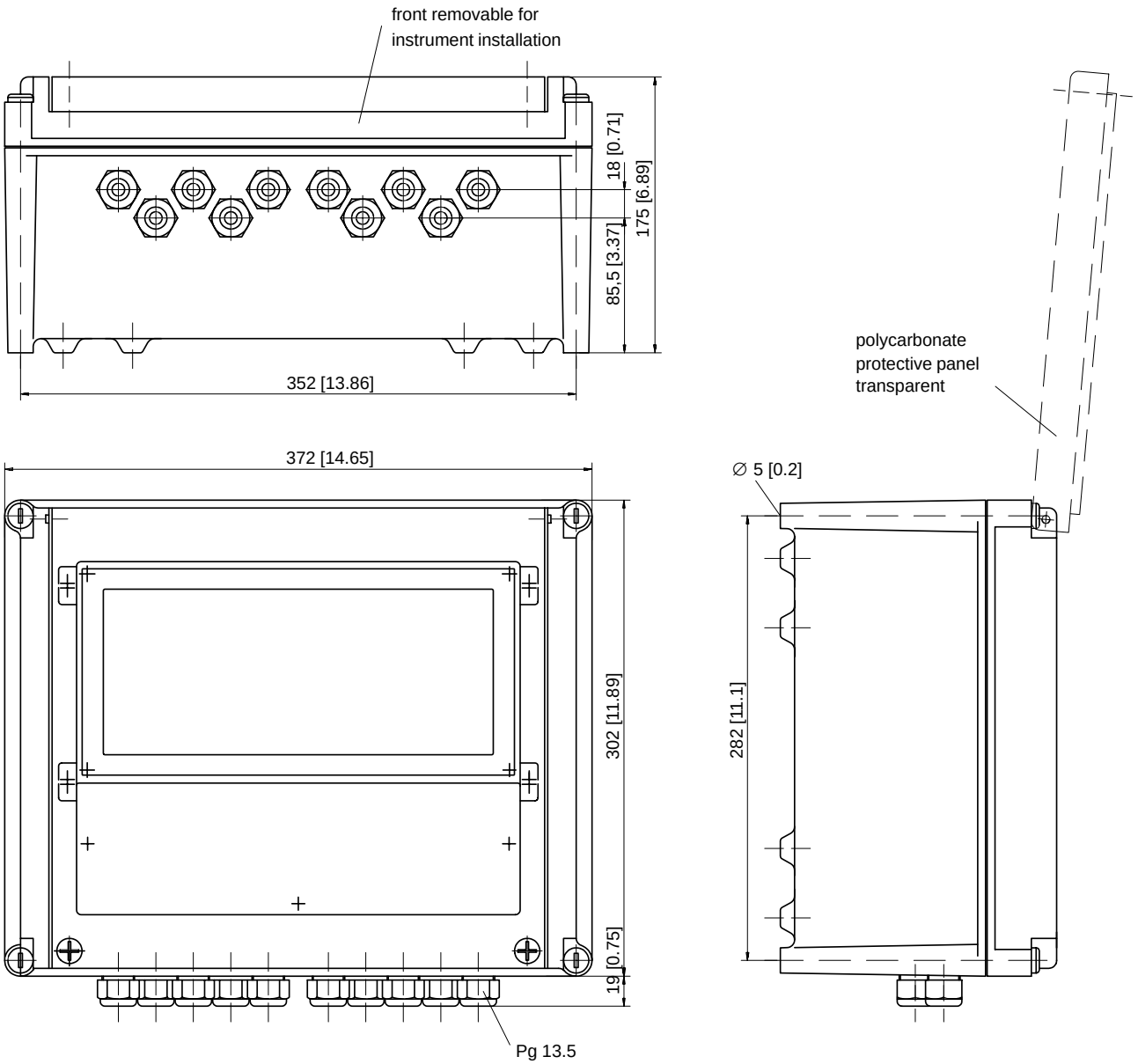
Note: All dimensions in millimeters [inches].

Fig. 10–1 Dimension Drawing Transmitter 7500



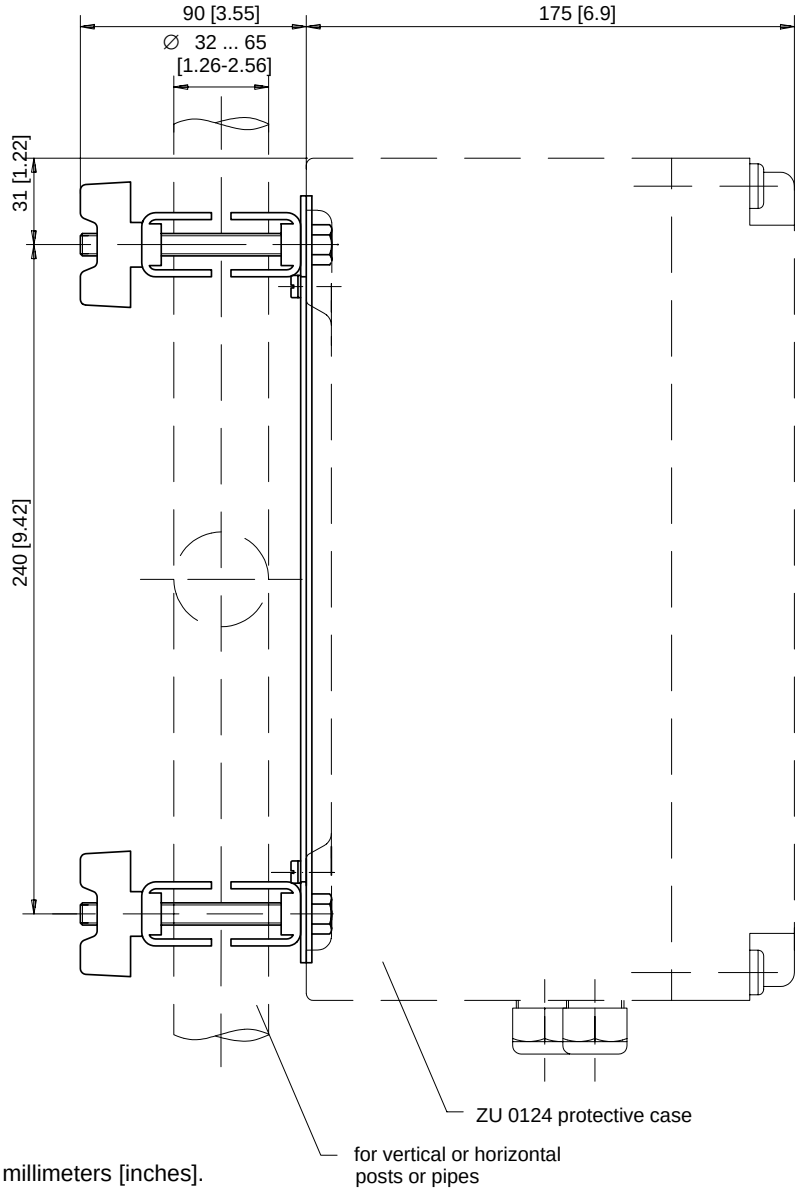
Note: All dimensions in millimeters [inches].

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 Transmitter 7500 in the ZU 0124 protective case

Set-up

The Transmitter 7500 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 Instructions

- Transcribe the specifications from the nameplate of the Transmitter 7500 to the nameplate (1) supplied with the protective case. See Fig. 10–5.

- Unscrew all Pg threaded cable glands and their gaskets from the Transmitter 7500 and put them aside 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 (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 nameplate (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 upward!

- Position the lid to align the Transmitter 7500 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 Transmitter 7500 (see page 10–8).
- Fasten the lid to the cabinet using the four assembly screws.

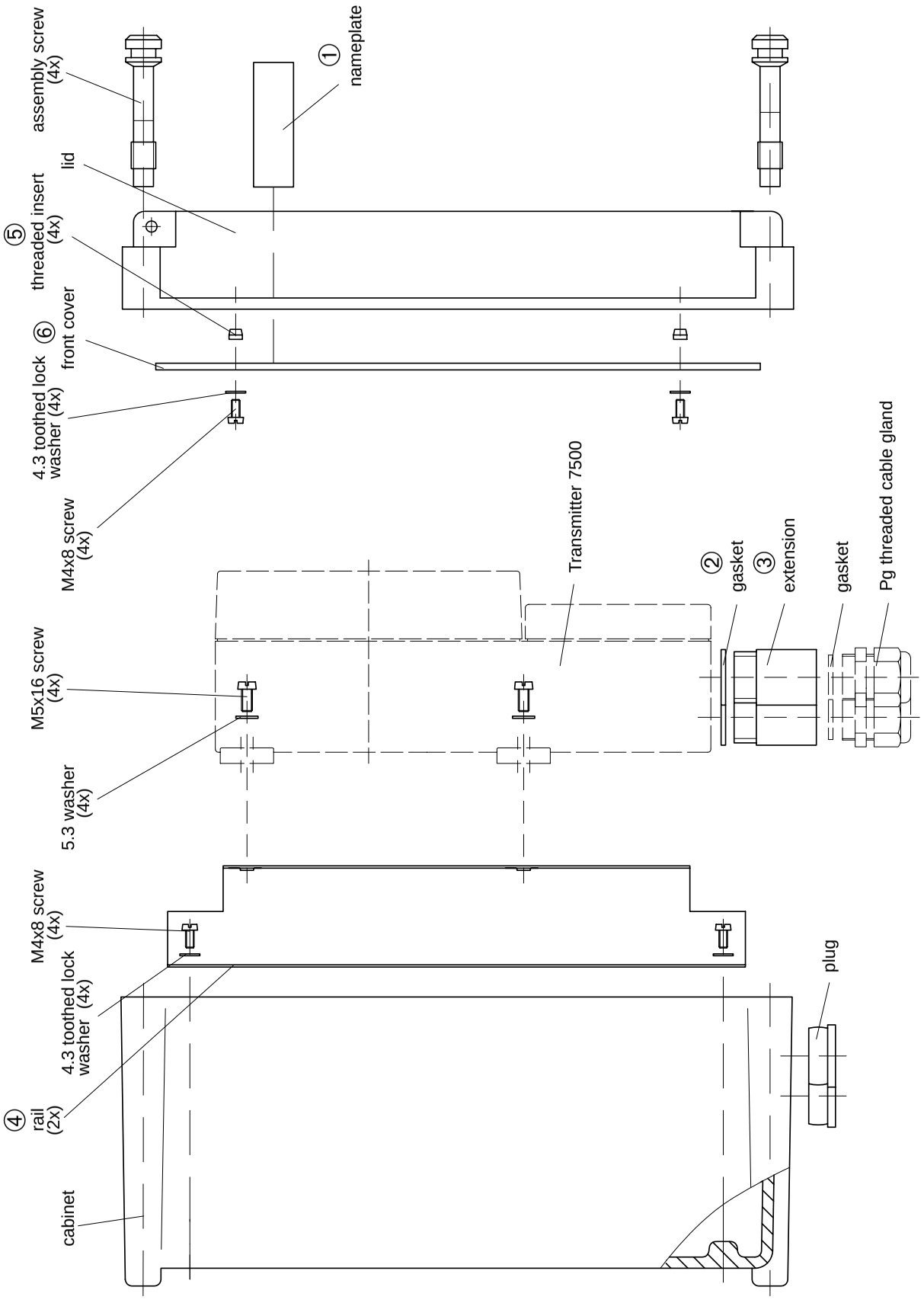


Fig. 10–5 Mounting the Transmitter 7500 in the Protective Case

Installation

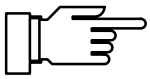
Installation of the Transmitter 7500 must be carried out only by specially trained experts in accordance with the relevant regulations and this instruction manual. Make sure that the technical specifications and input ratings are observed.

Commissioning of the Transmitter 7500 must be carried out only by specially trained experts in accordance with the relevant regulations and this instruction manual.
All parameters must be set by a system administrator pior to first start-up (see chapter 9).

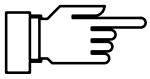
Before connecting power supply, make sure that your mains supply corresponds to the ratings on the instrument's nameplate:

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

To connect the Transmitter 7500, 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 one there are two clamping screws for connecting the cell cable shield. These clamping screws are electrically connected to terminal 5! (See also wiring examples on pages 9–4 and the following)



As delivered, all terminals are open 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 Transmitter be supplied with a German assignment label, simply pull it out and turn it over to read the English text.

Terminal Assignments

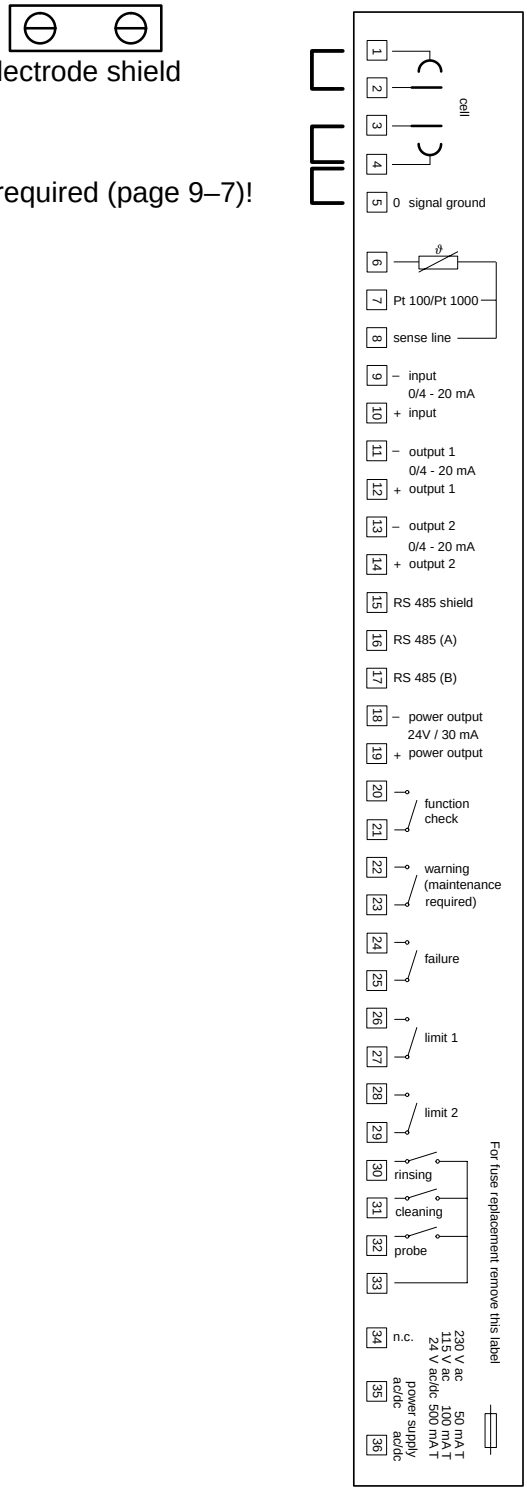


Fig. 10–6 Terminal Assignments Transmitter 7500

Maintenance and Cleaning

The Transmitter 7500 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 household cleaner or 2-propanol (isopropyl alcohol).

11 Error Messages

Only if concentration alarm is enabled, the range limits (0 – 100 %) for concentration determination of the Transmitter 7500 are also monitored.

If you have a Transmitter with option 359, 360 or 382 but *do not make use* of concentration determination, you should turn off concentration alarm, since otherwise certain conductivity values (e.g. > 800 mS/cm) would generate the error message ”Failure Concentration”.

Alphabetical Order

Error Message (Display in Diagnostics Menu ”Message List”)	Possible Error Causes and Remedies
Fail Concentration	Measured values for concentration determination out of range
Fail CRC Error par	CRC data error during parameter setting: Check all settings on the Administrator level!
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 Hi Cell Const	Cell constant > 200 1/cm or above failure limit
Fail Hi Conc Value	Measured value > 100 % or above failure limit
Fail Hi Conduct Value	Measured value > 2 S/cm or above failure limit
Fail Hi Current Inp	Input current above failure limit
Fail Hi Feed Time	Controller: Feed time above failure limit
Fail Hi Temp	Measured value > 250 °C or above failure limit
Fail Lo Cell Const	Cell constant < 0.005 1/cm or below failure limit
Fail Lo Conc Value	Measured value < 0 % or below failure limit
Fail Lo Conduct Value	Conductivity below failure limit
Fail Lo Current Inp	Input current below failure limit
Fail Lo Temp	Measured value < –50 °C or below failure limit
Fail Rinsing Cycle	Rinsing cycle interrupted; must be restarted
Fail Sensor Failure	Stable end value not obtained during calibration
Fail System Failure	Clock failure or CRC error in factory settings memory: Have instrument checked by manufacturer!
Fail TC Range	Temperature not within TC Charts for EN or ultrapure water (see page 9–14)

Error Message (Display in Diagnostics Menu ”Message List”)	Possible Error Causes and Remedies
Warn Cal Temp	Calibration temperature out of range
Warn Cell Const	Cell constant < 0.005 or > 200 1/cm during calibration
Warn Control Parameters	Parameter error for controller (see page 9–39)
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 Current1 Span	Current output 1: 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 Current2 Span	Current output 2: Initial and end value too close
Warn Current Par	Parameter error for current output (see page 9–20)
Warn Hi Cell Const	Cell constant above warning limit
Warn Hi Conc Value	Concentration above warning limit
Warn Hi Conduct Value	Conductivity above warning limit
Warn Hi Current Inp	Input current above warning limit
Warn Hi Feed Time	Controller: Feed time above warning limit
Warn Hi Temp	Measured temperature above warning limit
Warn Interface	Interface error: Parity or framing error
Warn Lo Cell Const	Cell constant below warning limit
Warn Lo Conc Value	Concentration below warning limit
Warn Lo Conduct Value	Conductivity below warning limit
Warn Lo Current Inp	Input current below warning limit
Warn Lo Temp	Measured temperature below warning limit
Warn Ref Temp	Reference temperature < –50 °C or > 250 °C
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	Stable end value not obtained during calibration
Warn TC	Temperature coefficient = 0 (must be ≠ 0)

Error Message (Display in Diagnostics Menu ”Message List”)	Possible Error Causes and Remedies
Warn TC Range	Temperature coefficient < 0 or > 20 %/K
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
050	Fail Hi Conduct Value	Measured value > 2 S/cm or above failure limit
051	Warn Hi Conduct Value	Conductivity above warning limit
052	Warn Lo Conduct Value	Conductivity below warning limit
053	Fail Lo Conduct Value	COnductivity below failure limit
054	Fail Hi Conc Value	Measured value > 100 % or above failure limit
055	Warn Hi Conc Value	Concentration above warning limit
056	Warn Lo Conc Value	Concentration below warning limit
057	Fail Lo Conc Value	Measured value < 0 % or below failure limit
058	Fail Hi Cell Const	Cell constant > 200 1/cm or above failure limit
059	Warn Hi Cell Const	Cell constant above warning limit
060	Warn Lo Cell Const	Cell constant below warning limit
061	Fail Lo Cell Const	Cell constant < 0.005 1/cm or below failure limit
062	Fail Concentration	Measured values for concentration determination out of range
063	Warn Ref Temp	Reference temperature < –50 °C or > 250 °C
064	Warn TC	Temperature coefficient = 0 (must be ≠ 0)
065	Warn Current Par	Parameter error for current output (see page 9–20)
066	Warn TC Range	Temperature coefficient < 0 or > 20 %/K
067	Warn Cell Const	Cell constant < 0.005 or > 200 1/cm during calibration
069	Fail TC Range	Temperature not within TC Charts for EN or ultrapure water (see page 9–14)
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

Error Code	Error Message (Display in Diagnostics Menu ”Message List”)	Possible Error Causes and Remedies
092	Warn RS485 Overflow	Interface error: Buffer Overflow, too many characters received without message terminator
093	Warn Interface	Interface error: Parity or framing error
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	Calibration temperature out of range
106	Warn Sensor Unstable	Stable end value not obtained during calibration
107	Fail Sensor Failure	Stable end value not obtained during calibration
108	Warn Time/Date	Clock had to be automatically initialized: Time must be set again!
109	Warn Control Parameters	Parameter error for controller (see page 9–39)
110	Fail CRC Error par	CRC data error during parameter setting: Check all 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
255	Fail System Failure	Clock failure or CRC error in factory settings memory: Have instrument checked by manufacturer!

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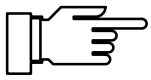
12 Interface Commands

Contents

Transmission Behavior



For fault-free data exchange between the connected computer and the Transmitter 7500, the parameter settings of both instruments must match (also see Pg. 9–49).

Read/Write

- Read commands:
  Read commands (queries) always supply an answer.

- Write commands:
  For write commands the answer is dependent on the parameter setting.

  The command “WPMSR1” 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 Transmitter 7500 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 Transmitter 7500 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 Transmitter 7500 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 Transmitter 7500 always selects the shortest possible display form, i.e., “50.00 mS/cm” is transmitted as “50”.

VALUE Commands: Query measured values

With the value commands, all measured values of the Transmitter 7500 can be queried. Value commands are read commands. As a result, the status of the Transmitter 7500 is not changed.

Command	Meaning
RV2	Query measured °C value
RV3	Query measured conductivity
RV4	Query concentration (option 359, 360, 382 only)
RV5	Query input current
RVI1	Query output current 1
RVI2	Query output current 2 (option 350 only)
RVR3	Query resistivity
RVTRT	Query time ”hhmmss”
RVDRT	Query date ”ddmmyy”*)
RVYCI	Query digital controller output (option 353 only)
RVYCN	Query analog controller output (option 483 only)

*) format depending on setting

STATUS Commands: Query messages and states

With the status commands, the instrument messages, such as the NAMUR messages Functional check, Warning (maintenance required) and Failure can be read out, instrument 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 status of the Transmitter 7500 is not changed.

Command	Function	Re-sponse	Meaning
RSF1	Query first failure message		
RSFA	Query all failure messages		
RSW1	Query first warning message		
RSWA	Query all warning messages		
RSP	Query device status (”menu”)	00	measuring mode
		01	parameter setting opl, adm
		02	calibration cal
		08	maintenance maint
		10	measuring mode, probe rins-ing 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

RSU	Query device status (messages, limits, SRQS)	1st bit	”1” if one or more failure messages are active
		2nd bit	”1” if one or more warning messages are active
		3rd bit	”1” with functional check active
		4th bit	”1” with limit 1 and/or limit 2 enabled
		5th bit	”1” if outputs are frozen (e.g. during calibration)
		6th bit	always ”1”
		7th bit	”1” status has changed since last query
		8th bit	always ”0”

Logbook: Query entries (Option 354 only)

For complete interrogation of the logbook, first use the command “RSLOO” to read the oldest entry. Then use the command “RSLOOC” 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 command “RSLOOC” 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

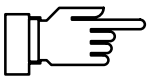
For start of diagnostics: see page 12–26

PARAMETER Commands: Query settings and set parameters

With the parameter commands, all functions of the Transmitter 7500 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 Transmitter 7500. Security prompts must then be implemented in the computer! With the command “WCOMIN0” (go to local) the computer returns control to the Transmitter 7500. The Transmitter 7500 restarts in the measuring mode.
Read commands cause no status changes and do not influence the system functions. The Transmitter 7500 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 instrument keypad, the NAMUR message Functional check is set. Warning and failure contacts are deactivated until parameter setting is completed.
If instrument 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 Transmitter 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 Transmitter functions are to be frozen during parameter setting, use the command “WCOU1”. 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 Transmitter 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

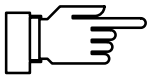
RPRTM	Query marker
WPRTM0	Set marker ”Off”
WPRTM1	Set marker ”On”
WPRTDF0	Set date format ”D.M.Y“
WPRTDF1	Set date format ”D/M/Y“
WPRTDF2	Set date format ”M/D/Y“
WPRTDF3	Set date format ”Y–M–D“

For setting time/date: see page 12–27

For query of time/date: see page 12–5

Temperature Probe Adjustment

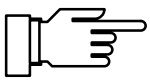
RPTFS	Query temperature probe adjustment settings
WPTFS0	Disable temperature probe adjustment
WPTFS1	Enable temperature probe adjustment



For input of adjustment value: see page 12–27

Automatic Calibration

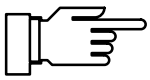
RPCAMM	Query marker
WPCAMM0	Set marker ”Off”
WPCAMM1	Set marker ”On”
RPCAMA	Query settings of calibration solution
WPCAMA1	Set calibration solution NaCl
WPCAMA2	Set calibration solution KCl
RPCAM1	Query settings of NaCl concentration
WPCAM10	Set saturated calibration solution
WPCAM11	Set concentration 0.1 mol/l
WPCAM12	Set concentration 0.01 mol/l
RPCAM2	Query settings of KCl concentration
WPCAM20	Set concentration 1 mol/l
WPCAM21	Set concentration 0.1 mol/l
WPCAM22	Set concentration 0.01 mol/l



For start of automatic calibration: see page 12–28

Calibration by Manual Input of Cell Constant

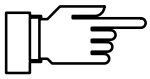
RPCAC	Query stored cell constant
WPCAC*p*	Set cell constant *p*



For start of calibration: see page 12–28

Calibration by Sampling

RPCAP	Query sample value
WPCAP*p*	Enter sample value *p*



For start of calibration: see page 12–28

Measurement Display

RPDIMM	Query marker
WPDIMM0	Set marker ”Off”
WPDIMM1	Set marker ”On”
RPDIMA	Query process variable assigned
WPDIMA2	Assign temperature value to measurement display
WPDIMA3	Assign conductivity value to measurement display
WPDIMA4	Assign concentration value to measurement display (option 359, 360, 382 only)
WPDIMAR3	Assign resistivity value to measurement display
WPDIMATRT	Assign time to measurement display
RPDIMVA	Query viewing angle
WPDIMVA–*n*	Adjust viewing angle (n = –2 ... 0 ... +2)

Parameter Setting of Left Secondary Display

RPDISLA	Query process variable assigned
WPDISLA2	Display measuring temperature
WPDISLA3	Display conductivity
WPDISLA4	Display concentration (option 359, 360, 382 only)
WPDISLA5	Display input current

WPDISLAI1	Display output current 1
WPDISLAI2	Display output current 2 (option 350 only)
WPDISLAR3	Display resistivity
WPDISLATRT	Display time
WPDISLADRT	Display date
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 manual temperature

Parameter Setting of Right Secondary Display

RPDISRA	Query process variable assigned
WPDISRA2	Display temperature
WPDISRA3	Display conductivity
WPDISRA4	Display concentration (option 359, 360, 382 only)
WPDISRA5	Display input current
WPDISRAI1	Display output current 1
WPDISRAI2	Display output current 2 (option 350 only)
WPDISRAR3	Display resistivity
WPDISRATRT	Display time
WPDISRADRT	Display date
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 manual 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

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” (option 392 only)
WPTCS3	Set TC linear
RPTCVR	Query setting of TC linear (at reference temperature)
RPTCR	Query setting of reference temperature for TC linear
WPTCVR*p*	Set TC *p* of the solution
WPTCR*p*	Set reference temperature *p*
WPTCS4	Set TC for natural waters to EN 27888)
RPTC1	TC process medium, query impurity (option 392 only)
WPTC10	Impurity NaOH (option 392 only)
WPTC11	Impurity NaCl (option 392 only)
WPTC12	Impurity HCl (option 392 only)
WPTC12	Impurity NH_3 (option 392 only)
RPTCC	Query sample calibration with or without TC
WPTCC0	Set sample calibration without TC
WPTCC1	Set sample calibration with TC

Temperature Detection

RPTOMM	Query marker
WPTOMM0	Set marker ”Off”
WPTOMM1	Set marker ”On”
RPTOT	Query temperature probe
WPTOT1	Set Pt 100
WPTOT2	Set Pt 1000
WPTOT3	Set Ni 100

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*

Conductivity Alarm

RPALF3S	Query settings
WPALF3S0	Disable alarm
WPALF3S1	Enable alarm
RPALF3FL	Query failure limit Lo
WPALF3FL*p*	Set failure limit Lo *p*

RPALF3WL	Query warning limit Lo
WPALF3WL*p*	Set warning limit Lo *p*
RPALF3WH	Query warning limit Hi
WPALF3WH*p*	Set warning limit Hi *p*
RPALF3FH	Query failure limit Hi
WPALF3FH*p*	Set failure limit Hi *p*

Concentration Alarm

RPALF4S	Query settings
WPALF4S0	Disable alarm
WPALF4S1	Enable alarm
RPALF4FL	Query failure limit Lo
WPALF4FL*p*	Set failure limit Lo *p*
RPALF4WL	Query warning limit Lo
WPALF4WL*p*	Set warning limit Lo *p*
RPALF4WH	Query warning limit Hi
WPALF4WH*p*	Set warning limit Hi *p*
RPALF4FH	Query failure limit Hi
WPALF4FH*p*	Set failure limit Hi *p*

Cell Constant Alarm

RPALFCS	Query settings
WPALFCS0	Disable alarm
WPALFCS1	Enable alarm
RPALFCFL	Query failure limit Lo
WPALFCFL*p*	Set failure limit Lo *p*
RPALFCWL	Query warning limit Lo
WPALFCWL*p*	Set warning limit Lo *p*
RPALFCWH	Query warning limit Hi
WPALFCWH*p*	Set warning limit Hi *p*
RPALFCFH	Query failure limit Hi
WPALFCFH*p*	Set failure limit Hi *p*

Output Current 1

RPOC1M	Query marker
WPOC1M0	Set marker ”Off”
WPOC1M1	Set marker ”On”
RPOC1A	Query process variable assigned
WPOC1A2	Assign measuring temperature as process variable
WPOC1A3	Assign conductivity as process variable
WPOC1A4	Assign concentration as process variable (option 359, 360, 382 only)
WPOC1AR3	Assign resistivity 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*
RPOC1F	Query curve settings
WPOC1F0	Set curve linear
WPOC1F1	Set curve trilinear
RPOC1BX	Curve trilinear: query settings 1st corner point X
WPOC1BX*p*	Curve trilinear: set 1st corner point X *p*
RPOC1BY	Curve trilinear: query settings 1st corner point Y
WPOC1BY*p*	Curve trilinear: set 1st corner point Y *p*
RPOC1EX	Curve trilinear: query settings 2nd corner point X
WPOC1EX*p*	Curve trilinear: set 2nd corner point X *p*
RPOC1EY	Curve trilinear: query settings 2nd corner point Y
WPOC1EY*p*	Curve trilinear: set 2nd corner point Y *p*
WPOC1F2	Set curve ”Function”
RPOC1PX	Curve ”Function”: query settings 50% point
WPOC1PX*p*	Curve ”Function”: set 50% point *p*

Output Current 2 (Option 350 only)

RPOC2M	Query markerr (not with option 483)
WPOC2M0	Set marker ”On”r (not with option 483)
WPOC2M1	Set marker ”Off”r (not with option 483)
RPOC2A	Query process variable assigned
WPOC2A2	Assign measuring temperature as process variable
WPOC2A3	Assign conductivity as process variable
WPOC2A4	Assign concentration as process variable (option 359, 360, 382 only)
WPOC2AR3	Assign resistivity 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*
RPOC2F	Query curve settings
WPOC2F0	Set curve linear
WPOC2F1	Set curve trilinear
RPOC2BX	Curve trilinear: query settings 1st corner point X
WPOC2BX*p*	Curve trilinear: set 1st corner point X *p*
RPOC2BY	Curve trilinear: query settings 1st corner point Y
WPOC2BY*p*	Curve trilinear: set 1st corner point Y *p*
RPOC2EX	Curve trilinear: query settings 2nd corner point X
WPOC2EX*p*	Curve trilinear: set 2nd corner point X *p*
RPOC2EY	Curve trilinear: query settings 2nd corner point Y
WPOC2EY*p*	Curve trilinear: set 2nd corner point Y *p*
WPOC2F2	Set curve ”Function”
RPOC2PX	Curve ”Function”: query settings 50% point
WPOC2PX*p*	Curve ”Function”: set 50% point *p*

Output 2/Controller (Option 483 only)

RPCNM	Query marker
WPCNM0	Set marker ”Off”
WPCNM1	Set marker ”On”
RPCNS	Query settings (current 2 or analog controller)
WPCNS0	Set output 2 as control output
WPCNS1	Set analog controller operation

Concentration Determination (Option 359 only)

RPCRMM	Query marker
WPCRMM0	Set marker ”Off”
WPCRMM1	Set marker ”On”
RPCRMA	Query settings of measured solution
WPCRMA1	Set process solution H_2SO_4
WPCRMA2	Set process solution HNO_3
WPCRMA3	Set process solution HCl
RPCRM1	Query settings concentration range H_2SO_4
WPCRM10	Set concentration range 00–30 % by wt
WPCRM11	Set concentration range 32–84 % by wt
WPCRM12	Set concentration range 92–99 % by wt
RPCRM2	Query settings concentration range HNO_3
WPCRM20	Set concentration range 00–30 % by wt
WPCRM21	Set concentration range 35–96 % by wt
RPCRM3	Query settings concentration range HCl
WPCRM30	Set concentration range 00–18 % by wt
WPCRM31	Set concentration range 22–39 % by wt

Concentration Determination (only with Option 382)

RPCRMM	Query marker
WPCRMM0	Set marker ”Off”
WPCRMM1	Set marker ”On”
RPCRMA	Query settings of process solution
WPCRMA3	Set process solution HCl
WPCRMA4	Set process solution NaOH
WPCRMA5	Set process solution NaCl
RPCRM3	Query settings concentration range HCl
WPCRM30	Set concentration range 00–18 % by wt
WPCRM31	Set concentration range 22–39 % by wt
RPCRM4	Query settings concentration range NaOH
WPCRM40	Set concentration range 00–14 % by wt
WPCRM41	Set concentration range 18–50 % by wt

(There is only one concentration range for NaCl. Therefore, interface commands are not required.)

Alarm Settings

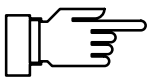
RPALM	Query marker
WPALM0	Set marker ”Off”
WPALM1	Set marker ”On”

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



For activation of controller: see page 12–28

Limit Contact 1

RPLI1A	Query process variable assigned to limit 1
WPLI1A2	Assign measuring temperature as process variable for limit 1
WPLI1A3	Assign conductivity as process variable for limit 1
WPLI1A4	Assign concentration as process variable for limit 1 (option 359, 360, 382 only)
WPLI1AR3	Assign resistivity as process variable for limit 1
WPLI1A5	Assign input current 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
WPLI1H*p*	Set hysteresis 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
WPLI2A2	Assign measuring temperature as process variable for limit 2
WPLI2A3	Assign conductivity as process variable for limit 2
WPLI2A4	Assign concentration as process variable for limit 2 (option 359, 360, 382 only)
WPLI2A5	Assign input current 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 1 hysteresis
WPLI2H*p*	Set hysteresis limit 1 *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
WPCIA2	Set measuring temperature as controlled variable
WPCIA3	Set conductivity as controlled variable
WPCIAR3	Set resistivity 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 settings
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
WPCNA2	Set measuring temperature as controlled variable
WPCNA3	Set conductivity as controlled variable
WPCNAR3	Set resistivity 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 to 20 mA
WPCNZ0	Set output 0 to 20 mA
WPCNZ1	Set output 4 to 20 mA

Feed Time Alarm (Controller, Option 353 or 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 (option 352 probe rinsing only)
WPICA0	Application as signal input (option 352 probe rinsing only)
WPICA1	Application as control input for probe rinsing (option 352 probe rinsing only)

Current Input Alarm

Not available with probe rinsing 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*

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]

For start of probe rinsing: see page 12–27

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 Transmitter 7500 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”

Automatic Device Diagnostics

RPTEM	Query marker setting
WPTEM0	Set marker ”Off”
WPTEM1	Set marker ”On”
RPTES	Query self test
WPTES0	Disable self test
WPTES1	Enable self test
RPTETI	Query interval time
WPTETI*p*	Set interval *p* (h)

DEVICE Commands: Device Description

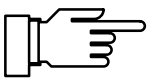
With the device commands the instrument description can be read out.

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

COMMANDs: Control Commands

The Transmitter 7500 can be controlled with the ”command” commands. ”Command” commands are write commands which call up functions or change instrument states.

With the first write command, the controlling computer (PC, SPS, ...) assumes control over the Transmitter 7500. Many safety prompts must then be implemented in the computer! With the command “WCOMIN0” (go to local), the computer returns control to the Transmitter 7500. The Transmitter 7500 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.

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)

Probe Rinsing (Option 352)

WCUCR Start rinsing cycle

Following commands only with measurement point maintenance enabled (WCOM08MA, RSP = 08):

WCUCCNR0 Open rinsing contact

WCUCCNR1 Close rinsing contact

WCUCCNC0 Open cleaning contact

WCUCCNC1 Close cleaning contact

For setting probe rinsing: see page 12–24

Resistance Measurement

WCOM08R3 Activate resistance measurement

Current Source Function

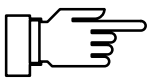
WCOM08CS Enable current source function

WCCSI1*p* Set output current 1 to value *p*

WCCSI2*p* Set output current 2 to value *p* (option 350 only)

Temperature Probe Adjustment

WCTFV*p* Temperature probe adjustment: set process temperature *p*

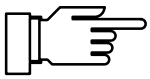


For setting temperature probe adjustment: see page 12–10

Digital Controller (Option 353, not with Option 483)

WCOM08CI Activate controller manually

WCCIM*p* Set controller output to value *p*

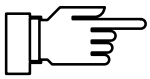


For setting the digital controller: see page 12–21

Analog Controller (Option 483, not with Option 353)

WCOM08CN Activate controller manually

WCCNM*p* Set controller output to value *p*



For setting the analog controller: see page 12–21

Automatic Calibration

WCOU1 Freeze output currents and controller, disable limit values

WCCAA1 Automatic calibration

WCOU0 Enable output currents, controller and limit values

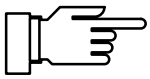
For setting calibration: see page 12–10

Calibration by Manual Input of Cell Constant

WCOU1 Freeze output currents and controller, disable limit values

WCCAM1 Manual calibration

WCOU0 Enable output currents, controller and limit values

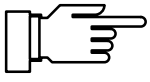


For setting calibration: see page 12–11

Calibration by Sampling

WCCAPT Take sample

WCCAPC Process sample



For setting calibration: see page 12–11

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 the lowest 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. 9–49).

Query

PC → Transmitter 7500:	R	V	2	<cr>	(ASCII)
	52	56	32	OD	(hexadecimal)

Response

Transmitter 7500 → 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 addresses 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 and 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 Transmitter 7500. 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 complete transmitted 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}.

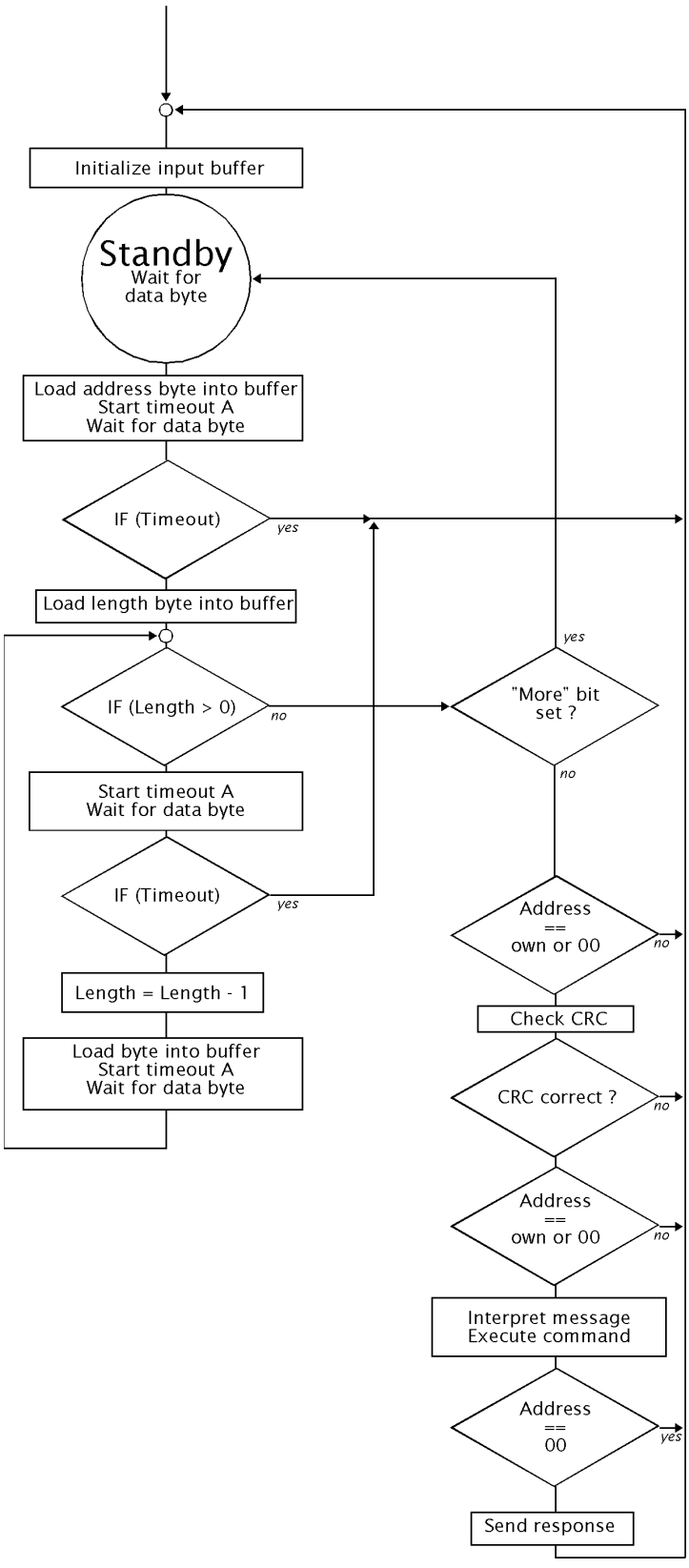
Calculating a CRC:

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 (Transmitter 7500)



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

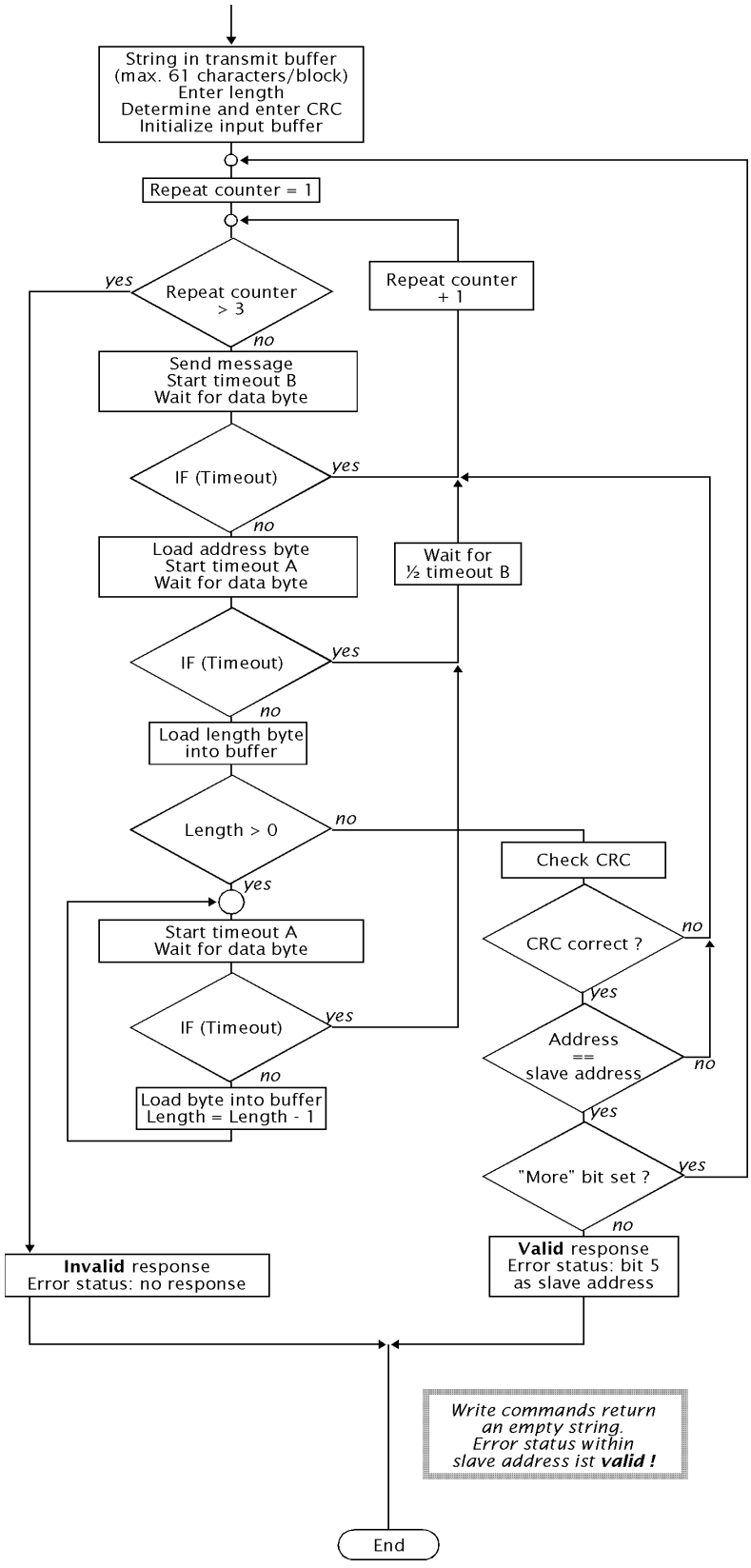
3) unknown target address (not addressed)

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.
Transmitter 7500	7500

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 together with option 483)	353
Logbook	354
Concentration determination H_2SO_4, HCl, HNO_3 (not together with opt. 360, 361, 382, 392)	359
Concentration determination to customer requirement (not together with opt. 359, 361, 382, 392)	360
TC for solutions to customer specification (not together with option 359, 360, 382, 392)	361
Concentration determination HCl, NaOH, NaCl (not together with opt. 359, 360,361, 392)	382
TC for ultrapure water with traces of impurity (not together with opt. 359, 360, 361, 382)	392
Ex II T6 (hazardous area Zone 2)	403
Temperature Range extended to 350 °C (only for Pt 100/Pt 1000)	424
Analog controller function (with option 350 only, not together 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 polycarbonate, complete with mounting kit, see Fig. 10–3, page 10–3	ZU 0124
Bracket kit for protective case (only with ZU 0124)	ZU 0128

Cells

Cells	**Ref. No.**
InPro® 7000 (2-electrode cell)	52 000 230
InPro® 7001/120 (2-electrode cell)	52 000 231
InPro® 7001/225 (2-electrode cell)	52 000 232
InPro® 7002 (2-electrode cell)	52 000 233
InPro® 7003 (2-electrode cell)	52 000 234
InPro® 7100 (4-electrode cell)	52 000 235
InPro® 7104 (4-electrode cell)	52 000 236

For specifications, refer to page 14–4 and the following.

The InPro® 7001 cells can be used with various installation fittings.

14 Specifications

Conductivity input	either 4-electrode or 2-electrode cells	
Ranges	Conductivity	0.001 µS/cm to 2,000 mS/cm
	Resistivity (1/ϰ)	0.5 Ωcm to 1,000 MΩcm
	Concentration	0.00 to 200.0 % by wt
Display range	0.1 µS · c to 1,999 mS ·c	(cell constant c = 0.0050 to 200.0 cm^{-1})
Accuracy (± 1 count)	< 1 % of measured value + 0.2 µS · c max. permissible direct voltage against signal ground ±2 V (especially when using stray-field probes, equipotential bonding is required)	
Resolution	0.000 µS/cm	c = 0.0050 to 0.1199 cm^{-1}
	0.00 µS/cm	c = 0.1200 to 1.199 cm^{-1}
	0.0 µS/cm	c = 1.200 to 11.99 cm^{-1}
	0.000 mS/cm	c = 12.00 to 119.9 cm^{-1}
	0.00 mS/cm	c = 120.0 to 200.0 cm^{-1}
Cell standardization	Operating modes*) ● automatic, by cell constant determination with NaCl or KCl solution ● entry of individual conductivity values for cell constant determination ● direct entry of cell constant ● calibration by sampling	
Permissible cell constant	0.0050 to 200.0 cm^{-1}	
Concentration determination (Option 359, 360, 382)	Calculation and display of concentration [% by wt.] from the conductivity and temperature values of specified substance solutions (see tables in annex) customer-specific tables on request (opt. 360)	
Temperature input	Pt 100 / Pt 1000 / Ni 100 2 or 3-wire connection	
Range	Pt 100/1000	-50.0 to +250.0 °C
	Ni 100	-50.0 to +180.0 °C
Accuracy (± 1 count)	< 0.2 % of measured value, + 0.2 K	
Temperature compensation*) media-dependent	automatic with Pt 100/Pt 1000/Ni 100 manual -50.0 to +250.0 °C Operating modes: ● without ● linear 0.00 to 20.00 %/K, reference temperature user-defined ● natural waters to EN 27888 ● optional: to customer specification (option 361) ultrapure water with traces of impurity (option 392)	
Current input	0(4) to 20 mA evaluation 0 to 100 % input resistance 50 Ω, overload 100 mA e.g. for limit monitoring In conjunction with power output complete 2-wire loop, e.g. for flow or level meter	
Accuracy	< 1 % full scale	

Display	Graphic LCD, 240 x 64 pixels with CFL[1] backlighting		
	Main display	character height approx. 20 mm	
	Secondary display	character height approx. 6 mm	
	Dialog display	7 lines, character height approx. 4 mm	
Display options	Main display	Secondary display	
	conductivity	conductivity	[S/cm]
	resistivity	resistivity	[Ωcm]
	concentration	concentration	[% by wt.]
	temperature	temperature	[°C]
	time	time	[h,min]
		date	[d,m,y]
		current output 1	[mA]
		current output 2	[mA]
		current input	[%]
		controller output	[%]
		controller setpoint man. temperature	[°C]
Output 1*)	0 to 20 mA or 4 to 20 mA, max. 10 V, floating user-defined for conductivity, concentration, resistivity, °C current characteristic user-defined: linear, bilinear, trilinear, function error message if load is exceeded		
Output 2*)	0 to 20 mA or 4 to 20 mA, max. 10 V, floating user-defined for conductivity, concentration, resistivity, °C optionally as analog controller output (option 483) current characteristic user-defined: linear, bilinear, trilinear, function error message if load is exceeded		
Beginning/End of scale*)	Anywhere within measurement range		
Spans	Conductivity	≥ 0.20 µS/cm, at least 20 % full scale	
	Resistivity	100 Ω·cm, at least 20 % full scale	
	Concentration	1.00 to 200.0 %	
	Temperature	10.0 to 300.0 °C	
Accuracy	< 0.25 % of meas. value + 20 µA		
Current source function	0.00 mA to 20.50 mA		
Power output	24 Vdc / 30 mA, floating, short-circuit-proof typical applications: loop current for universal input, signal current for switching outputs		
Switching contacts*)	8 switching contacts, floating, overvoltage category II up to 250 V≂		
Contact rating	ac < 250 V/5 A < 1,250 VA resistive dc < 120 V/5 A <120 W delay time user-defined		
NAMUR contacts[2]	functional check warning (maintenance required) failure failure/warning: delays separately definable		
Limit/controller contacts (Digital controller option 353)	limit 1 limit 2		
Cleaning contacts (Option 352)	rinsing cleaning probe		

PI controller[*)] Digital (Option 353)	Quasi continuous switching controller via limit contacts user defined for pulse duration or pulse frequency control range user defined within conductivity/resistivity/temp ranges
Analog (Option 483)	Continuous controller (0/4 – 20 mA) via output 2 three-way mixing valve and straightway valve user defined control range user defined within conductivity/resistivity/concentration/temp 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 units
Logbook (Option 354)	Recording of function activations, appearance and disappearance of warning and failure messages, with date and time Memory capacity 200 entries available Data retrievable via keypad/display or interface
Data retention in case of power failure	Parameters and factory settings > 10 years (EEPROM) Clock, logbook, statistics > 1 year (battery-backed)
Unit self-test	Test of RAM, EPROM, EEPROM, display and keypad, Record for quality management documentation (QM) to ISO 9000 Data retrievable via display and interface
Clock	Real-time clock with date, self-contained
Explosion Protection (Option 403)	Ex II T6 (hazardous area Zone 2), TÜV Hannover Sachsen-Anhalt No. 1004/3
RFI suppression	EN 50 081-1
Immunity to ESD	EN 50 082-2 and NAMUR[2)] EMC recommendation for process and laboratory control equipment
Protection against electrical shock	Inputs and outputs are isolated against power supply 230 V and 115 V and against switching contacts by the protective measure “Functional extra-low voltage with protective separation” as defined in DIN 57100/VDE 0100 Part 410 and DIN VDE 0106 Part 101.
Power supply	230 Vac -15 % +10 % < 4 VA 48 to 62 Hz Opt. 363 115 Vac -15 % +10 % < 4 VA 48 to 62 Hz Opt. 415 24Vac/dc ac: -15 % +10 % < 10 VA dc: -15 % +25 % < 10 W
Protection class	II ⧈ Overvoltage category III / I
Ambient temperature	Operation[3)] -20 to +50 °C Transport/storage -20 to +70 °C
Enclosure	Case with separate terminal compartment, suitable for outdoor mounting Material: acrylonitrile butadiene styrene (ABS) IP 65 protection
Cable glands	10 Pg 13.5 threaded cable glands
Dimensions	see dimension drawing Fig. 10–1, page 10–2
Weight	approx. 3 kg

*) user-defined

1) Cold fluorescent lamp

2) German committee for measurement and control standards in the chemical industry

3) At ambient temperatures below 0 °C, display readability may be reduced, however the unit functions *are not* impaired.

Cells

InPro® 7000 (2-electrode cell)

Cell constant	approx. 0.1 cm^{-1} (exact value printed on rating plate)	
Range	0.02 – 1,000 µS/cm	
Material	Body	PVDF
	Electrodes	titanium
Max. temperature	100 °C	
Max. pressure	34 bar (25 °C)	
Temperature probe	Pt 1000 (IEC Class A)	
Dimensions	See dimension drawing Fig. 14–1	

InPro® 7001 (2-electrode cell)

Cell constant	approx. 0.1 cm^{-1} (exact value printed on rating plate)	
Range	0.02 – 1,000 µS/cm	
Material	Body	AISI 316L (1.4435) stainless steel
	Electrodes	AISI 316L (1.4435) stainless steel
Max. temperature	100 °C	
Max. pressure	14 bar (25 °C)	
Temperature probe	Pt 1000 (IEC Class A)	
Dimensions	See dimension drawing Fig. 14–2	

InPro® 7002 / 7003 (2-electrode cell)

Cell constant	approx. 0.1 cm^{-1} (exact value printed on rating plate)	
Range	0.02 – 1,000 µS/cm	
Material	Body	AISI 316L (1.4435) stainless steel
	Electrodes	AISI 316L (1.4435) stainless steel
Max. temperature	100 °C	
Max. pressure	14 bar (25 °C)	
Temperature probe	Pt 1000 (IEC Class A)	
Dimensions	See dimension drawing Fig. 14 –3	

InPro® 7100 (4-electrode cell)

Cell constant	approx. 0.6 cm^{-1} (exact value printed on rating plate)	
Range	approx. 10 µS/cm – 300 mS/cm	
Material	Body	CPVC
	Electrodes	AISI 316L (1.4435) stainless steel
Max. temperature	80 °C	
Max. pressure	7 bar (25 °C)	
Temperature probe	Pt 1000 (IEC Class A)	
Dimensions	See dimension drawing Fig. 14–4	

InPro® 7104 (4-electrode cell)

Cell constant	approx. 0.6 cm^{-1} (exact value printed on rating plate)	
Range	approx. 10 µS/cm – 300 mS/cm	
Material	Body	CPVC
	Electrodes	AISI 316L (1.4435) stainless steel
Max. temperature	120 °C	
Max. pressure	14 bar (25 °C)	
Temperature probe	Pt 1000 (IEC Class A)	
Dimensions	See dimension drawing Fig. 14–4	

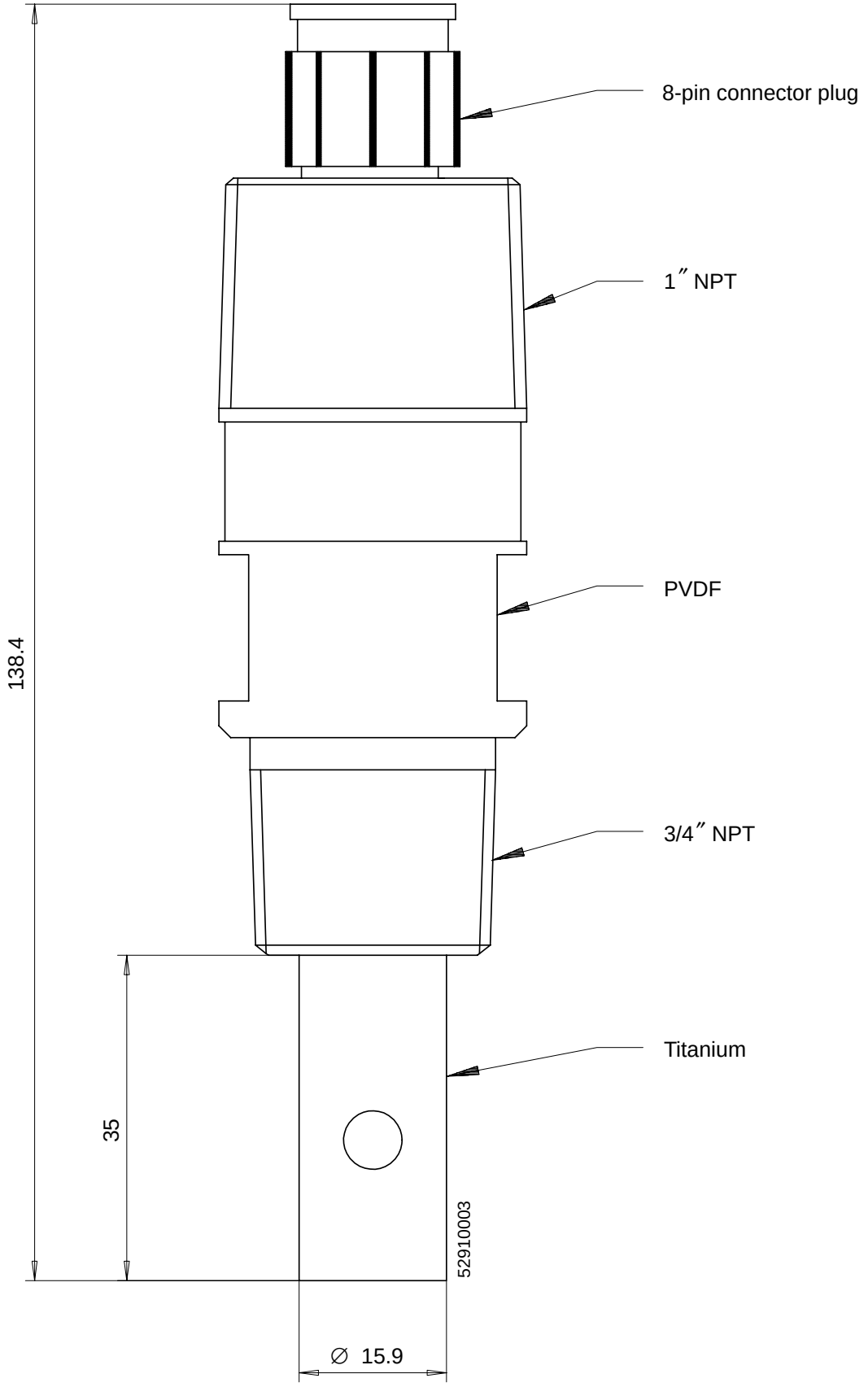


Fig. 14–1 InPro® 7000 Dimension Drawing

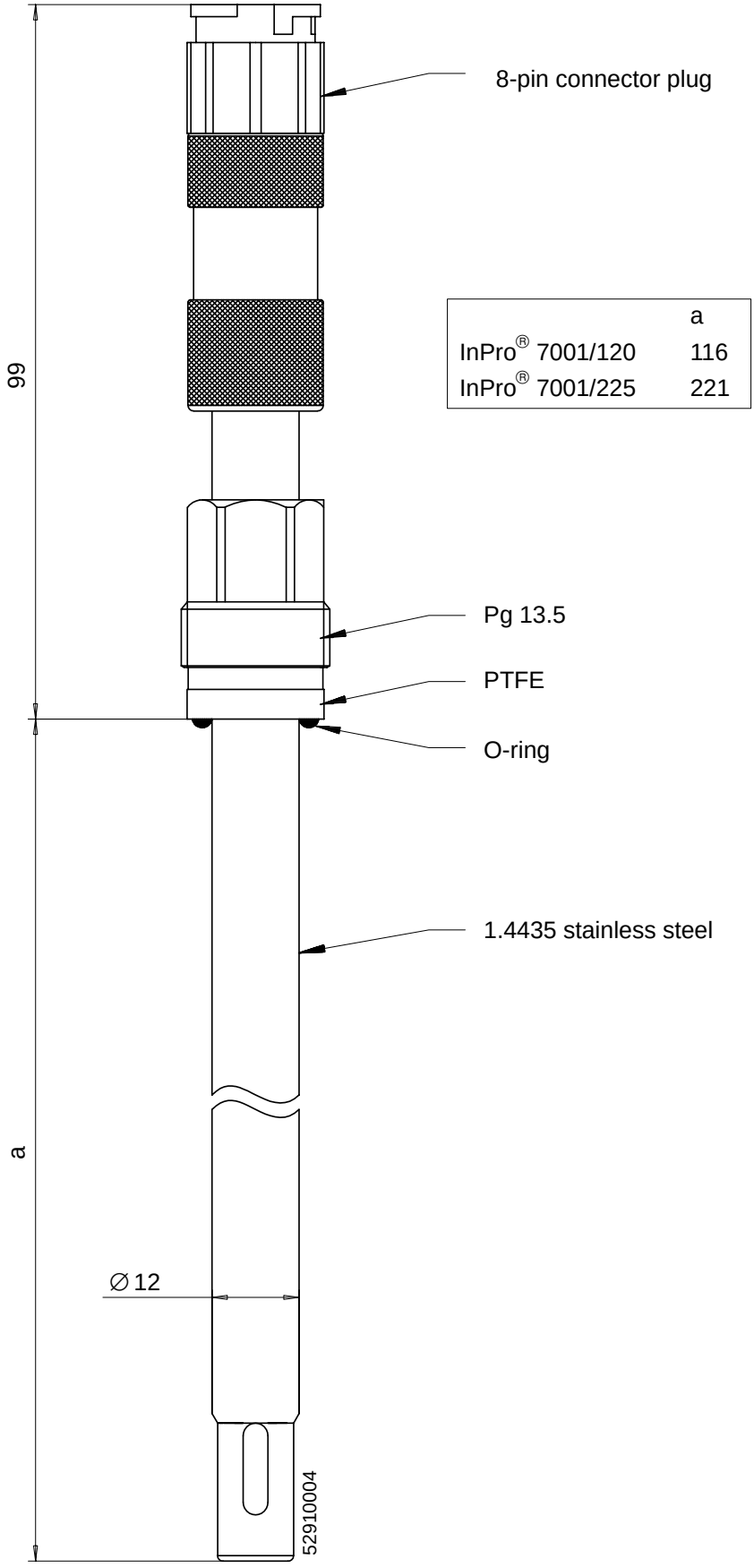


Fig. 14–2 InPro® 7001 Dimension Drawing

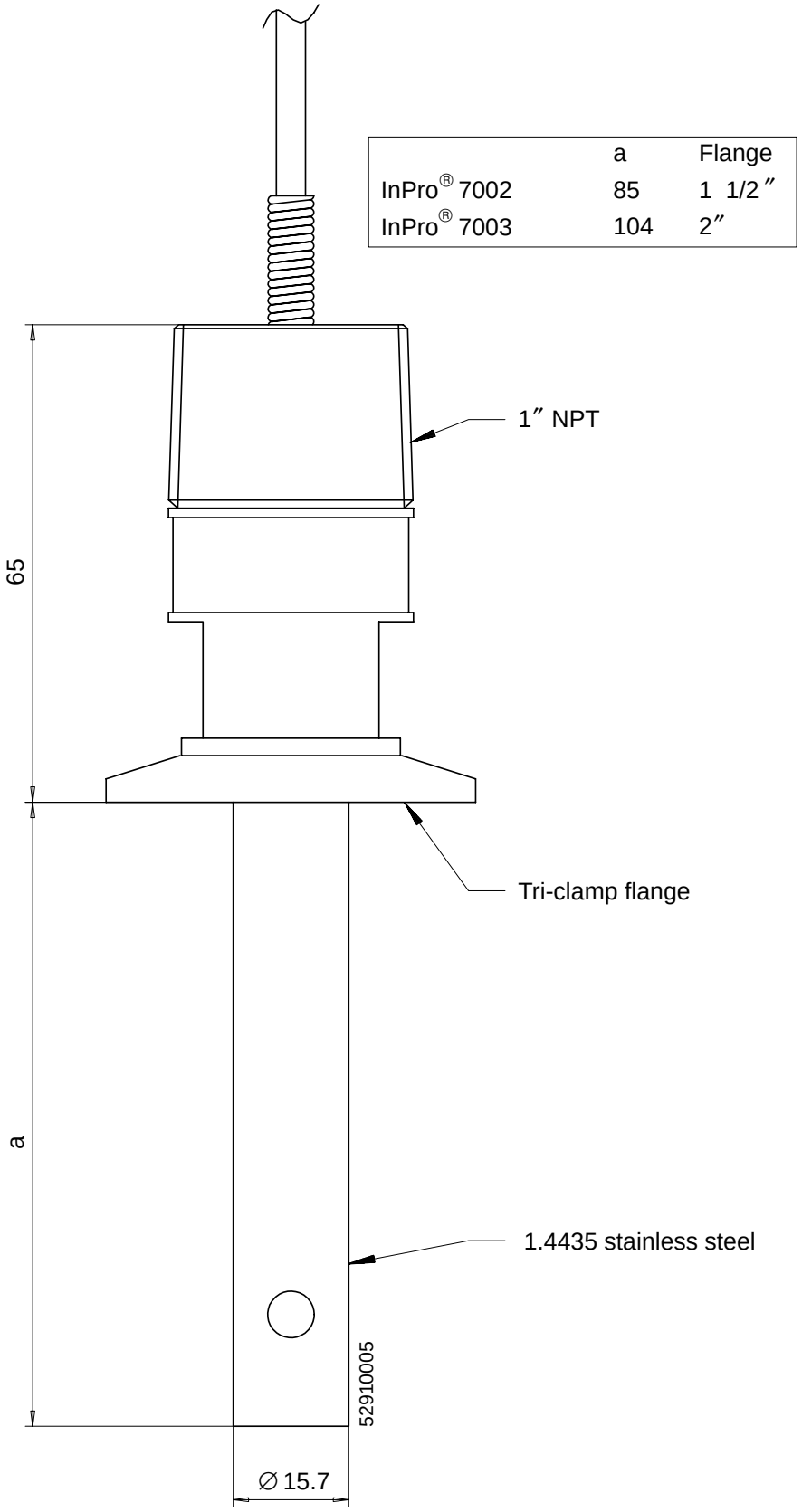


Fig. 14–3 InPro® 7002 / 7003 Dimension Drawing

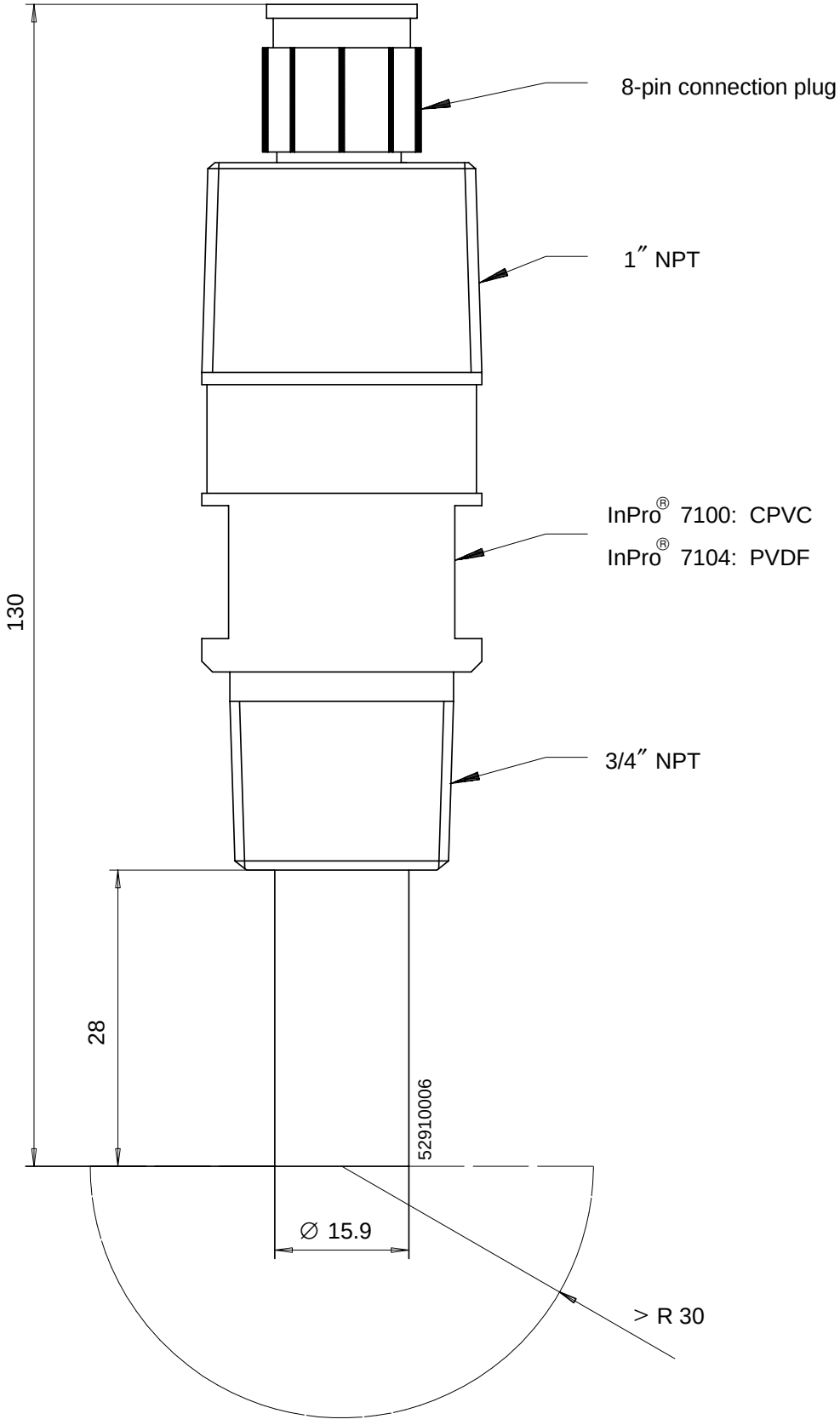


Fig. 14–4 InPro® 7100 / 7104 Dimension Drawing

Concentration Measurement (Opt. 359, 382)

Concentration ranges

Substance	Concentration ranges			
HNO_3	0 to 30	35 to 96		% by wt.
	–20 to 50	–20 to 50		°C
HCl	0 to 18	22 to 39		% by wt.
	–20 to 50	–20 to 50		°C
H_2SO_4 3)	0 to 30	32 to 84	92 to 99	% by wt.
	–17.8 to 110	–17.8 to 115.6	–17.8 to 115.6	°C
NaOH 4)	0 to 14	18 to 50		% by wt.
	0 to 100	0 to 100		°C
NaCl	0 to 26			% by wt.
	0 to 100			°C

3) Range limits based on 27 5C 4) Range limits based on 25 5C

Concentration Curves

- The concentration curves of many substances show a maximum. This means that if the substance concentration continues to increase and the temperature remains constant, the conductivity will drop.
- The curve is temperature-dependent.
- For sulfuric acid, the position of the maximum concentration shifts in dependence on the temperature.
- Near the maximum (or near the minimum as for sulfur), the curve is so flat that the conductivity hardly changes over a large concentration range.

This means *that practical concentration determination is only possible in some areas*:

- In the shaded areas of the concentration curves no concentration calculation is possible.
- Due to the ambiguity of the curves (the same conductivity may correspond to several concentration values), the measuring range of the concentration must be defined.

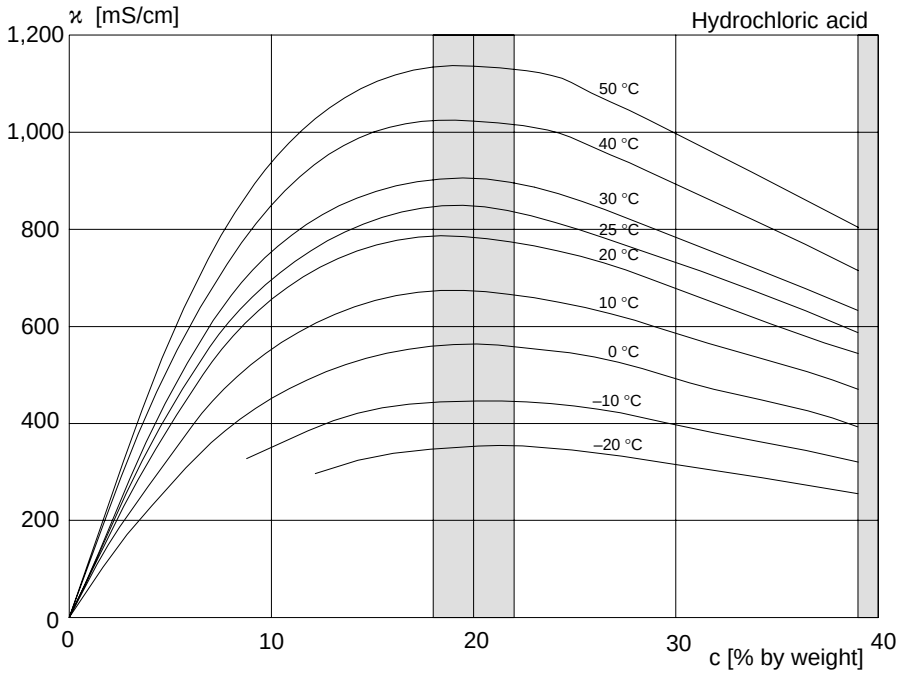


Fig. 14–5 Conductivity in dependence on substance concentration and medium temperature for hydrochloric acid (HCl), Source: Haase/Sauermann/Duecker, Z. phys. Chem. New Edition, Vol. 47 (1965)

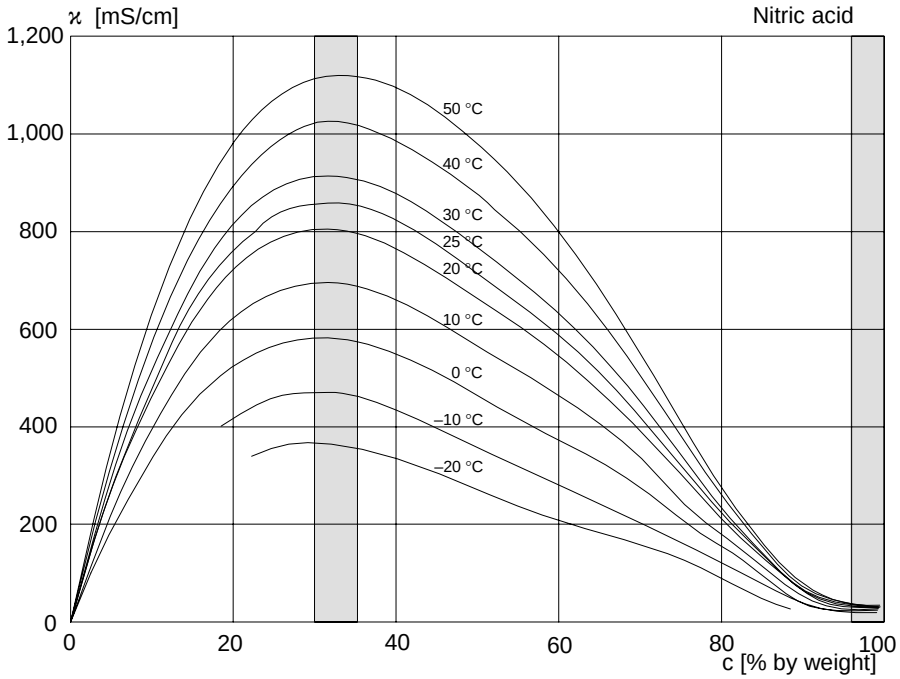


Fig. 14–6 Conductivity in dependence on substance concentration and medium temperature for nitric acid (HNO_3), Source: Haase/Sauermann/Duecker, Z. phys. Chem. New Edition, Vol. 46 (1965)

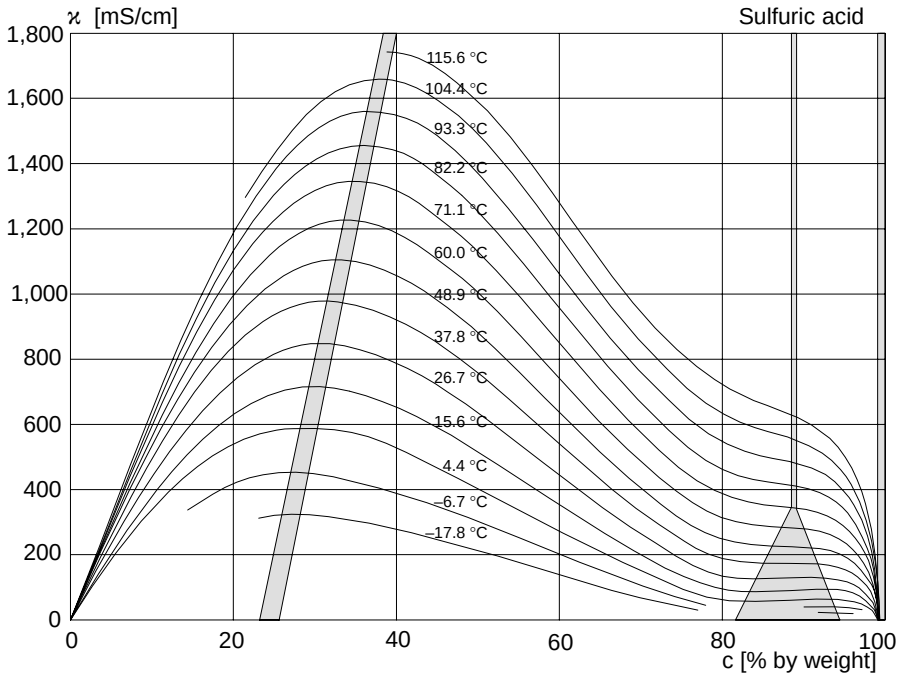


Fig. 14–7 Conductivity in dependence on substance concentration and medium temperature for sulfuric acid (H_2SO_4), Source: Darling, Journal of Chemical and Engineering Data, Vol. 9 No. 3, July 1964

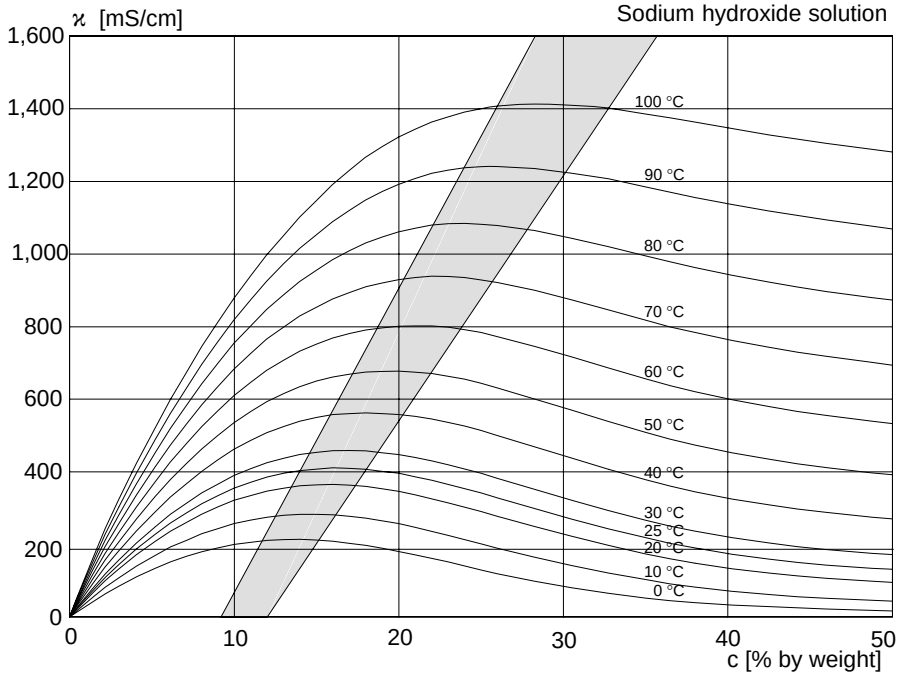


Fig. 14–8 Conductivity in dependence on substance concentration and medium temperature for sodium hydroxide solution (NaOH)

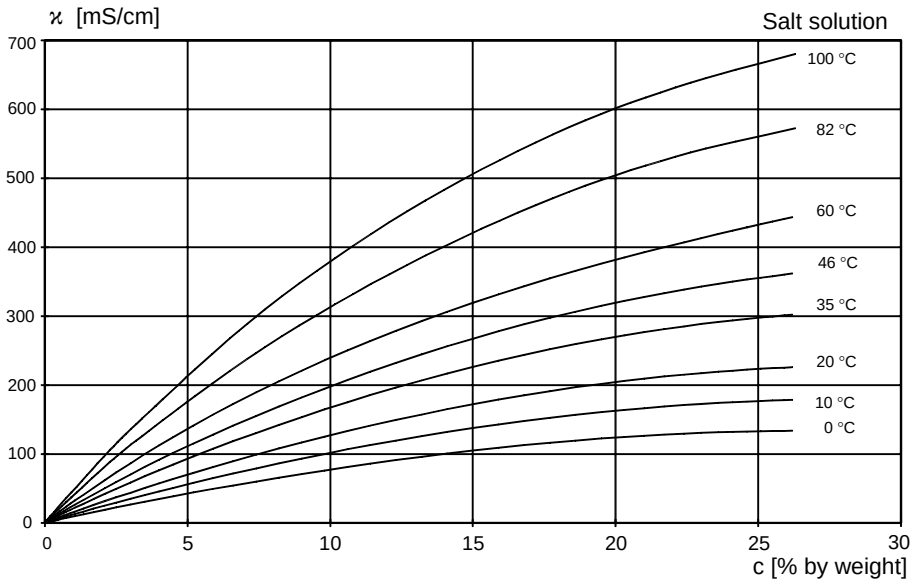


Fig. 14–9 Conductivity in dependence on substance concentration and medium temperature for salt solution (NaCl)

15 Calibration Solution Tables

Potassium Chloride Solutions
Electrical Conductivity in mS/cm

Temperature [°C]	Concentration 0.01 mol/l	0.1 mol/l	1 mol/l
0	0.776	7.15	65.41
5	0.896	8.22	74.14
10	1.020	9.33	83.19
15	1.147	10.48	92.52
16	1.173	10.72	94.41
17	1.199	10.95	96.31
18	1.225	11.19	98.22
19	1.251	11.43	100.14
20	1.278	11.67	102.07
21	1.305	11.91	104.00
22	1.332	12.15	105.94
23	1.359	12.39	107.89
24	1.386	12.64	109.84
25	1.413	12.88	111.80
26	1.441	13.13	113.77
27	1.468	13.37	115.74
28	1.496	13.62	
29	1.524	13.87	
30	1.552	14.12	
31	1.581	14.37	
32	1.609	14.62	
33	1.638	14.88	
34	1.667	15.13	
35	1.696	15.39	
36		15.64	

Data source: K. H. Hellwege (Editor), H. Landolt, R. Börnstein: Zahlenwerte und Funktionen ..., Volume 2, Part. Volume 6

Sodium Chloride Solutions
Electrical Conductivity in mS/cm

Temperature [°C]	Concentration saturated*)	0.1 mol/l**)	0.01 mol/l**)
0	134.5	5.786	0.631
1	138.6	5.965	0.651
2	142.7	6.145	0.671
3	146.9	6.327	0.692
4	151.2	6.510	0.712
5	155.5	6.695	0.733
6	159.9	6.881	0.754
7	164.3	7.068	0.775
8	168.8	7.257	0.796
9	173.4	7.447	0.818
10	177.9	7.638	0.839
11	182.6	7.831	0.861
12	187.2	8.025	0.883
13	191.9	8.221	0.905
14	196.7	8.418	0.927
15	201.5	8.617	0.950
16	206.3	8.816	0.972
17	211.2	9.018	0.995
18	216.1	9.221	1.018
19	221.0	9.425	1.041
20	226.0	9.631	1.064
21	231.0	9.838	1.087
22	236.1	10.047	1.111
23	241.1	10.258	1.135
24	246.2	10.469	1.159
25	251.3	10.683	1.183
26	256.5	10.898	1.207
27	261.6	11.114	1.232
28	266.9	11.332	1.256
29	272.1	11.552	1.281
30	277.4	11.773	1.306
31	282.7	11.995	1.331
32	288.0	12.220	1.357
33	293.3	12.445	1.382
34	298.7	12.673	1.408
35	304.1	12.902	1.434
36	309.5	13.132	1.460

Data sources: *) K. H. Hellwege (Editor). H. Landolt. R. Börnstein: Zahlenwerte und Funktionen .... Volume 2, Part. Volume 6
**) Test solutions calculated according to IEC 746-3

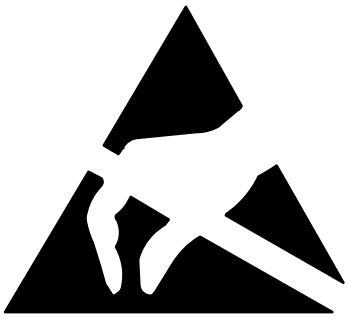
16 Appendix

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.

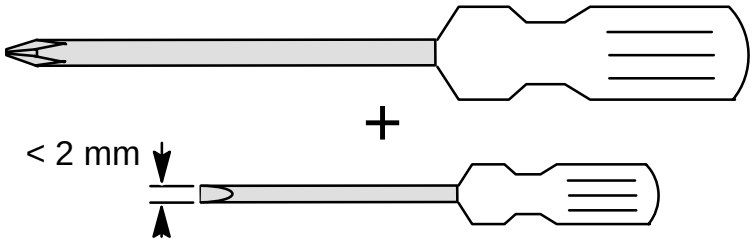


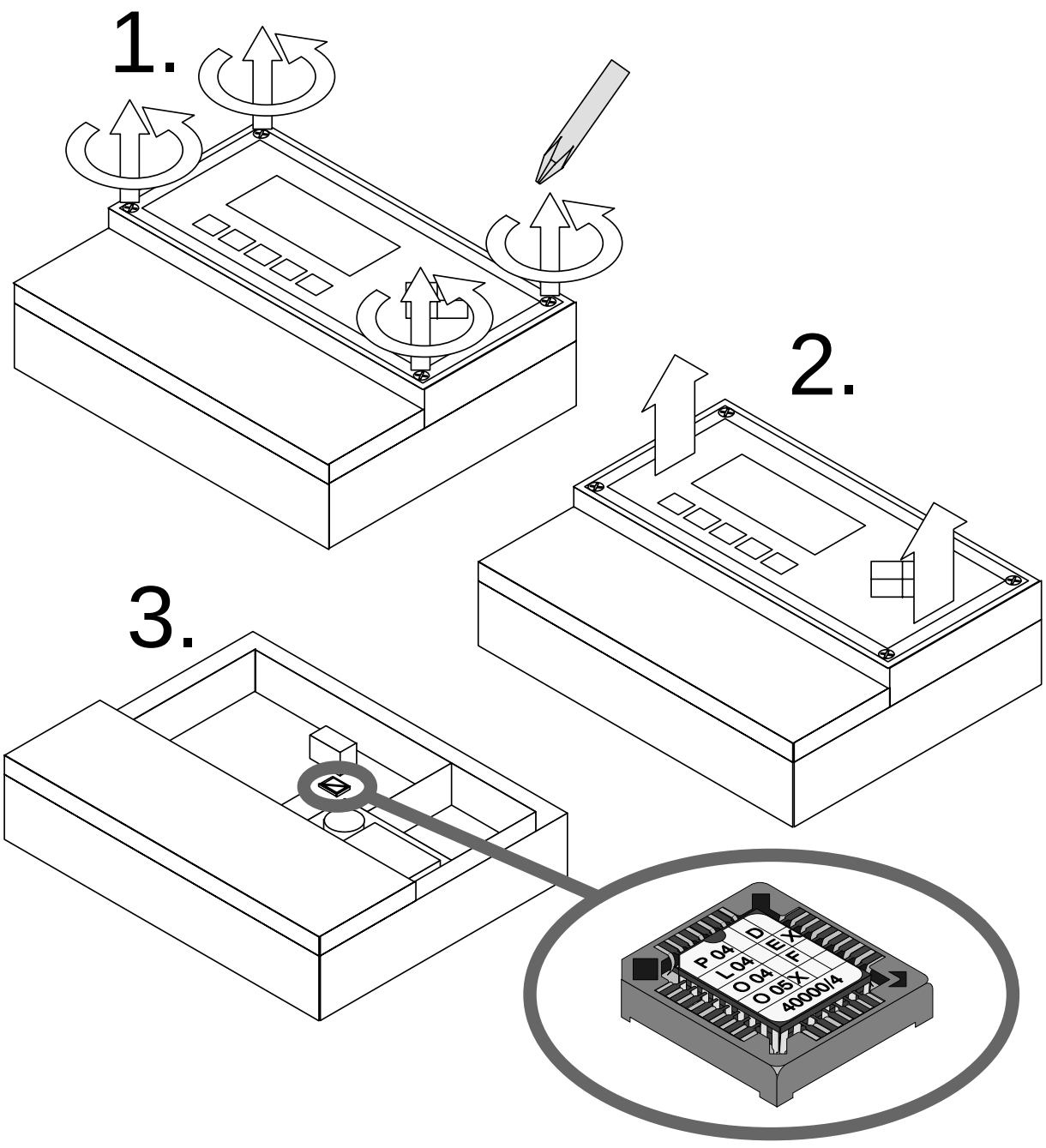
Caution

Observe the handling precautions for ESD sensitive components when acting on the opened apparatus!

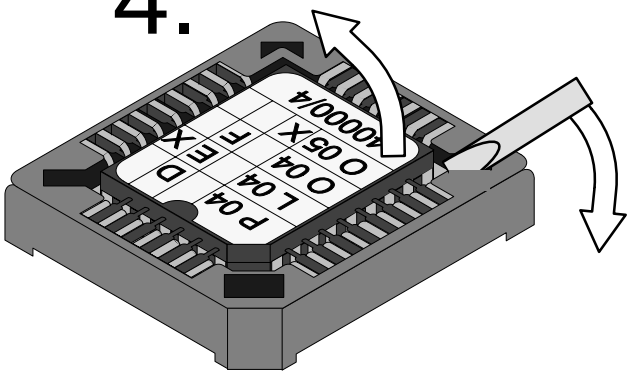
EPROM Replacement

You need:

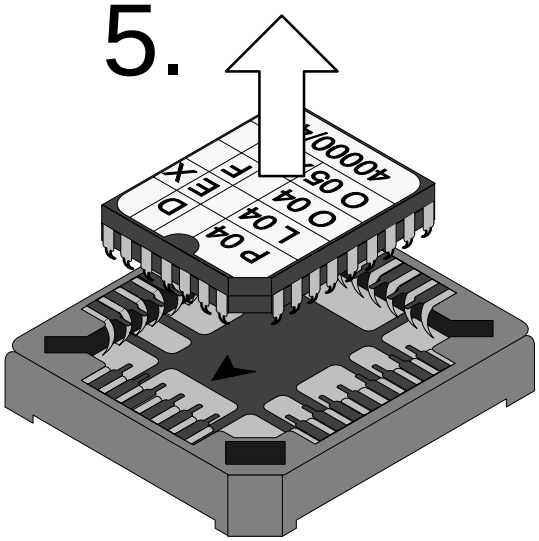




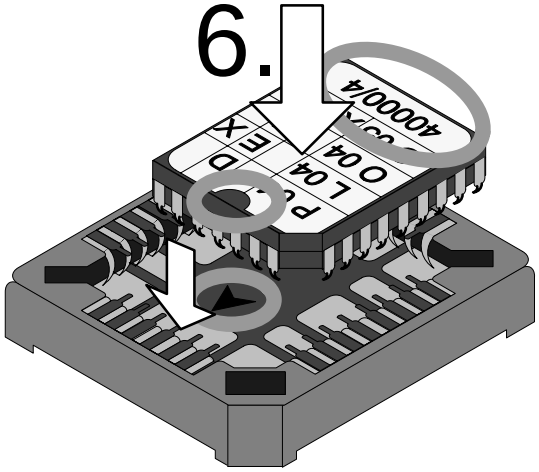
4.



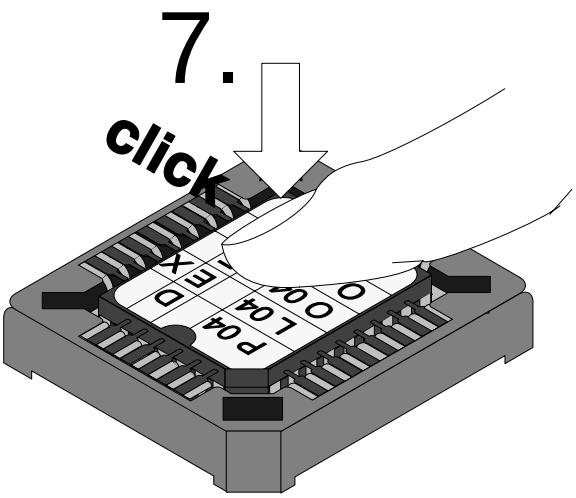
5.



6.



7.



8. Remount the instrument in reverse sequence.

17 Technical Terms

2-electrode cell	Conductivity cell with 2 (voltage) electrodes; suitable for measuring low conductivities
3-wire configuration	Connection of the temperature probe with a (third) sense line to compensate for the lead resistances; required for exact temperature measurement with long leads
4-electrode cell	Conductivity cell with 4 (2 current and 2 voltage) electrodes; suitable for measuring high conductivities
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 measured 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 will be activated.
cal	Menu key for Calibration menu
Calibration menu	Menu for calibrating the cell
calibration passcode	Protects access to calibration; can be edited or disabled on the Administrator level
calibration sequence	From the Calibration menu, you can select four sequences: automatic calibration, calibration with manual input of conductivity, input of cell constant, sample calibration.
cell	2-electrode or 4-electrode cells can be connected. The cell constant of the cell in use must be entered or automatically determined.
cell constant	c = d / A (theoretical) d: distance between electrodes A: electrode surface
cell standardization	Automatic determination or manual entry of cell constant
cleaning	User defined time during which the cleaning contact is closed during a rinsing cycle.

conductance	Conductance G [S] = 1 / R [Ω]
conductivity	Conductivity $\varkappa$ [S/cm] = G [S] * c [1/cm]
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
enter	Key for confirming entries
equipotential bonding	To prevent considerable measurement errors when measuring ungrounded media using stray-field cells, there must be an equipotential bond between medium and measuring input.
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 rinsing	User defined time during which contact ”rinsing” is closed at the beginning of a rinsing cycle
functional check	NAMUR contact – always enabled when instrument does *not* output the selected measured value
GLP	Good Laboratory Practice: guidelines for performance and documentation of measurements
GMP	Good Manufacturing Practice: Rules for performance and documentation of measurements.
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.
main display	Large measurement display in measuring mode. You can select a measured 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 opening 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.
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.
NAMUR	German committee for measurement and control standards in chemical industry
NAMUR contacts	”functional check”, “warning” and ”failure” – indicate status of measured variable and 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
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.
point of measurement	Can be defined for identifying the Transmitter; can be displayed in the diag menu or read out via remote interface
reference temperature	With temperature compensation enabled, the measured value is calculated for the reference temperature (usually 20 or 25 °C) using the temperature coefficient.
rinsing cycle	User defined sequence for cleaning the cell or other sensors; controls contacts ”probe”, ”rinsing” and ”cleaning”
rinsing lead time	User defined time at the beginning of the rinsing cycle, after closing of contact ”probe”, before closing of contact ”rinsing”
scrolling key	▲ and ▼ keys 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
temperature coefficient	With temperature compensation enabled, the measured value is calculated for the reference temperature using the temperature coefficient.
temperature compensation	Calculates the measured conductivity value for a reference temperature.
Viewing level	”view” – menu level of parameter setting; display of all configuration settings, no editing possible
wait position	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)
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”.

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