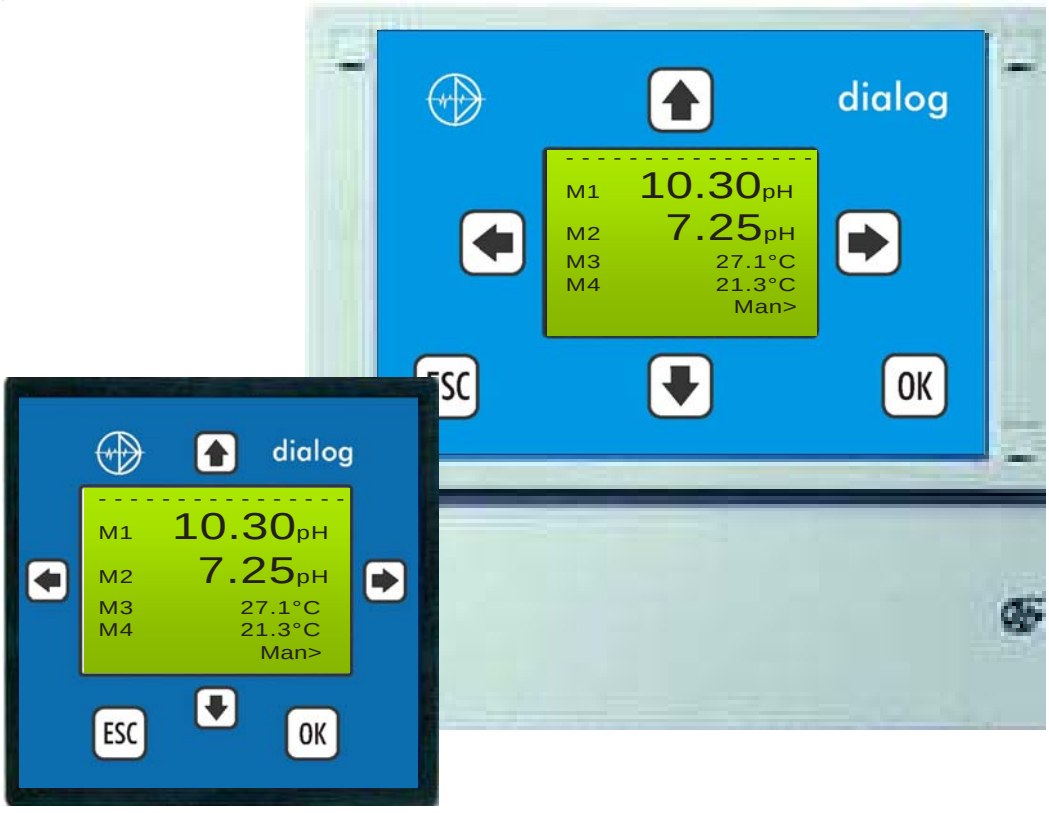
Manual

dialog (W) PR T / R
dialog (W) 2 PR T / R

Instruments for pH or ORP measurements (T)

Instruments for measurement and control of pH or ORP values (R)

Instruments for single-, double or difference measurements



DR. A. KUNTZE

GUTES WASSER MIT SYSTEM

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Content

1. Your dialog

is an instrument of Dr. A. Kuntze GmbH that guarantees high quality and reliability for years.

It is a member of our premium series designed for a maximum of flexibility and versatility. dialog instruments are available for pH, ORP, and conductivity measurements, and can be used for single, double, or difference measurement. The dialog 2 Cl2 PR is a special version with a combination of measurements typically found in desinfection applications, namely Chlorine concentration, pH, and temperature.

The dialog pH/ORP instruments are available for measurement (T /transmitter) or for measurement and control (R). They offer one or two pH or ORP measurements (individually selectable, including the combination pH and ORP) and two temperature measurements for temperature compensation. Instruments with two identical measurements can show and control the difference between the two values.

The R instruments offer two independent controllers. For each you can choose between ON/OFF, P, PI, or PID controller. For each controller, up to two set points can be used, with adjustable acting direction, so that even bidirectional control is possible. Servo motors can be controlled via run time or, with dialog PR R RFP, via potentiometer for position indication. Choose for yourself which of the three relays and the two or three analog outputs you want to use for control, limit supervision, and registration.

You can operate all relays manually and start/stop the controllers by remote control. Connect a level or flow sensor, and the controller will shut down automatically in a low water situation. The extensive internal supervision includes the dosing time with 100% feed rate, to help detect defective dosing lines.

All sensor signals are checked during measurement and calibration, and error messages are displayed if a sensor does not give satisfactory signals. If the cause of error renders further automatic control unfeasible, the concerned controller is deactivated automatically.

Dialog instruments have a large, graphical display. Measured values are stored over a period of three hours and displayed graphically - a valuable tool for the adjustment of the controllers.

With the dialog you have certainly made a good choice. On the following pages you´ll learn more about your dialog. If, however, you have further questions or are looking for information not included in this manual or if you are interested in supplementary products such as sensors or fiittings or other instrument series of Dr. A. Kuntze, just give us a call - we will be delighted to help you!

1.1 General and safety instructions

This manual applies to the following instruments:

Instrument and type	revision date
dialog PR T & dialog W PR T	5/08
dialog PR R & dialog W PR R	5/08
dialog 2 PR T & dialog W 2 PR T	5/08
dialog 2 PR R & dialog W 2 PR R	5/08
dialog PR R RFP	7/08

It contains technical information for the installation, start-up, and maintenance. If you have any questions not covered by this manual, please contact your supplier or the official representative of Dr. A. Kuntze GmbH in your country.
We would like to point out that the warranties specified in our general trading conditions are valid only if

- installation, connections, adjustments, start-up, and maintenance are carried out by authorized personnel with adequate qualification.
- the instrument is used as described in this manual.

Please check for damages immediately after receiving the instrument and report any damages within 24 hours to the delivering company. Never work with a damaged instrument!
Keep this manual in a safe place where you can always look up the safety instructions and the information on handling and usage.
This instrument was designed and built according to the safety measures for electronic devices and has left our premises in good working order. To preserve this condition and to ensure safe usage follow all instructions carefully and pay special attention to all warnings issued in this manual. If the instrument is visibly damaged or has been stored inappropriately or if there are any doubts concerning safe usage, shut it down and make sure it cannot be restarted accidentally.

You will notice that important safety instructions are highlighted:

CAUTION **highlights instructions for the protection of people. Disregarding these instructions may cause accidents and injuries!**

ATTENTION **highlights instructions for the protection of instrument and equipement. Disregarding these instructions may lead to damage or destruction of the instrument or equipment!**

NOTE is used to highlight interesting details.

Application

The instruments dialog (W) (2) PR T/R can be used to measure the pH or ORP values in water. The R instruments have two integrated controllers with two set points each. With these you can control actuators such as dosing pumps or valves to add chemicals until the desired concentration is reached and maintained.

Applications are detoxication of industrial waste water, water treatment, and desinfection.

While the controllers are set to Automatic, they control independently the dosing of possibly hazardous chemicals, according to the measured values.

For safety measures, both the measurement and the calibration are checked for failure. Failures are indicated in the display. If that failure makes control unreliable, the controller is automatically switched off until the failure has been taken care off.

CAUTION **The instrument checks the input signals, the calibration results, and the water flow, if a flow sensor is connected. It cannot detect erroneous settings or failures in the treatment system, nor can it check for plausibility! The safety of the system of which the instrument is part of, lies within the reach of responsibility of whoever built the system.**

We expressly point out that the safety of the plant in which the instrument is set up is the responsibility of whoever built the plant.

Intended use

Use these instruments only for the monitoring and control of water.

Use only sensors, fittings, and accessories of Dr. A. Kuntze, since instruments and sensors are attuned.

Ensure that the required measuring conditions are constantly maintained, such as flow, pressure, temperature, etc.

Set-up the instrument according to this manual. Carry out all the steps described, and check all measurements and settings before you activate the controller.

Use all available safety measures such as the alarm relay, the dosage check, and the low water- indication.

Regularly check that all safety measures are in good working order.

CAUTION **The protection built into the instrument is impaired if they are not used as intended!**

1.2 Features

Meter

Measurements	1x pH or ORP and temperature (dialog (W) PR T/R
	2x pH or ORP and 2x temperature (dialog (W) 2 PR T/R)
Measuring ranges	0.00 - 14.00 pH
	-1500 - +1500 mV ORP
	-30.0 - 140.0 °C temperature
Display	Measured values with units
	status of sensors, calibration, controllers & alarm
Temperature compensation	manual or automatic with Pt100

Controller (R instruments only)

Set points	2 x 2 set points with adustable direction
Controller types	ON/OFF, with hysteresis
	P-, PI- or PID controller as pulse-pause, pulse-frequency
	or continuous controller
Hysteresis	adjustable within the measuring range
P range XP	adjustable within the measuring range
Integral time TN	0 - 2000 sec.
Derivative time TV	0 - 500 sec.
Minimum pulse	0.0 - 9.9 sec.
Puls+Pause time	01 - 99 sec.
pulse frequency	100 - 7200 pulses/h
Motor running time	20 - 300 sec.
Alarm function	2 x min and max limits and delay time
Dosage control	0 – 2000 sec.

Connections

Relays	3 potentialfree contacts
	configurable, 6 A, 250 V, max. 550 VA
Analog outputs	2 x /3 x 0/4-20 mA galvanically isolated
	Power supply for Impedance converter +/-6V
	1000mV output for servo motor potentiometer (only dialog PR R RFP)
Analog inputs	1x or 2x (pH/ORP and temperature)
Digital input	external controller stop and/or flow indication
Digital interface	included, RS485, Baud rate 9600, data format 8Bit,
	1 start bit, 1 stop bit, no parity

1.3 Technical data

Feature	dialog	dialog W
Installation	in panels or switch boards	on walls
Dimensions	96 x 96 x 135 mm (H x W xD)	160 x 165 x 85 mm
Weight	1.0 kg	1.2 kg
Terminals	screw terminals for cable diameters max.1,5 mm2	spring terminals
Protection class	front IP54, housing IP30	IP65
Power supply	230 V +6/-10%, 40/60 Hz also available 117 V or 24 V	
internal fuse	none	230 V: 63 mA slow 117V: 125 mA slow 24 V: 800 mA semi-sloe
Power consumption	10 VA	
Display	LCD graphical display 128x64 dots, illuminated background Measured values with units, status messages	
Current outputs	2 / 3 x 0/4-20 mA, galvanically isolated, max load 500 Ohm	
Interfaces	RS485, Baud rate 9600, Data format 8Bit, 1 start bit, 1 stop bit	
Controller (R only)	2 x, assigned to any measurement	
Contact rating	6 A/ 250 V, max. 550 VA resistive load (with RC protective circuit)	
Operation temperature	0 - 50°C	
Storage temperature	-20 - 65°C	
Humidity	0 - 90 % non-condensing	

1.4 Declaration of conformity

EC Declaration of Conformity

DR. A. KUNTZE
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ISO 9001

Hereby we declare that our instruments:

dialog

are in conformity with the following directives:
2004/108/EC – Electromagnetic Compatibility directive (EMC)
2006/95/EC - Low voltage directive (LVD)

As long as the instructions for installation and set-up are observed.

The CE label was affixed in accordance with the technical harmonisation directive 2004/108/EC of the European Council dating from 15.12.2004.

Applied standards:

- EN 55011 :1998 +A1:1999 +A2:2002 EMC emission, industrial environment
- EN 61000-6-2 :2001 EMC immunity, industrial environment
  subject to the following essential requirements:

  -EN 61000-4-2: 1995 +A1:1998 +A2:2001
  -EN 61000-4-3: 2002 +A1:2002
  -EN 61000-4-4: 2004
  -EN 61000-4-5: 1995 +A1:2001
  -EN 61000-4-6: 1996 +A1:2001
  -EN 61000-4-11: 2004
- EN 61010-1 :2002-08 Safety requirements for electrical equipment for measurement, control, and laboratory use

Meerbusch, 31.03.2008

.....
Dipl.- Ing. Christoph Scheffold
Managing Director

CE

2. Installation

Installation:

On the following pages you will find detailed instructions for the installation.

For panel-type meters you have to prepare an opening of 92x92mm. Install the instrument and fix it with the two mounting clips which were part of the delivery.

You can install instruments in wall-mounting housings either by hanging them upon a screw by the center slot or by sliding the center slot under the screw, which is an alternative for limited space. Either way you have to fix it additionally with two screws.

ATTENTION Install the instrument in a place where it is not put under mechanical or chemical strain!

Mind the protection class:

dialog:	front IP54, with front door IP55
dialog W:	IP65 (closed terminal cover)

Connections:

You will find detailed connection diagrams on the following pages..

Before connecting the power supply check the information on the instrument label.

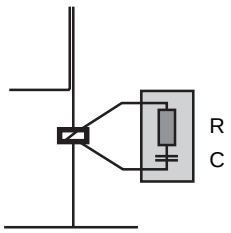
ATTENTION Input, output and control lines must be installed separate from each other and separate from power lines!

For inputs and outputs use screened cables, and connect the screens on one side only.

To protect the measurements against inferferences use only the special cables delivered for each measurement, and for pH measurement an impedance converter for long cable connections.

For the temperature sensor Pt100 use a low-resistance cable with a large diameter.

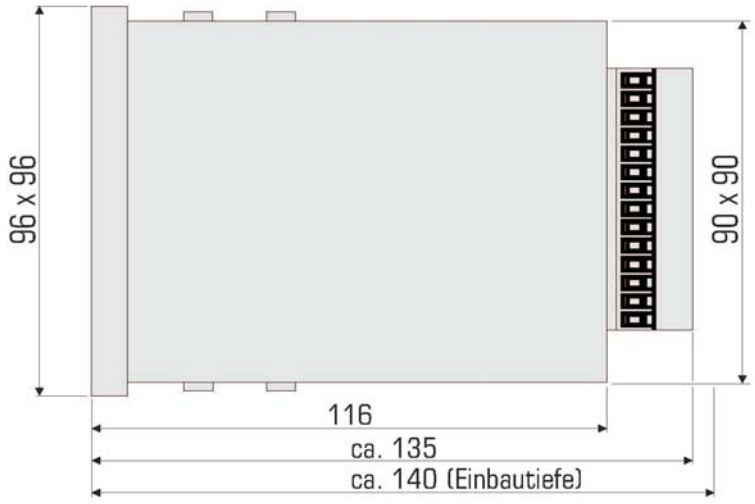
When using the relays, mind that with inductive loads, interference must be suppressed. If that is not possible, the relay must be protected at the terminals of the dialog by a resistance-capacitance filter, or, in case of direct current, by a free-wheeling diode.



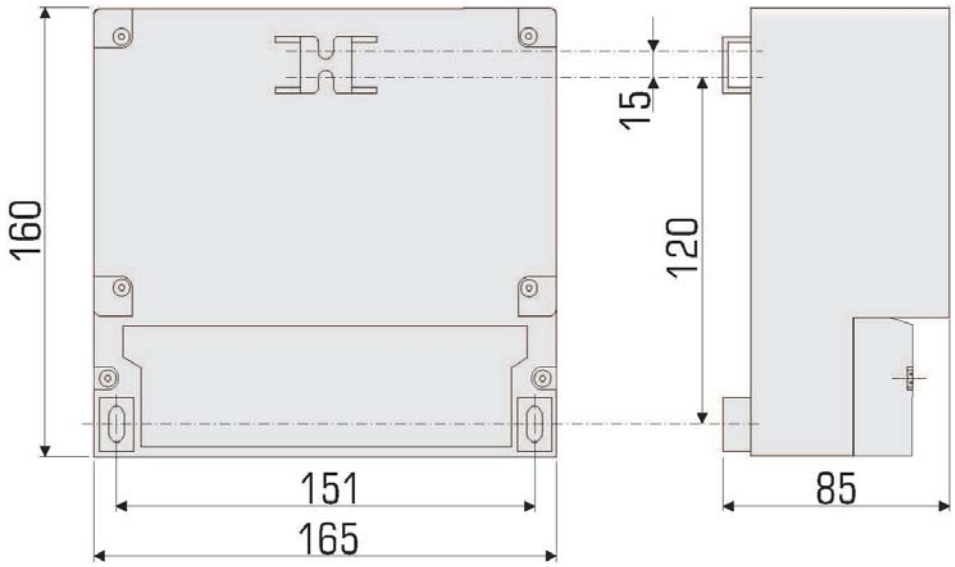
Current upü to	Capacitor C	Resistor R
60 mA	10 nF 260 V	390 Ohm 2 Watt
70 mA	47 nF 260 V	22 Ohm 2 Watt
150 mA	100 nF 260 V	47 Ohm 2 Watt
1,0 A	220 nF 260 V	47 Ohm 2 Watt

2.1 Dimensions

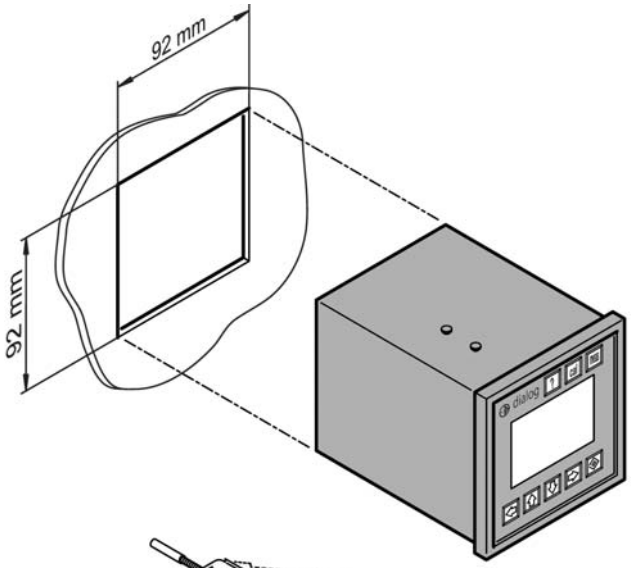
Panel-mounting housing



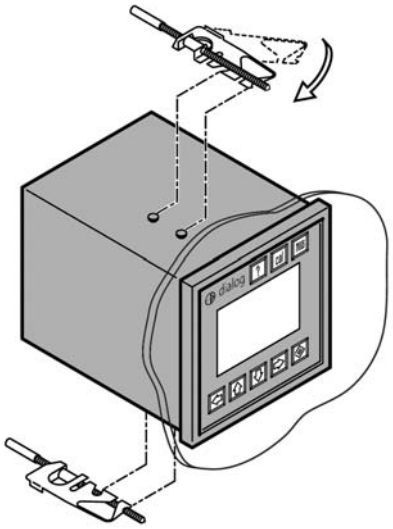
Wall-mounting housing



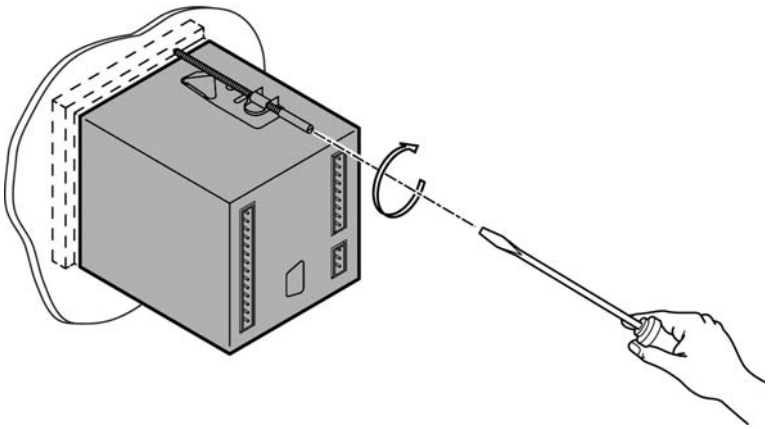
2.2 Installation panel-mounting housing



Prepare an opening of 92 x 92 mm.

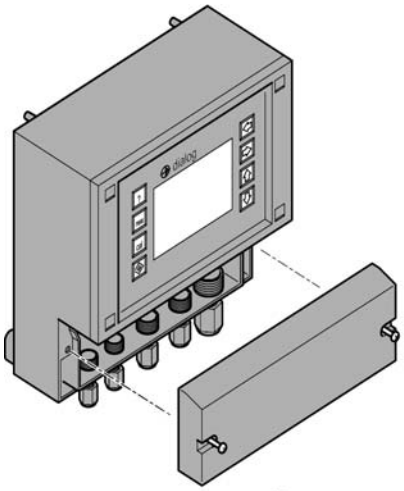


Install the instrument from the front side, and fix it with the two mounting clips which are part of the delivery.

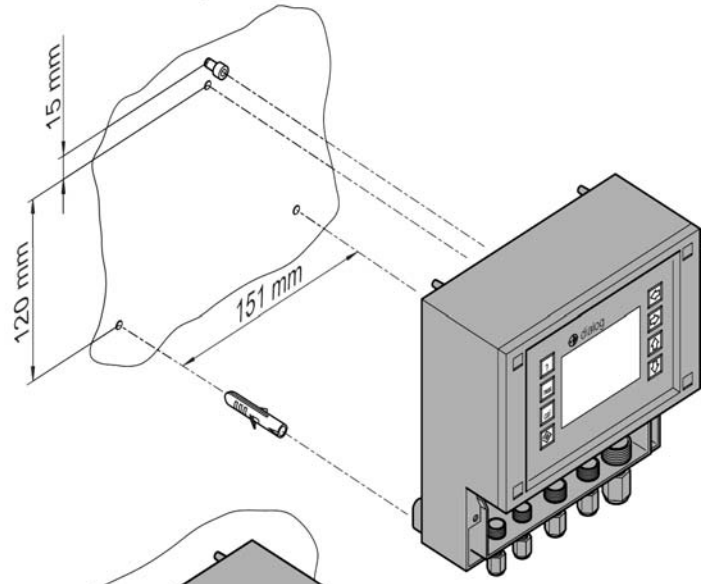


Screw tight until the instrument is fixed perfectly.

2.3 Installation wall-mounting housing

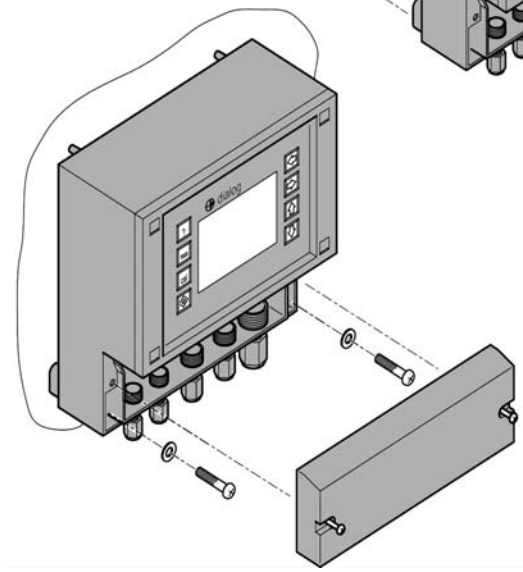


Unscrew the terminal cover.



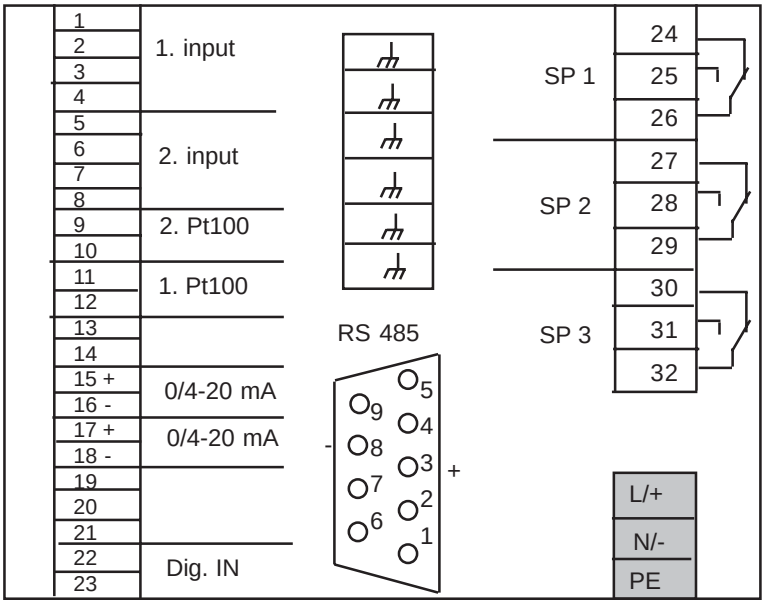
Drill three holes (max. M5) according to the drawing. Mind that there are two ways for installation: (1) You can hang the instrument upon the upper screw. In that case drill the upper hole 120 mm above the lower two. (2) Or you can slip the slot on the back of the housing under the upper screw. In that case the upper hole has to be another 15mm higher.

Insert the upper screw and make sure to leave at least 3mm between wall and screw head.



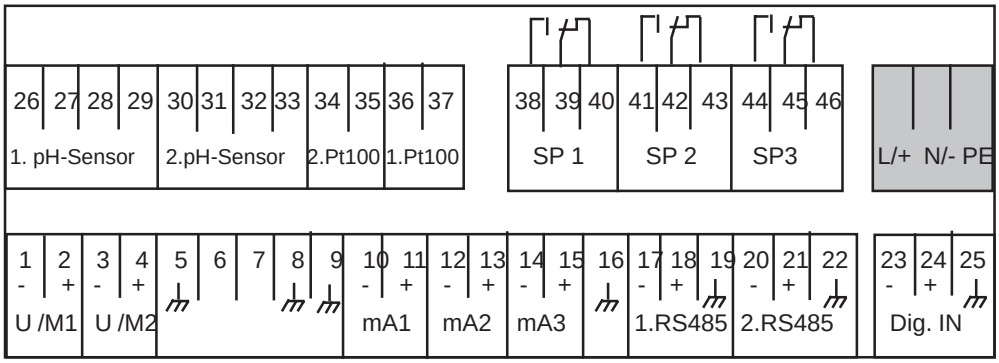
Mount the instrument and fix it with the two lower screws. Close the terminal cover or start with the connections.gehen Sie direkt weiter zu den Anschlüssen.

2.4 Connection diagram dialog / panel-mounting housing



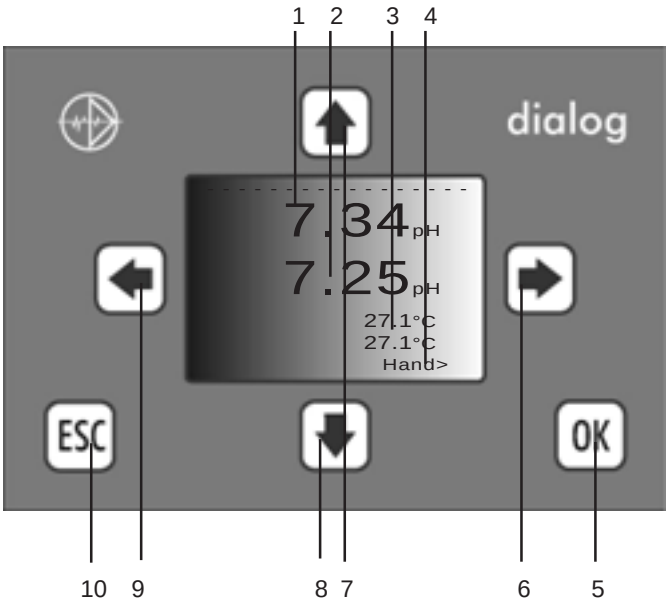
Connection	terminals	notes
1. pH sensor	1 - 3	1 = screen = reference 3 = core = meas. electrode
with IWA:	3, 19-21	3 = white = meas. electrode 19 = green = +6V 20 = brown = reference 21 = yellow = -6V
2. pH sensor (only dialog 2 PR)	5 + 7	5 = screen = reference 7 = core = meas. electrode
with IWA:	5, 7, 13-14	5 = brown = reference 7 = white = meas. electrode 13 = green = -6V 14 = yellow = +6V
servo motor potentiometer (only dialog PR R RFP)	5 - 7	5 = potentiometer 0% 6 = potentiometer 100% 7 = potentiometer output / position indicator
Pt100 for 1. pH sensor	11 + 12	mind the assignment to the measurements
Pt100 for 2. pH sensor	9 + 10	
Analog outputs 1	15 - 16	15 = +, 16 = - max. load 500 Ohm
Analog outputs 2	17 - 18	17 = +, 18 = - max. load 500 Ohm
relay 1	24 – 26	24 + 26: NC; 25 + 26: NO contact
relay 2	27 - 29	27 + 29: NC; 28 + 29: NO contact
relay 3	30 - 32	30 + 32: NC; 31 + 32: NO contact
power supply	L/+ N/- PE	See instrument label
RS485	Sub-D	3 = +, 8 = - ; bridge 4/7 activates termination

2.5 Connection diagram dialog W / wall-mounting housing



Connection	terminals	notes
1. pH sensor	26 + 27	26 = screen = reference 27 = core = meas. electrode
with IWA:	26+27, 1+2	26 = brown = reference 27 = white = meas. electrode 1 = yellow = -6V 2 = green = +6V
2. pH sensor	30 + 31	30 = screen = reference 31 = core = meas. electrode
with IWA:	30+31, 3+4	30 = brown = reference 31 = white = meas. electrode 3 = yellow = -6V 4 = green = +6V
Pt100 for 1. pH sensor Pt100 for 2. pH sensor	36 - 37 34 - 35	mind the assignment to the measurements
Analog output 1	10 – 11	10 = -, 11 = + max. load 500 Ohm
Analog output 2	12 - 13	12 = -, 13 = + max. load 500 Ohm
Analog output 3	14 - 15	14 = -, 15 = + max. load 500 Ohm
relay 1	38 - 40	39 + 40: NC; 38 + 39: NO contact
relay 2	41 - 43	42 + 43: NC; 41 + 42: NO contact
relay 3	44 - 46	45 + 46: NC; 44 + 45: NO contact
power supply	L/+ N/- PE	See instrument label
RS485	17 + 18	17 = -, 18 = +
Digital input 1	23 - 24	potential-free contact (NCor NO contact); external controller stop or low-water indication

3. Operation



1	measured value M1
2	measured value M2
3	Temperature M3 and M4
4	Status controller AUTO: controller ON MAN: controller OFF
5	„OK“-key
6	key right (▸)
7	key up (▲)
8	key down (▼)
9	key left (◂)
10	„ESCAPE“-key

When turned on the instrument shows the measured values and the status of the controllers (Auto / Man).

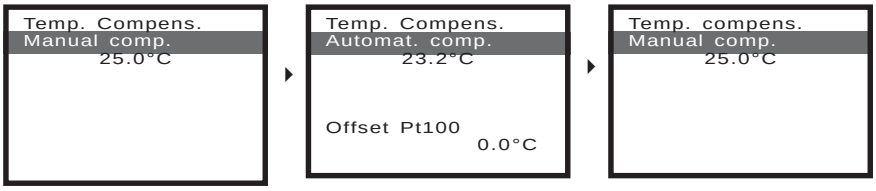
With the membrane keys you can move within the menue:
With key ▼ you enter the main menue.
With keys ▲ and ▼ you move up and down.
A black cursor line indicates your position in the menue.
With key ▸ you select a menue or parameter.
With key ◂ you leave a menue or store a change.
With the „ESCAPE-key you leave the menu without storing changes.

The OK-key is used for those operations which, as a safety measure, require that two keys are pressed simultaneously. For example, calibration is carried out only if the OK-key and key ◂ are pressed together .

NOTE **The instruments dialog and dialog W differ only in the housing and the number of analog outputs. Operation and menues are the same.**

3.1 How to adjust parameters

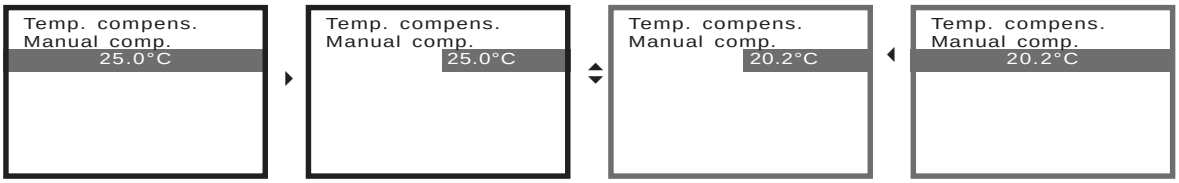
Choosing between alternatives



With many parameters you have the choice between two or more alternatives, for e.g. between manual and automatic temperature compensation. For these you only need key ▸. Switch from one alternative to the next until you either come back to where you started or until you reach the alternative you were looking for.

With these parameters any changes are immediately valid - there is no need to store the changes.

Adjustment of numerical values



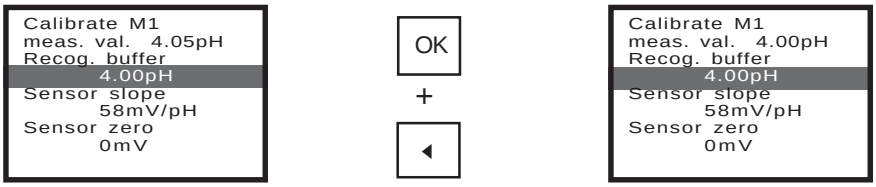
Numerical values can be altered only when they are highlighted by a half-line cursor bar. To achieve that set the cursor to the desired line and then press key ▸.

Adjust the value with keys ▲ and ▼. A short pressure changes the last decimal of the value by 1. Keep the key pressed, and the value starts changing continuously until you let go of the key.

Store the changes with key ◂: The cursor bar will expand over the whole line.

NOTE If you do not want to store the change, press the ESCAPE-key instead of key ◂.

Two-key operation

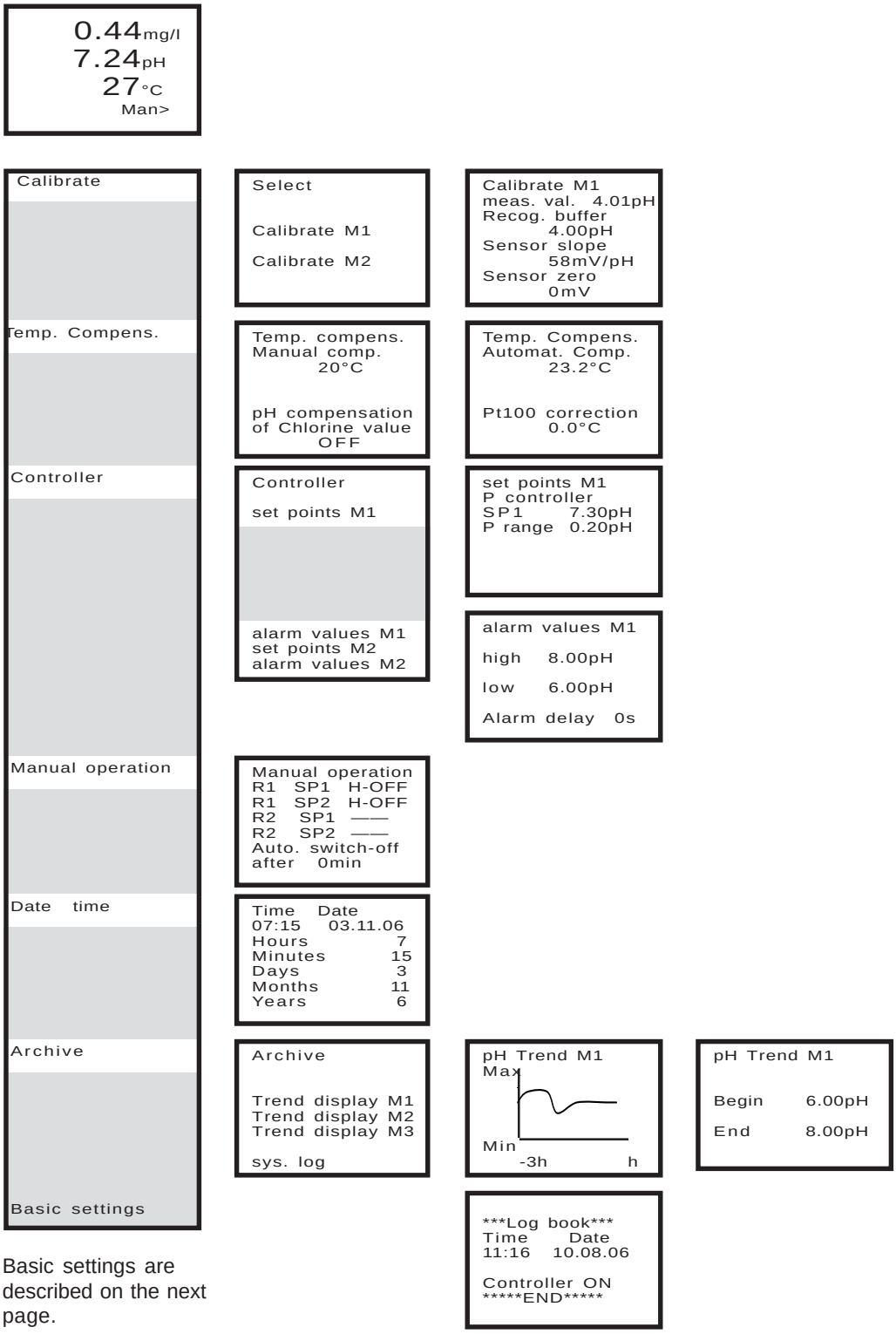


The actions „calibrate“ and „erase settings“ require a two-key operation. This is a safety measure, since their effects are difficult to undo.

Press the OK-key and then - while keeping the key pressed - additionally key ◂ to carry out calibration. The instrument responds by adjusting the measured value to the set concentration.

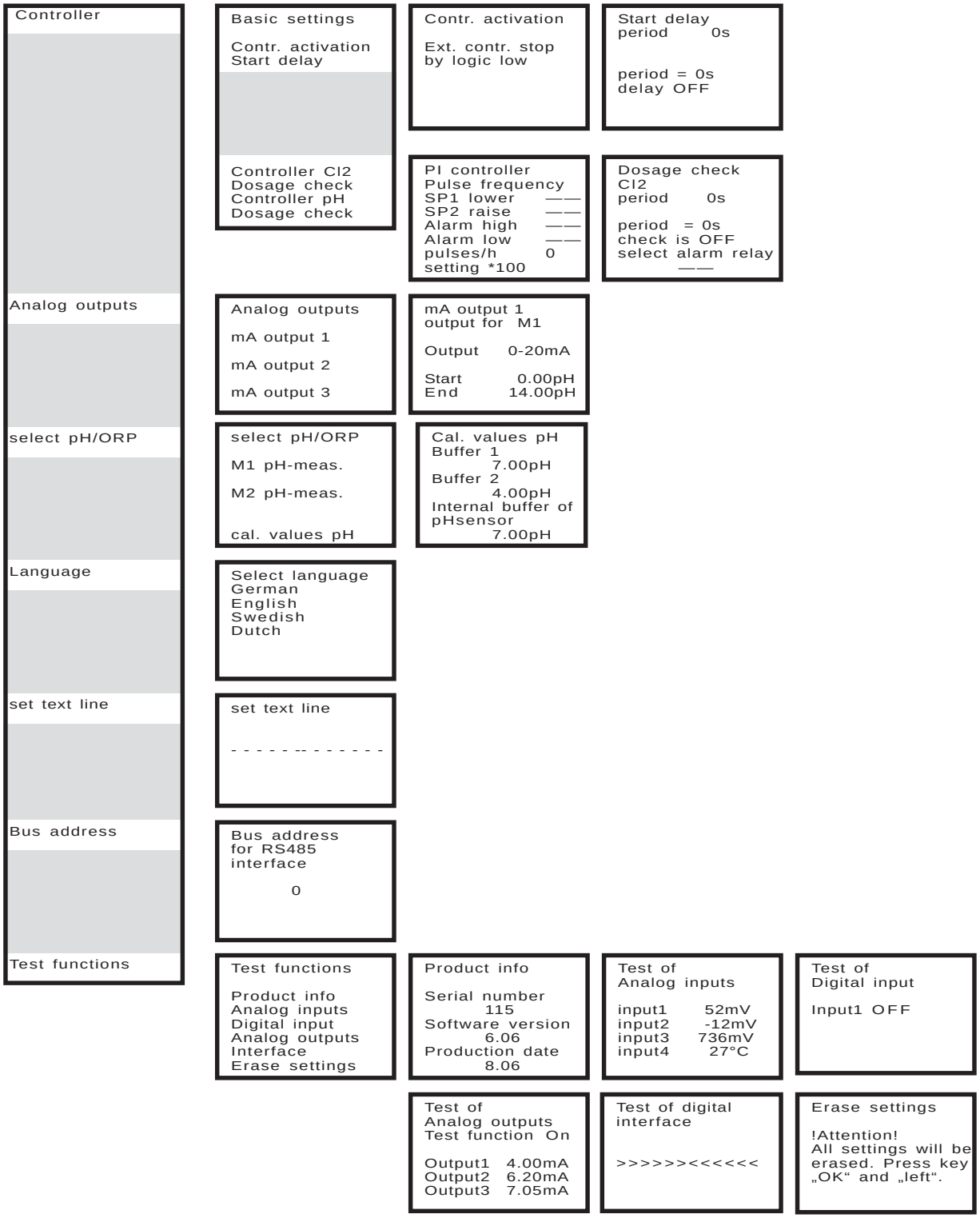
3.2 Menu overview

Main menu



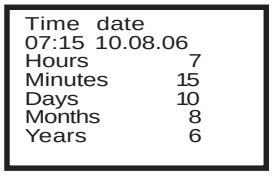
Basic settings are described on the next page.

Basic settings



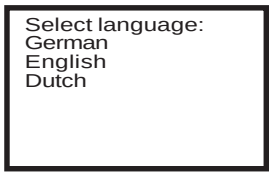
4. General settings

4.1 Date and time



The dialog contains a real-time clock which you have to set once during start-up. The clock is battery-powerde, so settings are unaffected by power failure. Settings are stored even if all other settings are erased.

4.2 Language



For the menue texts a variety of languages is available. German and English are standard, others at request..

Language selection is part of the basic settings which can only be entered with code 86. If a different code is set, you are first asked to enter the valid code.

4.3 Code

To enter the menue, you have to enter a valid code:

Code 11 gives access to the main menu.

Code 86 gives acces to all parameters and menues.

With any other code it is impossible to enter the menue.

When you have finished the configuration, we advise to lock the instrument with an invalid code or at least set the code to 11.

Press key „ESCAPE“ to leave the menue. Press the key again to enter the menue „enter Code“.

Enter a code, and leave the menue with key „ESCAPE“.

5. Adjustments for measurement

pH measurement

pH measurements require a calibration. By calibration the sensor characteristics are determined. The sensor is taken out of the test water to measure two buffer solutions of known pH value. At-works calibration solutions are pH 7.00 and 4.00. You can change these values in the basic settings.

If you use pH sensors with special filling, i. e. with an internal buffer unequal to 7, this you can also set in the basic settings.

ORP measurement

ORP measurements need no calibration and no temperature compensation. Therefor these menues will not be shown if you select ORP measurement.

Double or difference measurement

Instruments dialog (W) PR offer only one pH or ORP measurement and only one temperature measurement. Instruments dialog (W) 2PR offer two of each. You can choose for both measurements between pH and ORP via menue. Even the combination (1x pH, 1x ORP is selectable.

In case of two identical measurements, i. e. 2x pH or 2x ORP, you can select difference measurement. In that case the difference between both measurements is displayed beneath the two measurements. Furthermore you can read out the difference via analog output and use it for control purposes.

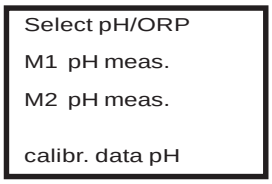
Temperature measurement

Temperature can be set manually or measured with a Pt100. In both cases the values are used automatically for temperature compensation. To deactivate temperature compensation, use manual compensation and set the temperature to 25°C.

Archive and log book

The instrument stores the measured values of all measurements over a period of three hours and displays them graphically. In the log book you can find recorded operation and alarms, such as calibration, lack of water, or activation of the controller.

5.1 Selection pH / ORP



In the basic settings you can select for each measurement between pH and ORP measurement. At works all measurements are set to pH.

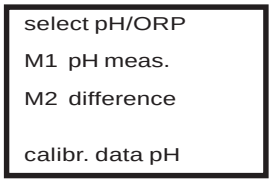
Go to the basic settings and select the item „select pH/ORP“.

Set the cursor to a measurement (M1 or M2). Switch from pH to ORP and vice versa by pressing key ▸.

Repeat for the second measurement (only with dialog (W) 2PR).

NOTE **If you switch all measurements to ORP, the menue items “calibration“, „temperature compensation“ and „calibration data“ vanish.**

5.2 Double or difference measurement

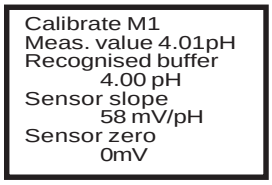


With instruments dialog 2PR you can select difference measurement if you have connected two identical measurements, i.e. 2x pH or 2x ORP. This you can do in the menue item „select pH/ORP“ in the basic settings:

For the second measurement you can select between pH, ORP and difference.

If you select „difference“, the difference between the two measured values is treated as a virtual third measurement, which is indicated in the display belneath the other measurements and to which you can assign an analog output and/or a controller.

5.3 Calibration of the pH measurement



Procedure

1) Switch off the controller and select manual temperature compensation. Enter the temperature of the calibration solutions. Enter the calibration menue. Select „calibrate M1 (or M2)“.

2) Immerse the selected pH sensor in one of the calibration solutions. The dialog recognises automatically which of the stored buffers the electrode is immersed in, and displays its pH value as „recognised buffer“. Wait until the measured value is stable, then calibrate by pressing key „OK“ and then - while still applying pressure - additionally key ◂ . The pH of the calibration solution is now displayed as measured value.

3) Rinse the electrode and repeat step 2 with the second calibration solution.

4) Check slope and sensor zero, then put the electrode back into the flow cell. Don´t forget to select automatic temperature compensation and to switch on the controller.

NOTE **The slope should be close to 59mV (at 25°C), the zero-point close to 0mV. The slope decreases and the zero error increases with time. When either value exceeds certain limits, the instrument displays an error message indicating that the sensor has to be replaced.**

A word on calibration of double- or difference measurements:

If you use two pH measurements, you have to calibrate both measurements. To tell the instrument which sensor you want to calibrate, you need to select in the calibration menue between „calibrate M1“ and „calibrate M2“. This choice appears automatically when you enter the calibration menue.

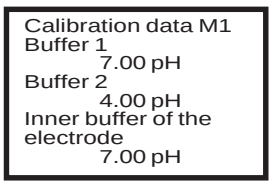
Be careful: If you want to calibrate both measurements subsequently, i.e. if you are already in the calibration menue when starting with the second calibration, don´t forget to select „calibrate M2“ before starting the calibration of the second sensor!

This selection is important. Otherwise the instrument will assign all operations to the (still-active) first sensor which at that time probably stands in test water, and this will lead to a slope error for sensor 1 - which means you have to recalibrate sensor 1 on top of everything else.

We recommend to leave the menue via the ESCAPE-key after each calibration. This way you start each calibration with entering the calibration menue and are automatically reminded to select which sensor you want to calibrate.

NOTE **If you have forgotten the selection and have ended up with a slope error for the already calibrated sensor, just repeat the calibration for both sensors, this time leaving the menue between the two calibrations.**

5.4 Calibration data



The calibration data are part of the basic settings, since they are usually chosen once at the beginning. You find the calibration data under „select pH/ORP“.

At works the following buffers are stored:

calibration solutions: buffers pH 4 and pH 7

internal buffer of the sensor: pH 7

If these are the solutions you are using, you don´t have to change anything.

During calibration, the instrument recognises which calibration solution the sensor is submersed in, and displays the pH of that buffer in the calibration menue. It does not matter whether you start with the higher or the lower pH value.

If you want to use other calibration solutions, you can change the buffer values in the basic settings. Here again, it does not matter whether you start with the higher or the lower pH.

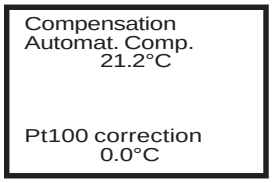
NOTE **Buffer values do not have to be integers. You can enter all sorts of values, e.g. 4.66. This you can use for example to account for temperature influences: If you calibrate at 30°C and your buffer pH is 7.1 instead of 7.0, just enter the correct value to get a higher accuracy.**

Changes in the calibration data are put to effect with a subsequent calibration.

NOTE **During the first calibration after changing the calibration data, a calibration error might be displayed after the first calibration solution, because the calculation is now a mixture between old and new settings. The error message vanishes when the calibration is completed.**

If you are using electrodes with a special internal buffer (i.e. not pH 7.0), adjust the pH value of the sensor buffer since this is used as zero for the calculation of the measured values. You find the pH of the sensor buffer printed on the electrode. If you cannot find any indication concerning the internal buffer, it is probably pH 7.0.

5.5 Temperature compensation



You can choose between two alternatives:

1) Automatic compensation with temperature sensor Pt100

Mind that the temperature sensor should measure the temperature in the vicinity of the pH sensor. If Pt100 and pH sensor are not immersed in the same solution, as for e.g. during calibration, better switch to manual compensation.

2) Manual compensation

If the temperature is more or less stable you can enter its value manually and use manual compensation. The dialog will then compensate the temperature effects of this temperature.

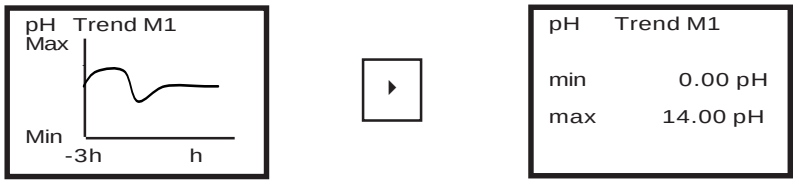
Calibration of the temperature measurement

Since the temperature sensor is connected with a two-wire cable, slight deviations might occur between measured and real temperature. These deviations can be eliminated by calibration.

During start-up, measure once the temperature manually, and enter an offset so that the display shows the exact temperature.

NOTE **The temperature compensation compensates the temperature influence on the sensor signal output. It does not compensate temperature influences on the pH of the solution. In most solutions (including buffer solutions), there is a real pH change as a result of changing temperature, due to dissociation or other effects, that must not be compensated.**

5.6 Trend display



Under the heading “Archive“ in the main menue you find trend displays for all measurements. These are graphical displays of the measured values over the past three hours.

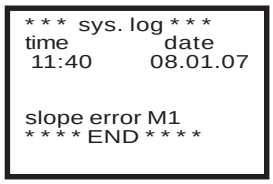
This is expecially helpful for the adjustment of the controller.

Go to the main menue and select “Archive“ and there “Trend display M1“ to get a display liek the one shown above.

To zoom press key ▸. This leads to the display shown on the right, where you can set min and max values for the trend display.

The time interval is fixed at 3 hours and cannot be changed.

5.7 Logbuch



The log book stores alarm and status messages such as switching on the controller, alarm due to exceeded limits etc. Up to 220 messages are stored with date and time of occurence. If you enter the menue, the last message is displayed.

With key ◂ you can scroll through all the previous messages, with key ▸ you move forward in time again.

The addition „****END****“ indicates that the status was terminated at that time. To use the example indicated above, the END means that the slope error was corrected on january 8th at 11:40.

6. Adjustment of the controllers (only R instruments)

With R instruments, you can assign each of the two controllers to any measurement. Both controllers can be configured as ON/OFF, P, PI, or PID controllers with one or two set points each. The acting direction for each set point can be inverted for bidirectional control. Three relays and two or three analog outputs can be used as controller outputs.

To make configuration easy, the dialog assists you in two ways: (i) at works the controllers are preconfigured in a way appropriate to many applications, so that you may probably only need to make minor adjustments. (ii) with each choice you make the dialog displays only the parameters and possibilities that go with the choice you made, so that the original amount of variables is quickly reduced and easy to handle. Besides, you will instantly notice if a choice did not lead to the configuration you had in mind.

NOTE **The menue „set points“ shows only those set points to which you have previously assigned a relay or current output. If you have not yet made this assignment, the message „function not active“ is displayed when you select the menue.**

NOTE **A relay assigned to a max. or min. limit can be assigned to other limits as well. Relays, however, that have been assigned to a set point, cannot be used for other set points or limit values.**

Choose between the following controller versions:

ON/OFF controller

The ON/OFF controller switches ON if the measured value exceeds the set point and OFF if it drops below the set point or vice versa. Dosage is always carried out at 100% (ON) or 0% (OFF). The parameter for an ON/OFF controller is the hysteresis.

P controller

The P controller or proportional controller reduces the dosage in the vicinity of the set point prportional to the control deviation. This is easily achieved if the analog output is used as continuous controller output. If the relays are used, the proportional reduction is achieved by either reducing the switch frequency of the relay (impulse-frequency controller) or by reducing the time within a given period of time in which the relay is ON (pulse-pause controller). The parameters for a P controller are the P range and the impulse-frequency or the pulse-pause time and minimum pulse, respectively.

PI controller

The PI controller is a P controller with additional integral action. Adjustments and parameters are the same as for a P controller. Additionally the integral action time has to be adjusted which determines the integral action. The integral action eliminates the P controller´s disadvantage of a remaining steady-state deviation.

PID controller

The PID controller is a PI controller with additional derivative action. Adjustments include all of the above plus the derivative action time that determines the derivative action. The derivative action speeds up the control response and is especially useful in control loops with sudden large control deviations.

With PI and PID controllers you can control a servo motor. In that case, only one acting direction is possible, since both set points are used for one motor.

6.1 At works configuration

At works the dialog is configured as follows:

Controller	Controlled variable	direction	relay
Controller 1	measurement M1	raise	1
Controller 2	measurement M2	lower	2

Both P controllers are configured as pulse pause controllers with a pulse pause time of 10 seconds and a minimum pulse of 0.5 seconds.

The third relay is configured as alarm relay for the limit surveillance of min and max limits of both measurements.

The current outputs are not used for control purposes.

If you want to change the configuration, select „controller“ in the basic settings. The necessary steps are explained in detail within the following pages.

Set points and P ranges can be asjusted in the main menue under „set points“.

6.2 How to change the configuration

ON/OFF controller	
SP1 raise	Rel.1
SP2 lower	———
Alarm max	Rel.3
Alarm min	Rel.3
Hysteresis	0.00pH

P controller	
Pulse pause	
SP1 raise	Rel.1
SP2 lower	———
Alarm max	Rel.3
Alarm min	Rel.3
P-Pause	10s
P-min	0.5s

PI controller	
Pulse frequency	
SP1 raise	Rel.1
SP2 lower	———
Alarm max	Rel.3
Alarm min	Rel.3
pulses/h	0
value *100	

PID controller	
Servo motor raise	
Motor open	Rel.1
Motor close	Rel.2
Alarm max	Rel.3
Alarm min	Rel.3
Run time	0s
P-min	0.5s

Select „Controller“ in the basic settings.

Select the controller you want to configure.

First line - controller version

In the first line the current controller version is indicated. Use key ▸ to switch from one version to the next. Versions available are: ON/OFF, P, PI, and PID.

Second line - output version (not for ON/OFF controllers)

In the second line the current output version is displayed. Use key ▸ to switch from one version to the next. Versions available are: pulse pause, pulse frequency, and (with PI and PID controllers) servo motor raise or lower, respectively.

Lines 3 and 4 - acting direction and assignment of controller outputs

For each controller you can define one or two set points. To use a set point you have to select the direction (raise or lower), and you must assign a relay or current output as controller output.

Position the cursor on the set point. Use key ▸ to switch from one alternative to the next.

NOTE **Select „raise“ if the dosage raises the measured value, and „lower“ if the dosage lowers the measured value.**

NOTE **If you don´t want to use a set point, assign no output (——).**

NOTE **Only those relays and current outputs are shown that have not yet been assigned.**

NOTE **With servo motors, the direction is fixed. Therefor you only have to assign relays to open and close the valve.**

Lines 5 and 6 - limit surveillance

If you want to get a limit alarm you have to assign a relay to that limit.

NOTE **Only the relays are shown that have not been assigned to set points.**

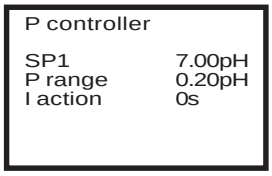
NOTE **A relay assigned to a limit can be used for other limits as well.**

Lines 7 and 8 - parameters

Lines 7 and 8 show only those parameters that belong to the selected controller version. Here is some information on the various parameters:

Hysteresis	The hysteresis prevents high-frequency switching of the relay in the vicinity of the set point. The relay will switch only when the measured value exceeds the set point by more than half the hysteresis.
P-Pause	(Pulse pause time) Define a period of time that will be parted into pulse (relay ON) and pause (relay OFF) in proportion with the controller deviation.
P-min	(Minimum pulse) Define the minimum time that the relay has to be ON to get a reaction from the actuator.
Pulses/h	Define the maximum pulse frequency that equals 100% dosage. Setting is made in 100/h. For example: if you set 16, the relay will switch 1600 times per hour.
Run time	Enter the time necessary for the motor to go from completely closed to completely open.
Position	With servo motors that signal their current position via potetiometer you need to calibrate positions 0% and 100% at the beginning.

6.3 Set points, P range, I and D action



Since these parameters are adjusted from time to time, they are part of the main menue.

Select „set points“ in the main menue. Select „set points M1“ or „set points M2“.

Set the cursor on set point 1 „SP1“ and enter the desired value. Repeat for set point 2 if necessary.

NOTE Only those set points are displayed that have been assigned relays or current outputs in the basic settings.

If you have selected ON/OFF controllers, your controller settings are complete now.

If not, you have to define a P range. Start with a large range and reduce the value until the measured value starts to oscillate. The optimum range is the smallest value that still produces stable measured values.

For PI or PID controllers you have to define the I and/or D action.

One way to determine the appropriate values has been described by Ziegler-Nichols: Reduce the P range until the measured values oscillate with a constant frequency. Determine the period of time from one maximum to the next.

NOTE The graphical display of the archive function may be helpful at this point.

Adjustments for PI controllers:

Set the P range to 2.2 times the value it had during oscillation.

Set the I action to 0.85 times the period of the oscillation.

Adjustments for PID controllers:

Set the P range to 1.66 times the value it had during oscillation.

Set the I action to 0.5 times the period of the oscillation.

Set the D action to 0.12 times the period of the oscillation.

NOTE It may be necessary to use slightly larger values to achieve stable measured values.

6.4 Activation and deactivation of the controllers

The controllers are activated and deactivated from the main display without any menues. Press key ▸ to

switch from Manual Mode (controller OFF) to Automatic Mode (controller ON) and vice versa. The selected mode is indicated in the display.

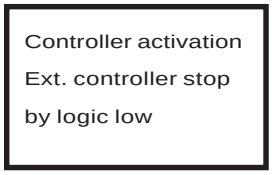
CAUTION **Make sure the controllers are deactivated before connecting pumps or actuators!**

6.5 External controller stop

You can activate and deactivate the controllers with an external switch by using the digital input. This feature requires no settings or adjustments. Whenever the digital input is short-circuited, the controller stops, and the message „external controller stop“ appears in the display. .

NOTE **This feature can be used as low-water indication. Just connect a level sensor to the digital input.**

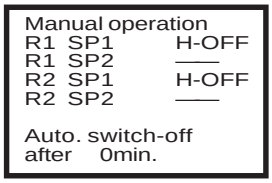
At works the digital input is configured as normally open contact: Closing stops the controller. If your level sensor requires a normally closed contact, you can invert the direction of the digital input.



If you get the message „external controller stop“ under good flow or level conditions, select „controller“ in the basic settings and there „controller activation“. Switch the digital input from logic high to logic low or vice versa with key ▸.

If you use the digital input for flow indication, the controller is deactivated whenever the flow drops below minimum.

6.6 Manual operation of the relays



You can operate all relays that are assigned to set points manually, for e.g. to fill or empty feeding tubes.

Manual operation is possible only if the controllers are set to Manual Mode.
Use key ▸ to switch from Automatic Mode to Manual Mode in the main display.

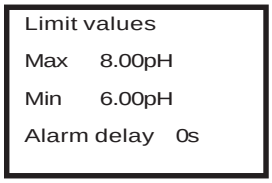
Select „Manual operation“ in the main menue. The display shos all set points with their assigned relays/ current outputs or with „——„, if no relays or outputs have been assigned.
Select a set point and switch the relay ON with key ▸. „H-OFF“ is replaced by „H-ON“.

CAUTION **Manually activated relays remain ON until they are switched OFF manually!**

As a safety measure the dialog provides an automatic switch-off. Define a period of time after which all relays will be switched OFF automatically.

CAUTION **If you enter „0 min“, the automatic switch-off is deactivated!**

6.7 Limits



You can adjust maximum and minimum limit values for both measurements. However, an alarm is issued only for those limits that have been assigned a relay in the basic settings.

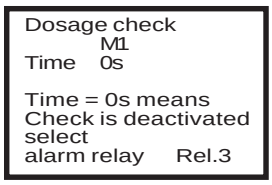
If the measured value exceeds a limit, the message „limit max M1 (or min, or M2, respectively)“ is displayed. If a relay has been assigned, this will switch to activate an external horn or similar signal.

Alarm delay

In some applications it happens regularly that the measured value exceeds a limit for a short period of time. To avoid having an alarm issued under these circumstances you can adjust a turn-on delay which has to pass before an alarm is issued.

NOTE **The limit surveillance is only active in the automatic mode. If you swtich to manual mode, the alarm message disappears, and the relay switches OFF.**

6.8 Dosage check



For each controller you can define a maximum time for 100% dosage.

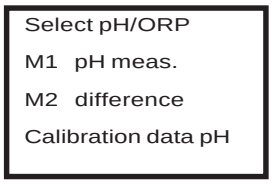
If after that time the set point or at least the P range has not been reached, an alarm is issued, and the dosage is stopped.

This is a safety measure to prevent unchecked dosage in case of defective or broken feeding lines.

NOTE **In case of dosage alarm only the controller concerned is deactivated.**

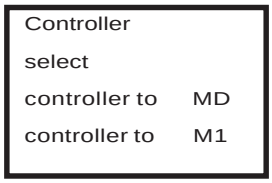
NOTE **If you set the check time to 0 seconds, the dosage check is deactivated.**

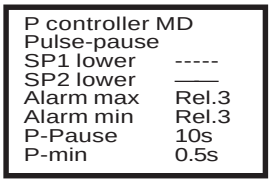
6.9 Alarm values and control for difference measurements



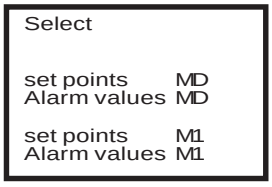
Instruments dialog (W) 2 PRcan be set to difference measurement. In that case you can use the difference measurement for control purposes and you can define alarm values for the difference. First of all you need to set the instrument to difference measurement by selecting „difference“ for M2 in the basic settings in the menue „select pH/ORP“.

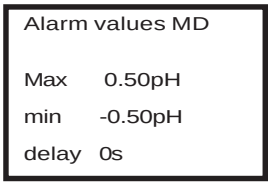
After that, you can assign a controller to the difference. Assign controller 1 to „MD“ and define control and alarm relais as usual.





The alarm is part of the control functions - if you have assigned a controller to the difference measurement, then you can define alarm values in the main menue in the menue „set points“.





6.10 Controlling a servo motor

PID controller	
servo motor raise	
Motor open	Rel.1
Motor closed	Rel.2
Alarm max	Rel.3
Alarm min	Rel.3
Position	0%
P-min	0.5s

PID controller	
servo motor raise	
Motor open	Rel.1
Motor closed	Rel.2
Alarm max	Rel.3
Alarm min	Rel.3
runtime	0s
P-min	0.5s

Select in the basic settings the option „Servo motor raise“ or „Servomotor lower“. You have to chose one direction, since both relays are used for one motor, one for opening and one for closing.

According to the dialog version the list of parameters shows either „run time“ or „position“.

Servo motor with position information

Some servo motors contain a potentiometer that indicates the current position of the actuator. For these use the dialog version PR R RFP. It gives out a 1000mV voltage and can read out the exact position of the motor. Since this allows precise positioning of the motor during control, even a simple P controller can be used.

Once in the beginning you need to calibrate positions 0% and 100%. This you do in the basic settings in the menue „controller“.

Use the manual mode to close the actuator completely. Set the cursor bar upon the line „position %“ and press keys „OK“ and ◂ simultaneously.

Now position the motor so that the actuator is completely open. Calibrate this position with keys „OK“ and ▸. If you now move the cursor bar up, the current position is indicated in the line.

The current position of the motor is also shown graphically in the main display.

Servo motor without position information

If your servo motor does not contain a potentiometer, the dialog controls it via the run time.

Once in the beginning you need to determine how long it takes to move from completely closed to completely open. This time you need to enter in the basic settings in the menue „controller“ as „run time“. The control output is then calculated as percentage of that time. Since there is no information on the dosing strength, a PI or PID controller is needed to correct the position according to the changing measured values.

Close the actuator completely, using the manual mode. Then open it completely and note down the time this takes.

Set the cursor bar to the line „run time“. Press key ▸ to enter the edit mode, enter the time you just measured, and store with key ◂.

7. Alarm

Additional to the limit function the dialog provides various check functions that raise alarm.
In case of alarm, the cause of alarm is indicated in the display. If the cause of alarm is such that control is no longer possible or might even be dangerous, the controller is automatically deactivated until the alarm is switched off. Switching off the alarm is done automatically by the instrument as soon as the cause of alarm is eliminated.

Sensor check during calibration

If a sensor gives unsatisfying results during calibration, an alarm is issued. The alarm is held until a new calibration shows satisfying sensor data. In case of calibration failure the controller is not deactivated, to enable you to continue the dosing or treatment process until a replacement sensor is at hand.

Sensor check during measurement

During measurement all connected sensors are checked. If an analog input does not receive a correct signal, for e.g. if a cable is broken, an alarm is issued, and the controller deactivated. Alarm and controller stop remain until the analog input receives correct signals again.

Lack of water

If you have connected a level or flow sensor to the digital input of the dialog, low water will cause alarm. The alarm remains until the level sensor shows that water is again available. During the alarm the controller ist deactivated.

Dosage control

If a controller output is 100% for longer than the defined dosage time, an alarm is issued, and the corresponding controller is deactivated. The alarm remains until the controller output drops below 100%. It can also be extinguished by setting the controller to manual mode.

CAUTION **Dosage control only checks the time during which the controller output is 100%. If your controller settings are such that the value of 100% cannot occur, for e.g. because you have a set point of pH 2.00 and a P range of 4.00pH, so that the maximum controller output is 50%, this condition is never met. Make sure that dosage control is not made impossible by your settings before activating the controller!**

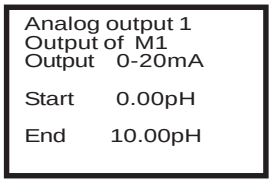
Cause of alarm	only active in AUTO mode	deactivates controller
Slope error	no	no
Sensor zero	no	no
Error A/D converter (Error input 1/2)	no	yes
Error temperature	no	yes
Limit min/max	yes	no
Dosage check	yes	yes
Lack of water	no	yes

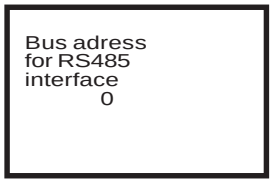
7.1 Error messages

Error message	Cause	Measures
Slope pH	The slope determined during calibration was less than 50mV/pH or higher than 65mV/pH.	Check the temperature, the cables and connections, and calibrate again. If the error message remains, the sensor has to be cleaned, regenerated, or replaced.
Sensor zero pH	The zero point determined during calibration was higher than +/- 55mV.	Make sure that the internal buffer stored in the basic settings corresponds to the value printed on the sensor. If this has been the case, try to regenerate the sensor (exchange the KCl filling solution, store the sensor in 3M KCl for a few hours, mechanically clean the junction).
error A/D converter pH/T	The specified input does not receive a correct signal.	This message always indicates a defective part. This can be the sensor, the cable or a wrongful connection. „A/D converter T“ is also displayed if automatic temperature compensation was selected although no temperature sensor Pt100 was connected.
Limit min/max M1 / M2	The measured value exceeds the specified limit.	Please check the dosing and readjust the control parameters, if necessary.
Dosage check R1 / R2	Controller 1 or 2 gives out 100% for longer than the allowed period of time.	Please check the dosing, especially the feeding tubes and tips. Caution! Carefully check for leaking chemicals!
Ext. controller stop	The digital input has been short-circuited.	Open the input as soon as you want to continue the dosing. If you have connected a level sensor, this message indicates lack of test water.

8. Data output

8.1 Analog outputs





Instruments with panel-mounting housings have two analog outputs, instruments with wall-mounting housings three.

Select „analog outputs“ in the basic settings. Select the output you want to configure.

In the second line you can assign the current output to a measurement. Use key ▸ to switch from one measurement to the next.

NOTE **If you have already assigned this ouput to a controller, the second line shows „assigned to R1 (R2)“. This assignment can only be changed in the basic settings of the controller.**

With „start“ and „end“ you define which part of the measuring range you want to read out via the current output.

NOTE **If an analog ouput is used as controller output, the output is 0-100%, and you don´t need to define start and end values.**

8.2 Data output via serial interface RS485

All dialog instruments have an integrated serial interface RS485 and can be integrated in a data bus system. Via the interface, all settings, measured and control values can be read out digitally.

Information on the communication and a list of parameters accessible via interface are to be found in a separate leaflet „Information concerning the RS485“.

9. Operation and maintenance

Exchange fuse

Instruments in wall-mounting housings have an internal fuse which has to be replaced at need. You will find a spare fuse fixed inside the terminal cover. Information on the fuse can be found in the chapter „technical data“.
To exchange the fuse, open the front carefully. The fuse is located on the right hand side. It is kept in place by a Bayonet lock. Turn the lock to the left until the fuse pops up. Exchange it and fix the new fuse by turning the lock to the right. Put the front back on and fix it tightly.

CAUTION **Disconnect the power supply before opening the instrument!**

ATTENTION **Mind that the cable connection to the front are not damaged, broken, or torn during the process!**

Cleaning

The front and display should not get in touch with organic solvents such as methanol. Never let water get inside the instrument. We suggest to simply use a damp cloth for cleaning.

Maintenance of the measurement

The metal surfaces of the sensors must be cleaned regularly. pH sensors and reference electrodes can change due to ageing or demanding usage, so that the sensor characteristics change with time. These changes have to be determined regularly by way of calibration. The period between subsequent calibrations depends on the application and on the accuracy required.

NOTE **The dialog checks the sensors´characteristics during each calibration and displays an error message if a sensor has to be cleaned or replaced. See chapter „error messages“.**

To clean solied or discoloured junctions a variety of cleaning solutions is commercially available. You can find more information on regeneration and cleaning in the leaflets that come witht he sensors. After each cleaning store the sensors in 3M KCl for some time.
If you have to exchange a sensor, make sure that the replacement sensor is appropriate for your application and corresponds to the equipment used.
Mind that you have to calibrate whenever you change a sensor - or an instrument!

Regularly clean filters, flow cell, and assemblies.

Maintenance of the safety functions

Regularly check the alarm relay to make sure that in case of alrm both the indication by the instrument and the recognition by the superior control (SPS etc.) work reliably.
You can set off the alarm for example by setting a max. alarm value to a value smaller than the current measured value.

NOTE **Mind that perhaps an alarm delay has been set. Also remember to restore the original settings after the test!**

Regularly check the function of the flow sensor to make sure that in case of low water the sensor gives the signal that leads to the controller stop.
Simulate low water by briefly interrrupting the water supply. This must lead to a switch of the flow sensor, and the message „ext. controller stop“ must appear in the display.

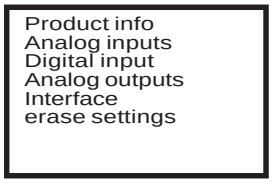
Start-up and re-start-up

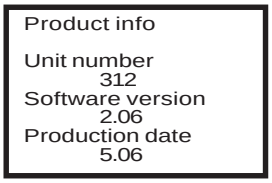
Follow the instructions in this manual. Carry out all steps decribed. Check all measurements and settings for plausibility before turning on the controller!
Do so not only during start-up but also during re-start-up, whenever you have had an interruption, deinstallation, external maintenance or repair. Mind that in such case all customer settings might have been replaced by at works settings!

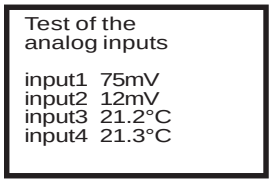
Disposal

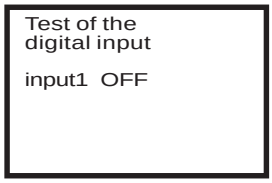
For disposal please note that the instrument contains electrolyte capacitors which have to be disposed separately.

10. Test functions









In the menue test functions in the basic settings you find information which is especially important for any inquiries, updates, and problems. Additionally the dialog provides a variety of test functions to check the performance of inputs and outputs. Last not least you can erase all customer-made settings and restore the at-works settings.

Product info

These figures allow a precise indetification of the instrument (hardware and software).

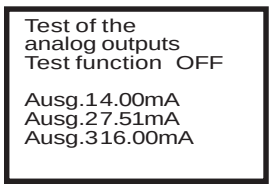
Test of the analog inputs

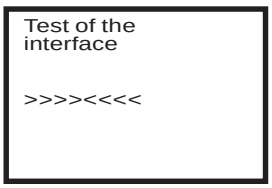
Here you can see the raw data the instrument obtains from the sensors. They are not influenced by calibration or compensation and offer valuable information in case of problems with the measurement or the instrument

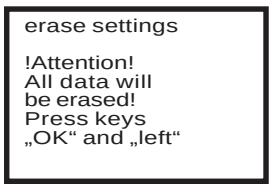
If you have difficulties interpreting the data, send them to your supplier, together with the instrument data - he will know what to do.

Test of the digital inputs

Here you can see whether the digital input is switched ON or OFF.







Test of the analog outputs

While switched off, this functions shows the output values of the various analog outputs.

While switched ON, you can define values of your choice and then verify that these values are put out.

Test of the digital interface

Here you can see whether the interface sends and receives data.

Erase settings (reset)

With this function you can erase all customer settings and restore the original at-works data.

The process takes some 30 seconds. When it is finished, the display will show the measured values, and the controller will switch off.

Customer settings - for reference!

Instrument:

Location / identification: .....

Type: ..... installation date: .....

Instr. Nr. ..... Software version: .....

Measurements:

M1: ☐ pH ☐ ORP

M2: ☐ pH ☐ ORP ☐ difference (only with dialog (W) 2PR)

Calibration data:

Buffer 1: ..... pH buffer 2: ..... pH

Inner buffer: ..... pH

Temperature compensation:

☐ Manual ☐ Automatic

Temperature M3: ..... °C Correction.....°C

Temperature M4: ..... °C

Current outputs:

Output 1

☐ 0-20mA ☐ 4-20mA

for: ☐ Meas. value .....

☐ contr. S1 ☐ contr. S2

Start: .....

End: .....

Output 2

☐ 0-20 mA ☐ 4-20 mA

for: ☐ meas. value.....

☐ contr. S1 ☐ contr. S2

Start: .....

End: .....

Output 3 (only instruments with wall-mounting housings)

☐ 0-20mA ☐ 4-20mA

for: ☐ meas. value .....

☐ contr. S1 ☐ contr. S2

Start: .....

End: .....

Serial interface RS 485:

Bus adress .....

Digital input:

☐ normally closed (logic low) ☐ normally open (logic high)

Controller 1: (only for „R“ instruments)

For: ☐ M1 ☐ M2 ☐ M3 ☐ M4 ☐ MD

☐ ON/OFF Hysteresis .....

☐ P ☐ PI ☐ PID

☐ Pulse-Pause P-Pause .....s P-min .....s

☐ Pulse-Frequency pulses/h *100

☐ servomotor run-time .....s P-min .....s

SP1: ☐ raise ☐ lower

☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3 ☐ AA1 ☐ AA2 ☐ AA3

SP2: ☐ raise ☐ lower

☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3 ☐ AA1 ☐ AA2 ☐ AA3

Alarm max: ☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3

Alarm min: ☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3

Set point: .....

P range ..... I-function.....s D-function.....s

Dosage check period .....s

Alarm values: max ..... min .....

Alarm delay: .....s

Controller 2:

For: ☐ M1 ☐ M2 ☐ M3 ☐ M4 ☐ MD

☐ ON/OFF Hysteresis .....

☐ P ☐ PI ☐ PID

☐ Pulse-Pause P-Pause .....s P-min .....s

☐ Pulse-Frequency pulses/h *100

☐ servomotor run-time .....s P-min .....s

SP1: ☐ raise ☐ lower

☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3 ☐ AA1 ☐ AA2 ☐ AA3

SP2: ☐ raise ☐ lower

☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3 ☐ AA1 ☐ AA2 ☐ AA3

Alarm max: ☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3

Alarm min: ☐ Rel. 1 ☐ Rel. 2 ☐ Rel. 3

Set point: .....

P range ..... I-function.....s D-function.....s

Dosage check period .....s

Alarm values: max ..... min .....

Alarm delay: .....s

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