# Neon® pR
# Manual


CLEAR. CONTROL. CONNECT.

KUNTZE.COM

# Content

Content

# 1. Neon® pR

is an instrument by Kuntze Instruments GmbH which offers high quality and long-term reliability, made in Germany.

With its modular design, the Neon® instrument can be tailored to your application.

The entry-level version contains inputs for measurement and temperature, a digital input, and an alarm relay.

A set of codes allows access to different operation levels. If you want to ensure that only authorized personnel can operate the instrument, define an auto-lock time after which the code is reset to default setting.

Save energy with the Eco mode, in which the display illumination is deactivated after an adjustable interval.

The Neon® instruments have an SD card slot. You can store and load instrument settings, to duplicate software settings to additional instruments or to reinstall yoursettings after updates or repair. You can also use the SD card for software updates.

We have equipped the Neon® instruments with some very convenient features:

The touch screen for example is the perfect complement to the graphical operation and gives you shortcut access to important menus from the main display.

The information displayed on the screen can be defined by the user, adding for example control values, data log status, – or maintenance information, such as the name and phone number of responsible facility personnel. In case of problems, the diagnosis function allows quick assessment of the situation.

Test functions make trouble-shooting and installation easier by providing manual operation of all digital and analog outputs.

The Neon® instruments are expandable through software add-ons and hardware modules.
You can add:

- A second digital input
- Up to two analog outputs
- A data log function that stores data on the SD card
- A PID controller with two control relays for concentration-based dosing
- Volume based dosing with two relays and flow measurement
- Modbus RTU interface

With the Neon® you have certainly made the right choice. On the following pages find out more about your instrument. If you have further questions or are looking for information not included in this manual or if you are interested in supplementing products such as sensors, or assemblies, just give us a call – we will be delighted to help you!

## 1.1. General and safety instructions

This operation manual applies to the following instruments

| | |
|---|---|
| Instrument type | Neon® pR |
| SW version | V 2.38 |

The manual contains technical information on installation, operation, and maintenance.

Keep this manual in a place where you can always look up the safety instructions and the information on handling and usage. According to DIN 61010 the manual is part of the product and has to be preserved as long as the instrument is used, and given to the new owner if the instrument is sold.

The instrument was designed, built, and tested according to the directives for electronic devices and has left our company in perfect working condition. To preserve this condition and to ensure safe operation, 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 operation, shut it down and make sure it cannot be restarted.

You will notice that certain safety instructions are highlighted:

| | |
|---|---|
| **Warning** | **highlights instructions for the protection of people. Disregarding warnings may cause accidents and injuries!** |
| **Attention** | **highlights instructions for the protection of the instrument and equipment. Disregarding these instructions may lead to damage or destruction of the instrument or equipment!** |
| **Note** | **is used to highlight interesting details.** |

## 1.2. Warranty conditions

We have to point out that the warranties specified in our trading conditions are valid only if the following conditions are met:

- Installation and start-up by Kuntze personnel or trained and authorized technicians
- Maintenance of instrument and peripherical equipment according to the instructions of this manual
- Use according to the designation specified on the following pages
- Use of original accessories and spare parts only
- Observance of operation conditions and settings according to this manual

Warranty is void if any one of the conditions listed above is disregarded.

### *1.2.1. Transport damages*

Please check for damages immediately after delivery and report any damages within 24h to the delivering company. Never work with a damaged instrument!

### *1.2.2. Application*

Neon® instruments can be used for the following measurements:

| Instrument | Measurement |
|---|---|
| Neon® EC IL | Inductive conductivity and temperature |
| Neon® EC | Conductive conductivity and temperature |
| Neon® pR | pH or ORP and temperature |
| Neon® DIS | Free Chlorine, Chlorine dioxide, Ozone, Hydrogen peroxide or Total Chlorine and temperature |
| Neon® GAS | Gas monitoring for Chlorine, Chlorine dioxide and Ozone gas |

In many applications, the measured parameters are used for control purposes. Neon® instruments can be equipped with a controller with two set points. With this you can control actuators such as dosing pumps or valves to add chemicals until the desired set point is reached. Alternatively, the measured signal can be used as input for an external controller via the instruments´ interfaces.

Applications are for example neutralisation, detoxication, drinking water treatment, industrial waste water, process water, disinfection, and process control.

As a safety precaution, measurement and calibration are checked for failure by the instrument. Failures are indicated on the display via text messages that are stored in an eventlog and via the alarm relay and, if activated, as 22mA current via the analog output.

If the failure makes control unreliable, the controller is automatically switched off until the failure has been taken care of.

**Warning** **The instrument checks the input signals, 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!**

### *1.2.3. Intended use*

Use these instruments only for the monitoring and control of water – or, in case of gas monitoring instruments, of ambient air.

Use only sensors, assemblies, and accessories made by Kuntze Instruments, and make sure that they fit your application. Make sure that the required measuring conditions such as flow, pressure, temperature etc. are constantly maintained.

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

Use all available safety measures such as the alarm relay, the 22mA alarm current, the dosage control, and the low-water indication.

Regularly check that all safety measures are in good working condition!

**Warning** **The protection built into the instrument is impaired if it is not used as intended!**

## 1.3. Features

| **Basic instrument pR** | |
|---|---|
| Measuring ranges<br>pR | <br>-2,00.. +16,00 pH<br>-1500.. +1500 mV |
| Temperature | -30.. +140°C |
| Display | Measured value and temperature with units<br>Additional information selectable: contact data, SD card status, mA output, control variable, or relay status |
| Operation | Touch screen |
| Calibration | Guided 2-point calibration<br>List of the last 10 calibration results |
| Measurement | pH or ORP<br>pH with regular or differential sensors with high-impedance reference |
| Averaging | Off / low / medium / high, selectable via menu |
| Temperature measurement | With Pt100 or Pt1000, 2-wire or 3-wire connection |
| Temperature compensation | Automatic or manual |
| Relay 3 – alarm relay | Potential-free contact 6A, 250 V, max. 550VA<br>Alarm events selectable via menu<br>Min. and max. limits and adjustable delay |
| Digital input 1 | For external controller stop, low-water indication, or level monitoring<br>Display text can be selected according to intended function<br>Input can be set to N/O or N/C contact via menu |
| Test menu | Operation of relays and outputs |

| **Basic instrument pR** | |
|---|---|
| SD card | To load and save settings<br>To save the diagnosis file<br>To load software updates |
| Auto lock | Resets the code to 0000 after a defined period of time |
| Eco mode | Saves energy by deactivating the display illumination after an adjustable interval |
| Eventlog | Stores up to 100 events |
| Event help | Provides help for current events |
| Add-on | Functions can be added via code |

| **Add-ons** | |
|---|---|
| Digital input 2 | For external controller stop, low-water indication, or level monitoring<br>Display text can be selected according to intended function<br>Input can be set to N/O or N/C contact via menu<br>Flow measurement for volume based dosing |
| Analog output 1 | 0/4.. 20 mA galvanically isolated, max. load 500 Ohm<br>22 mA alarm current selectable via menu<br>To read out measured value, or temperature, or controller output<br>Scaleable within the measuring range |
| Analog output 2 | 0/4.. 20 mA galvanically isolated, max. load 500 Ohm<br>22 mA alarm current selectable via menu<br>To read out measured value, or temperature, or controller output<br>Scaleable within the measuring range |
| Data log | Measured value, temperature, input signal and control variable selectable<br>Interval adustable between 1 second and 24 hours<br>Ring or Stop mode |
| Digital interface | Modbus RTU, 19200 bps, 8 Bit, 1 Stop-Bit, even parity |

| **Add-on PID controller** | |
|---|---|
| Controller options | On/Off controller with adjustable hysteresis P/PI/PID controller as Pulse-Pause, Pulse-Frequency, or continuous controller<br>3-point controller |
| Set points | 2 set points with adjustable acting direction (except 3-point controller) |
| Relays | 2 potential-free contacts 6A, 250 V, max. 550 VA |
| Hysteresis | Adjustable within the measuring range (only positive values) |
| Proportional range ($X_P$) | Adjustable within the measuring range (only positive values) |
| Integral time ($T_N$) | 0 … 2000 seconds |
| Derivative time ($T_V$) | 0 … 2000 seconds |
| Min. pulse | 0,2 … 9,9 seconds |
| Pulse+Pause time | 2 … 99 seconds |
| Max. frequency | 1 … 7200 pulses/h |
| Start delay | 0 … 200 seconds |
| Dosage monitoring | 0 … 99 minutes |

| **Add-on volume based dosing** | |
|---|---|
| Dosing | 0,000 … 9,999 l reagent per l of water |
| Flow measurement | 0,000 … 9,999 l/pulse |
| Dosing rate | 0,0 … 999,9 l/h |
| Min. pulse | 0,2 … 9,9 seconds |
| Pulse+Pause time | 2 … 99 seconds |
| Max. frequency | 1 … 7200 pulses/h |
| Relays | 2 potential-free contacts 6A, 250 V, max. 550 VA<br>Relay 1 – control variable<br>Relay 2 – circulation pump |

## 1.4. Technical Data

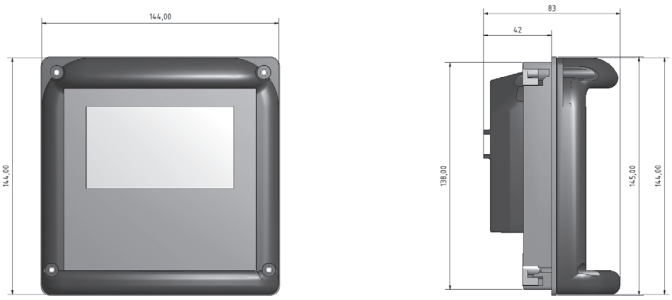
| Feature | Neon® panel mounted | Neon® wall mounted |
|---|---|---|
| View |  |  |
| Installation | panel-mounted housing | wall-mounted housing |
| Dimensions | 138x138x83 mm | 144x144x156 mm |
| Weight | 0,6 kg | 1,0 kg |
| Connections | Cable inlet: 2x M16, 2x M12 + optionally: 2x M12 and 1x M25<br>Terminals<br>Basic function: rigid/flexible 0.2-2.5 / 0.2-2.5 mm²<br>Measurements: rigid/flexible 0.2-1 / 0.2-1.5 mm² | |
| Protection class | Front IP54 | IP65 |
| Power supply | 85.. 250 V AC, +6/-10%, 40.. 60Hz<br>Option: 24 V DC | |
| Power consumption | 10 VA | |
| Contact rating | 3 relays, potential-free N/O contacts,<br>max. 250 V, 6A, 550 VA | |
| Operation temperature | 0.. 50°C | |
| Storage temperature | -20.. +65°C | |
| Rel. humidity | max. 90% rH at 40°C (non-condensing) | |

# 2. Instructions for installation and connections

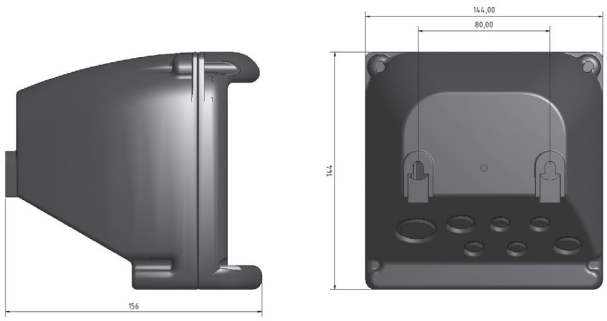
**Attention** **Install the instrument in a place where it is not put under mechanical or chemical strain!**

**Note** **Mind the protection class!**

## 2.1. Dimensions

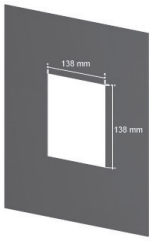



**Picture 1 Dimensions Neon® panel-mounted housing**

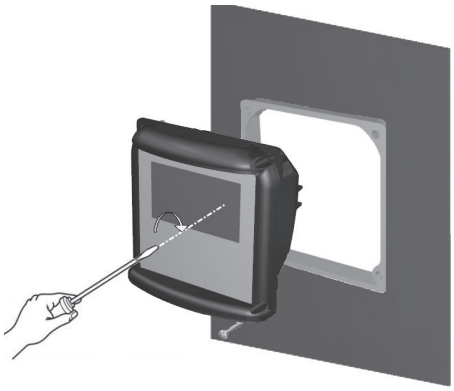



**Picture 2 Dimensions Neon® wall-mounted housing**

## 2.2. Installation panel-mounted housing




Prepare an opening of 138 x 138 mm. Clip the installation frame into the opening.



Place the instrument inside the frame and secure it with the M4 x 25 screws. Tighten the screws until the instrument is firmly fixed.

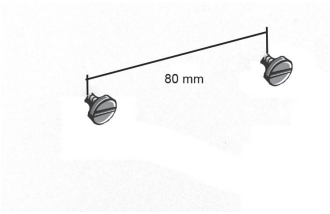
**Attention** **To preserve the protection class, the flat gasket of the housing and the sealing ring of the frame must be used!**

## 2.3. Installation wall-mounted housing

Pierce the pre-cut openings of the housing for as many cable glands as you wish to use and remove any remaining pieces from the openings.

Place the installation plate into the back frame and screw in the cable glands.

Drill two holes at 80 mm horizontal distance. Screw two screws into the holes and mount the instrument on the screws.




Or you can open the instrument and put the screws through the holes at the back of the instrument. Mind to replace the covers before closing the instrument.

## 2.4. Connections

A detailed connection diagram can be found on the following pages.

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

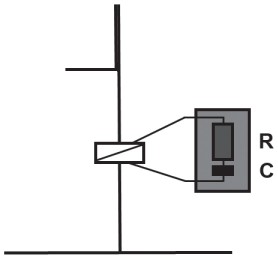
**Warning** **Input, output, and control cables must be installed separate from each other and especially apart from power lines!**

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

The measurements are interference-sensitive. Use only our special cables with a very high insulation for short distances, and for longer distances an impedance converter.

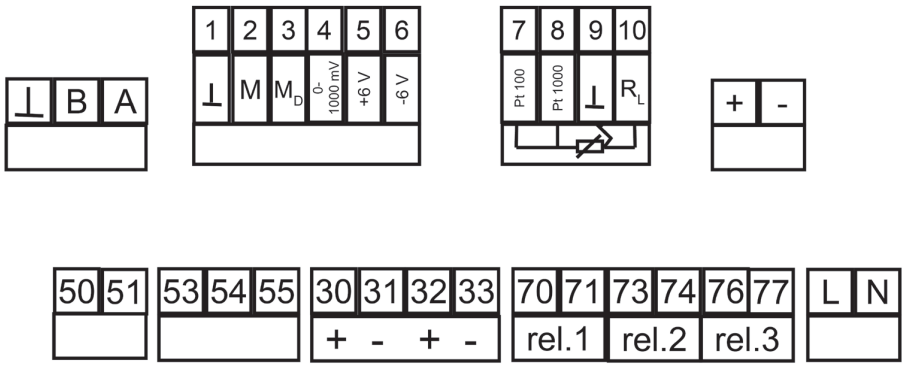
For the connection of temperature sensors use a low-resistance cable with a large diameter.

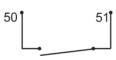
When using the relays, mind that with inductive loads, interference must be suppressed. If that is not possible, the relay must be protected at the terminal block by a resistance-capacity filter or, in case of direct current, by a free-wheeling diode.

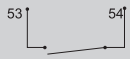
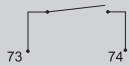



| Current up to | Capacitor C | Resistance R |
|---|---|---|
| 60 mA | 10 nF 260 V | 390 Ohm 2 Watt |
| 70 mA | 47 nF 260 V | 22 Ohm 2 Watt |
| 150 mA | 100 nF 260 V | 47 Ohm 2 Watt |
| 1,0 mA | 220 nF 260 V | 47 Ohm 2 Watt |

### *2.4.1. Connection diagram*




| Connection | Terminals | Notes |
|---|---|---|
| pH sensor | 1+2 | 1 = reference electrode = screen<br>2 = measuring electrode = core<br>With IWA 11.4<br>1 = measurement = brown<br>2 = measurement = white<br>5 = power supply = +6V = green<br>6 = power supply = -6V = yellow |
| pH differential sensor | 1-3 | 1 = GROUND<br>2 = measuring electrode<br>3 = high-impedance reference |
| ORP sensor | 1+2 | 1 = Messelektrode = Innenleiter<br>2 = Bezugselektrode = Abschirmung |
| Pt 100 | 7,9+10 | 7 = T1 (Pt 100)<br>9 = T2 (Pt 100)<br>10 = RL – for 3-wire connection/cable*<br>*For 2-wire-connection there should be a jumper between terminal 9+10 |
| Pt 1000 | 8,9+10 | 8 = T1 (Pt 1000)<br>9 = T2 (Pt 1000)<br>10 = RL – for 3-wire connection/cable*<br>*For 2-wire-connection there should be a jumper between terminal 9+10 |
| Digital input 1 | 50+51<br>  | 50 = +, 51 = -, low water, level monitoring, or<br>controller stop |

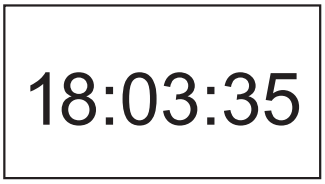
| Connection | Terminals | Notes |
|---|---|---|
| Digital input 2 | 53-55<br>  | 53 = +, 54 = -, Wassermangel, Behälterüberwachung oder Reglerstopp<br>Mengenproportionale Dosierung<br>53 = Signal<br>54 = GND<br>55 = + 15 VDC |
| Analog output 1 | 30+31 | 30 = + und 31 = -,<br>max. load 500 Ohm |
| Analog output 2 | 32+33 | 32 = + und 33 = -,<br>max. load 500 Ohm |
| Relay 1 | 70+71<br>  | Controller: control variable set point1<br>volume based dosing: control variable set point 1<br>Max. 2 A, AC 250 V/550 VA<br>DC 30 V / 60 W |
| Relay 2 | 73+74<br>  | Controller: control variable set point 2 (with 3-point controller control variable set point 1)<br>volume based dosing: circulation pump<br>Max. 2 A, AC 250 V/550 VA<br>DC 30 V/60 W |
| Relay 3 | 76+77<br>  | Alarm relay<br>Max. 2 A, AC 250 V/550 VA DC 30 V/60 W |
| Power supply | L+N | 85-265 V AC |
| Power supply 24 V DC | +/- | 24 V DC |
| Modbus RTU | A+B<br>⊥ | A = +<br>B = -<br>⊥ = Screen |

Add-ons (marked in grey)

Controller or volume based dosing, second digital input, up to 2 mA outputs, data logging, and RS 485

# 3. Operation

When the power is switched on, the instrument initialises. During that process, the time is displayed.




After approx. 20 seconds the process is finished, and the measured values are displayed.

## 3.1. Touch screen operation

The measuring isntrument is operated via touch screen. The screen is of the resistive type, with the advantage that a touch is recognized via pressure – it can be operated even with gloves, and does not respond to mere splashes of water. Press your finger on the screen gently but firmly, and keep the pressure until the instrument shows that the touch has been recognized.

In the desktop (display of the measured values), touching various areas of the screen gives access to different functions and submenus:


Touch

- **text** to switch to another desktop design
- **time** to enter the time setting menu
- **event message** to get suggestions for trouble-shooting
- **the triangle** to enter the main menu

**Note** **Mind that access might be limited via code. If the current code does not permit access to a selected area, the touch will only yield an empty display. In that case you have to enter the main menu and set a valid code first (0202 for the calibration level, 1612 for full access)**

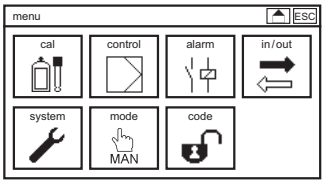
### *3.1.1. General*

All submenus show on the right side of the top line two symbols:

Home – Touching this symbol takes you back to the desktop from any position

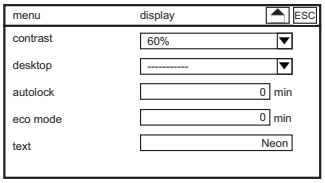

ESC – Touching ESC takes you back to the previous menu.

### *3.1.2. Main menu*




Press the triangle on the left side of the bottom line of the desktop to enter the main menu. In the main menu, select submenus by touching the corresponding symbols.

### *3.1.3. Submenus*




In submenus you will find on the left side the parameters and on the right side the corresponding settings. If the submenu contains more parameters than can be shown, a scroll bar on the right side gives access to the parameters currently not shown.

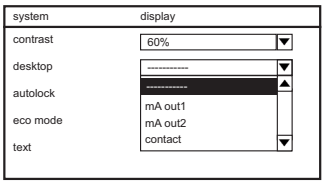
Move the scroll bar by pulling the bar with your finger or by touching the triangles at the top and bottom of the bar.

## 3.2. Settings

Parameters are set either by entering a value via keyboard or by selecting a setting from a drop-down list or by activating or deactivating an item from an action list, depending on the nature of the parameter.

**Drop-down lists**

Drop-down lists appear whenever you have to select a single option from a variety of options, for example when you choose a display design:




Drop-down lists are indicated by a triangle on the right side of the parameter setting.

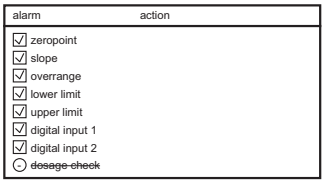
Move the cursor with the UP and DOWN keys in the submenu until the setting of the desired parameter turns black. If you press OK, the drop-down list appears. Move the cursor with UP and DOWN keys in the list until the desired parameter turns black. Press OK to choose the parameter.

With a touch screen instrument open the drop-down list by touching the triangle. A list of possible settings appears. Select the desired setting via touch.

Press ESC if you want to cancel and leave without changing the setting.

## Action lists

Action lists appear whenever you can select more than one option from a list, for example alarm actions:



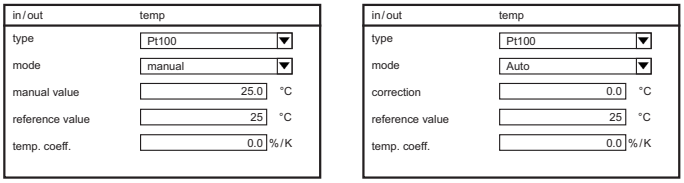

Action lists contain all selectable items. On the left side, each item has a box that can be ticked.

With key pad instruments, scroll through the options with the UP and DOWN keys until the desired option turns black, then press OK to tick the box or to remove the tick. With touch screen instruments, press the desired option with your finger to tick or untick its box.

**Note Options that are not activated in your instrument are crossed out and cannot be ticked.**

**Neon®´s support with the settings:**

Parameters that do not fit to previous selections are hided, e. g. in the TEMP menu correction and manual Temperature depending on the mode.




## Entering a value / keyboard

For settings of a freely adjustable parameter, like buffer values or contact data, a keyboard appears if you select the input field – with key pad instruments with the UP and DOWN keys and OK, with touch screen instruments by touching the settings box of the parameter.

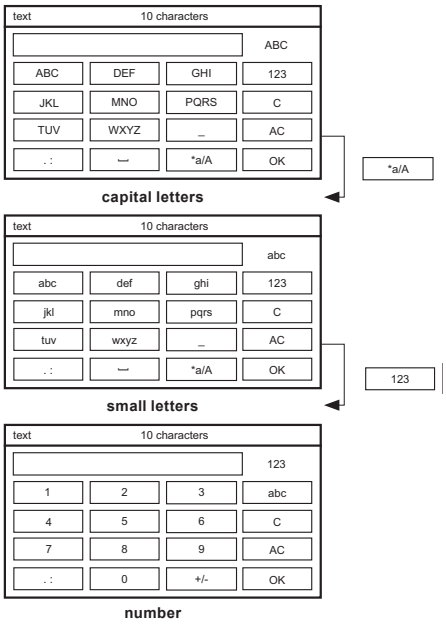
On the right side of the keyboard, four function keys are shown:

> The upmost function key shows „123“ or „abc“ and allows changing from characters to numbers and vice versa.

> The „C“ (clear) key erases the last input

> The „AC“ (all clear) key erases the complete input

> The „OK“ acknowledges the selection




**Note** **With numerical parameters, the keyboard automatically shows only numbers.**

Navigate through the keyboard by pressing the UP and DOWN keys. By pressing OK you choose the inverted field. If a key represents several characters, touch it twice for the middle character or three times for the right character. With touch screen operation simply select numbers and characters by pressing the field.

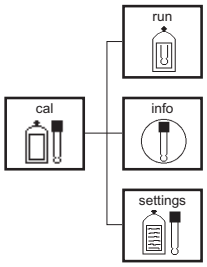
**Example: abc key**
*abc key touch once: a appears*
*abc key twice: b appears*
*abc key three times: c appears*

Touch OK when the input is complete. Now the instrument checks if the input is within the allowed limits. If it is, the new value is stored, and the setting is finished. The keyboard disappears.

If the value does not lie within the allowed limits, the value is not stored. The input field turns dark, and the keyboard remains open until you enter a correct value or cancel the setting and touch ESC or home.

**Note** **For maximum comfort the instrument adds zeros automatically. An input of pH 4, for example, is automatically turned into 4.00, and an input of 1 for the datalog interval is automatically interpreted as 00:00:01 (hours:minutes: seconds). Unfortunately, for date, code, add-on codes, text, and contact data, this support is not feasible.**

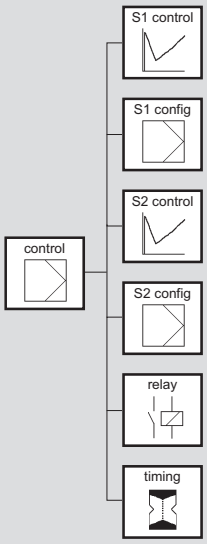
## 3.3. Menu overview – where to look?




Run calibration.

List of the last 10 calibration results.

Buffer and internal buffer settings.




Settings of control parameters for set point 1.

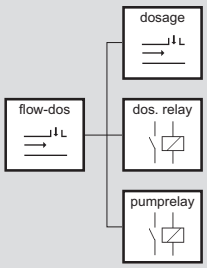
Settings of output parameters for set point 1.

Settings of control parameters for set point 2.

Settings of output parameters for set point 2.

De-/activating of relay and setting of acting direction.

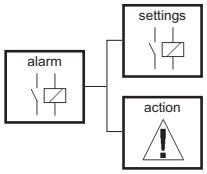
Settings of delay and dosing check.




Settings for volume based dosing.

Settings for dosage relay.

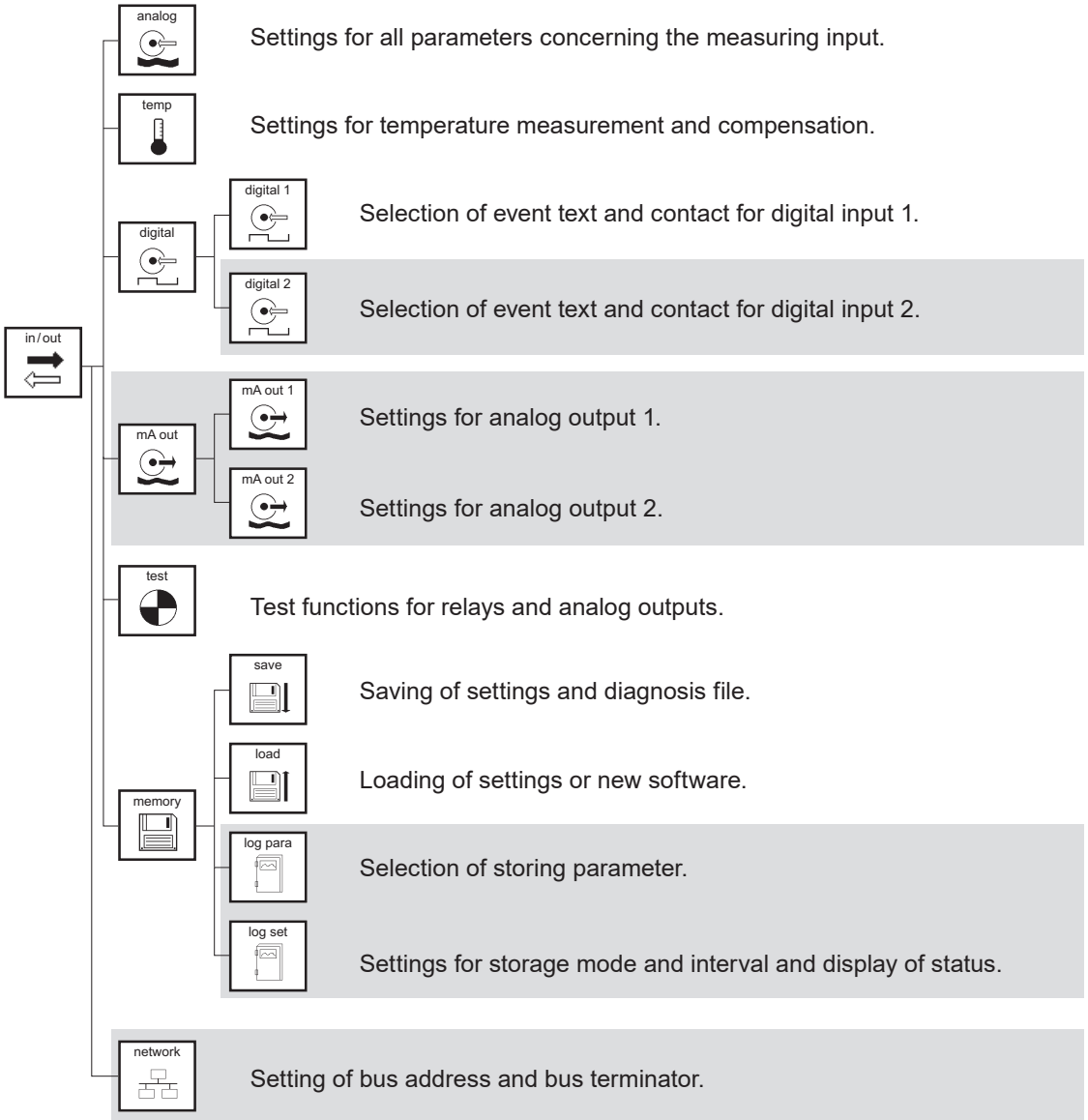
Settings for pump relay.



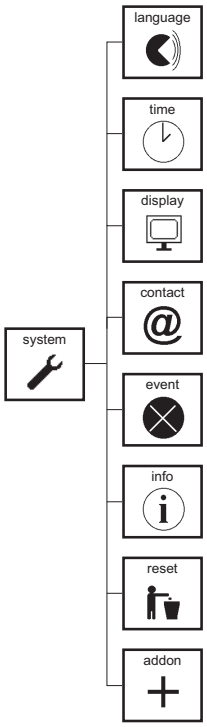

Setting of limit value, delay time and contact of relay 3.

Selection of events which cause an alert.

**Add-ons (marked in grey)**
Controller or volume based dosing, second digital input, mA output, Datalogger and Modbus RTU.




**Add-ons (marked in grey)**
Controller or volume based dosing, second digital input, mA output, Datalogger and Modbus RTU.




Language selection.

Adjustment of date and time.

Setting of contrast, auto lock function, eco mode, text and desktop.
For touch additionally the calibration.

Setting of contact data.

Help with active event messages.

Device information, eventlog, list of settings and
overview on in- and outputs.

Restore to factory settings.

Activating of add-on codes.


Selection of device mode: Man, Hold or Auto
(Auto only available for add-on controller or volume based dosing).

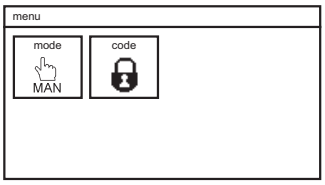

Entering a code.

**Add-ons (marked in grey)**
Controller or volume based dosing, second digital input, mA output, Datalogger and Modbus RTU.

## 3.4. Menu appearance depending on code and options

The main menu and the submenus appear different, depending on code, add-ons, and settings.

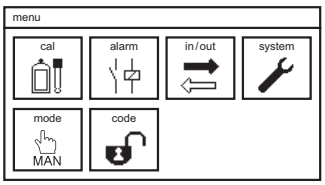
**No valid code**



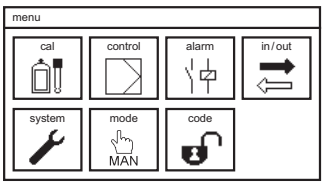

If no valid code is set, the main menu shows only two symbols, one to enter another code, and the other to stop the controller.

When the code is set to 1612 to give full access to all functions, the main menu shows all functions of the instrument. In the entry-level version the main menu shows six symbols. In the maximum version with all available add-ons, the main menu contains seven symbols.

**Entry-level version**



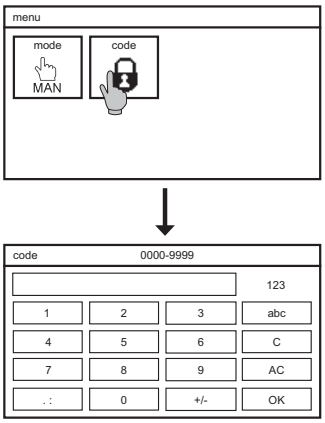

**Maximum version**




With code 0202, access is restricted, and the number of symbols decreases.

If you use the Neon® for ORP measurements, all unnecessary submenus disappear, such as the CAL symbol in the main menu.

# 4. Code




To enter a code, select the symbol CODE from the main menu, and enter the code via the keyboard.

The Neon® instruments have two access levels:

**Calibration level code: 0202**

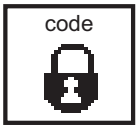
On this level you can calibrate, save settings, events and the diagnosis file, and view various settings.

**Full access code: 1612**

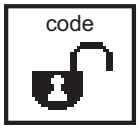
On this level you can enter and change all functions and settings.

If the full access code is set, the CODE symbol in the main menu shows an open lock instead of a closed one.

**Invalid code or calibration level**




**Full access**

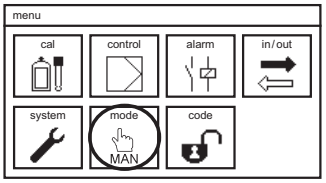
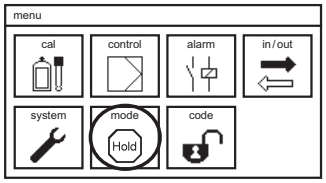
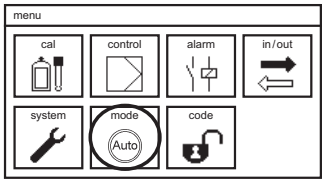



**Autolock function**

On delivery, the autolock function is deactivated. If you activate it via menu, the code is reset to 0000, to prevent unauthorized operation, after a defined interval without operation, or whenever the power supply was cut off. For more information, see the chapter “System functions”.

# 5. Mode

There are two, with the option controller three modes of operation. To change the operation mode, select the symbol MODE. The symbol changes according to settings.

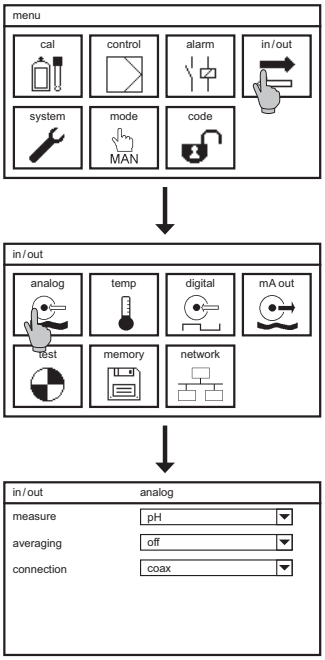
| MAN | Hold | Auto |
|---|---|---|
|  |  |  |
| > Desktop display active<br>> Alarm relay active<br>> Test functions active<br>> Limits active<br>> Data log active<br>> mA outputs active<br>> Controller OFF<br>> Modbus RTU active | > Desktop display active<br>> Alarm relay deactivated<br>> Test functions deactivated<br>> Limits deactivated<br>> Data log on HOLD<br>> mA outputs on HOLD<br>> Controller OFF<br>> Modbus RTU on HOLD | > Desktop display active<br>> Alarm relay active<br>> Test functions deactivated<br>> Limits active<br>> Data log active<br>> mA outputs active<br>> Controller ON<br>> Modbus RTU active |

**Note** **The instrument shows always only the features that you have purchased. In the entry-level version, the instrument contains the desktop, the alarm relay, the test functions, and the limits.**

In operation mode auto Neon® stops automatically the controller if

> the digital input switches (low water, level or ext. Controller stop)
> there is no measuring value (check measuring input, check temperature input)
> dosage check is activated

# 6. Analog input – pH or ORP measurement




Select the symbol IN/OUT in the main menu and then the symbol ANALOG. A submenu opens, showing three drop-down lists, or two, if ORP has been selected.

In the submenu ANALOG you can switch from pH to ORP and back, activate a suitable averaging level, and define the connection (for pH-differential sensors).

**Measure**

To select the parameter, select pH or mV (ORP).

**Averaging**

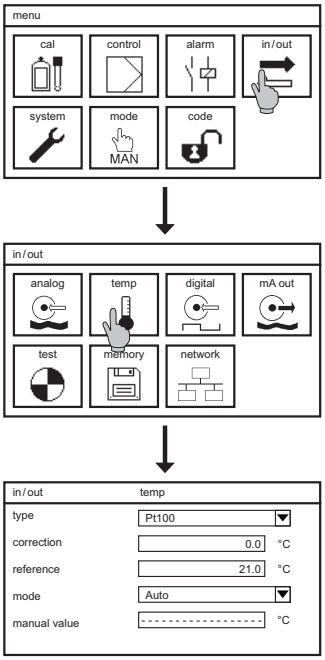
To activate the averaging function, select:

OFF: no averaging
low: mean of 5 values
medium: mean of 10 values
high: mean of 20 values

**Connection**

Select Triax if you want to connect a pH differential sensor with a high-impedance reference and a third electrode as ground potential. Select Koax for common pH sensors with or without integrated temperature sensor. Mind that the sensor and sensor connection must fit the setting.

# 7. Temperature measurement




All settings concerning temperature measurement and compensation are found in the submenu IN/OUT =>TEMP. Select the symbol IN/OUT in the main menu, and TEMP in the submenu.

**Type**

Select Pt100 if you have connected a Pt100, or Pt1000 if you have connected a Pt1000. Other temperature sensors cannot be used.

**Note** **You can connect temperature sensors with 2-wire or 3-wire connection. If you use 3-wire connection, make sure that your sensor supports this type of connection.**

**Correction**

If the sensor is connected with a 2-wire cable, slight deviations might occur between measured and real temperature. Check the temperature once during installation, and calibrate the temperature measurement if necessary by entering a correction value between -10 °C and +10 °C.

**Note** **If the mode is manual the input for the correction value is hided.**

**Reference**

The reference temperature is the temperature to which the measurement iscompensated.

**Mode**

In the automatic mode, the measured temperature values are used to compensate the temperature influence on the measurement, and in the manual mode, a manual temperature setting is used.

**Note** **On the desktop is shown whether the shown value is set manual (Tman) or measured (Tauto).**

**Manual value**

Enter the temperature of your solution for manual compensation. If you want to deactivate temperature compensation, set the manual value to the same value as the reference temperature and set mode to manual.

**Note** **If the mode is auto, the input for the manual value is blocked.**

## 7.1. Temperature compensation – pH measurement

If you have connected a Pt100 or Pt1000, select auto for the temperature mode. The measured values are then shown on the display and given out via the various interfaces, and the pH measurement is automatically compensated to the reference temperature.

**Note** **The compensation compensates only the temperature effect on the sensor, not on the buffers and solutions!**

**Note** **Mind that the temperature sensor should always measure the temperature in the vicinity of the pH sensor. If the two sensors are not in the same solution, for example during calibration, switch to manual compensation.**

If you have no temperature sensor connected, select manual compensation, and enter the temperature manually. This value is then shown on the desktop, given out via the various interfaces and used for temperature compensation of the pH measurement. For pH measurements with fluctuating temperatures, we recommend to use automatic compensation with an appropriate temperature sensor.

**Note** **If you do not want to compensate the pH-value, choose the same temperature values for reference and manual value.**

## 7.2. Temperature compensation – ORP measurement

Temperature has a strong influence on the oxidation/reduction potential of most solutions. But since the ORP potential is often used as such and not as a measure for a concentration, there is no temperature compensation for ORP measurements. Therefore the parameter reference is inaccessible with ORP measurements. However, temperature measurement is still possible, and the measured temperature can be displayed in the desktop.

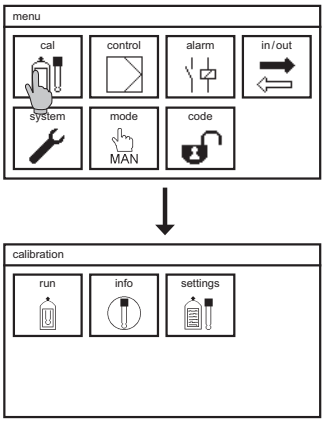
If you have connected a Pt100 or Pt1000, select auto for temperature mode. The measured values are then shown in the display and are also available via mA or digital outputs.

If you have no temperature sensor connected, select manual compensation, and enter the temperature manually. This value will then be displayed on the desktop and be given out via the various interfaces.

# 8. Menu Cal – Calibration – pH

Set the controller to MAN or HOLD: MAN stops the controller, all other functions are still active. HOLD stops the controller, all outputs are frozen to the last value and the alarm relay is deactivated.

Mind the temperature compensation! For automatic compensation, the temperature sensor has to be put in the calibration buffers together with the pH sensor. If that is not possible, switch to manual mode and enter the temperature of the buffer solutions manually.



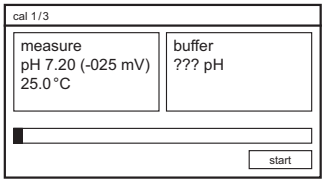

Select the symbol CAL to enter the submenu calibration. Here you find three symbols: run, info, and settings.

**Note** **If you have selected ORP measurement, the symbol CAL is not shown, since the ORP measurement cannot be calibrated.**

## 8.1. Calibration – Run

**Note** **You can leave the calibration menu any time with ESC, and with touch screen operation also with the HOME symbol.**

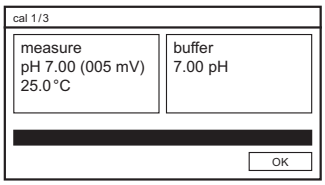
> Select the symbol RUN to start the calibration.




> Put the pH sensor in the first buffer solution and press START. Default values for the buffer solutions are pH 4 and pH 7. If you want to use other buffer solutions, you have to change the calibration settings.

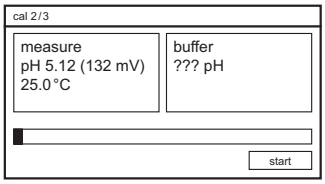
> The automatic buffer recognition starts. When it is finished, the right window shows the recognized buffer.

> When the measured value stabilizes, or at the latest after 120 seconds, the process bar is complete, and an OK button appears.




**Note** **If the measured value is still not quite stable after the 120 seconds, as can be the case with older sensors, wait until it stabilizes, and then press OK.**

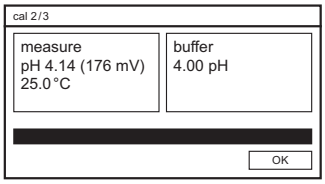
> With the OK button you execute the first calibration point and reach the second step of the calibration process.



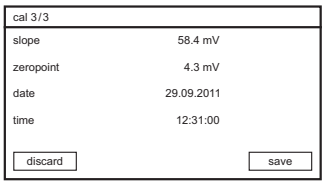

> Rinse the sensor with water, dry it with a soft tissue, and place it in the second calibration buffer.

> Start the second calibration step with the START button.

> When the second step stabilizes, or at the latest after 120 seconds, the process bar is complete, and an OK button appears.



> With OK you execute the second calibration point and reach the info screen, showing the results of the calibration.

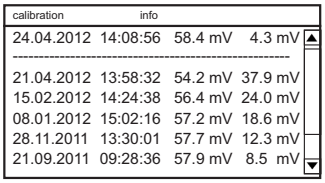



> With the SAVE button you store the results. With DISCARD you reject the results and keep the previous calibration values.

**Note** **If the slope does not lie within 50mV and 65mV per pH, or the zero point not within -60mV and +60mV, an event message is displayed. If the calibration process has been carried out proper and correct, these messages indicate that the sensor is worn out and has to be replaced as soon as possible. Refer to the eventlog or the chapter "Trouble shooting" for more information.**

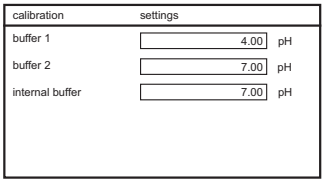
## 8.2. Calibration – Info

If you select the symbol INFO in the submenu CAL, you get a list of the last calibrations. This is helpful with regard to predictive maintenance.




As you can see in the example, the sensor characteristics slowly deteriorated, and in April the sensor was replaced.

## 8.3. Calibration – Settings

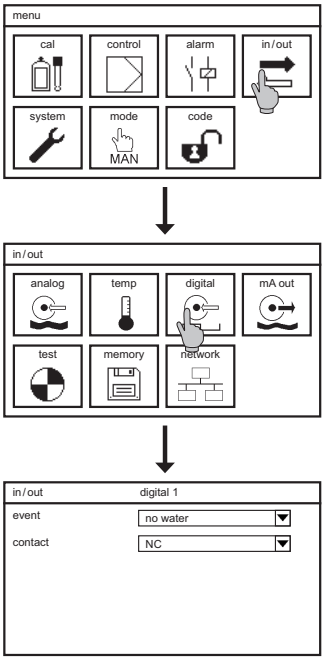



If you select SETTINGS in the submenu CAL, you see the current settings for buffer solutions and internal buffer, and can change the settings if you want to use other solutions or a sensor with a special internal buffer.

**Note** **The internal buffer is the buffer filled into the pH-glass bulb. The pH of this buffer represents the zeropoint of your sensor. You can find the pH of the internal buffer printed on the sensor, whenever it is not pH 7.**

**Note** **The pH values of the buffers are given for a certain temperature. If you calibrate at a different temperature, select the correct pH value from the table on the buffer bottle. The temperature compensation compensates only the temperature influence on the measurement, not on the buffers!**

# 9. Digital inputs




In the entry-level version, the Neon® instrument has one digital input. All settings concerning the digital input(s) are found in the submenu IN/OUT=>DIGITAL. If you have two digital inputs, separate symbols will appear for them.

**Contact**

For both inputs you can define whether the input should work as a normally open (NO) or normally closed (NC) contact.

**Event**

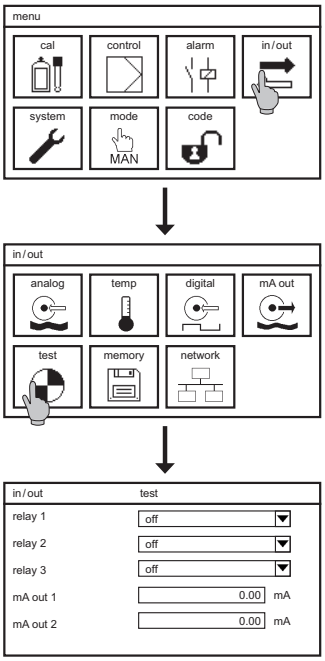
You can select one of three text messages that will appear if the input is closed: low water, or level, or controller stop.

**Note** **Switching of the digital input will stop the controller no matter what text you have selected.**

**Note** **If you have activated the add-on volume based Dosing, then the second digital input is used for the flow measurement. In that case no symbol for the second digital input appears.**

# 10. Test menu

The menu TEST is only accessible in the MAN Mode. In all other modes, the symbol is not shown. The test menu always shows a list of the maximum available analog and digital outputs. Naturally, you can operate only those outputs that are activated in your instrument. In the entry-level version this means only relay 3.




Set the mode to manual. Select the symbol TEST in the submenu IN/OUT.

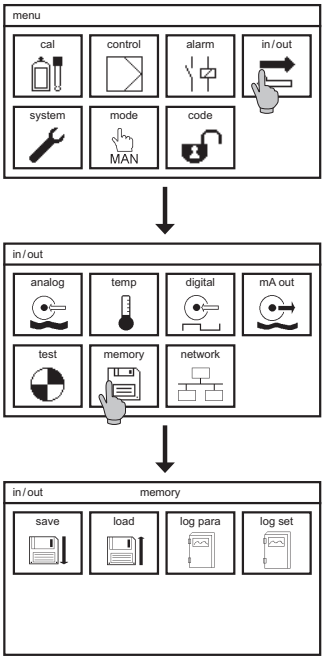
In the submenu TEST you can switch all available relays and define mA values for the analog outputs. To switch a relay, select ON from its drop-down list.

To check an analog output, select its settings to open the keyboard. Set the output to a value between 0.00 and 22.00 mA. This value is then sent out via the selected analog output.

**Note** **When you leave the menu, all relays and all analog outputs are reset to their previous settings.**

# 11. Memory

In the menu MEMORY you can find all functions and settings concerning the SD card.




Select the symbol IN/OUT in the main menu, and then in the submenu the symbol MEMORY.

**NOTE** **The submenus LOG PARA and LOG SET are shown only if the datalog function has been activated.**

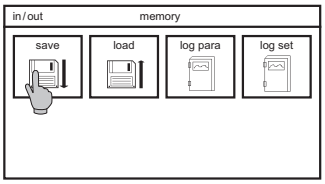
## 11.1. Store and load settings

You can save all settings on the SD card, for safekeeping, or to duplicate the settings into another instrument of the same type. This way you can easily restore your settings with a new instrument, or after a software-update, or after adding additional functions. With an appropriate PC program, you can even do all settings on the PC and then load them into the Neon® instrument via SD card.

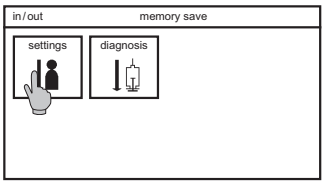
**Note** **Settings can be duplicated only to instruments of the same type, and in case of pR instruments only if they are set to the same parameter, i.e. either pH or ORP.**

### *11.1.1. How to save settings*

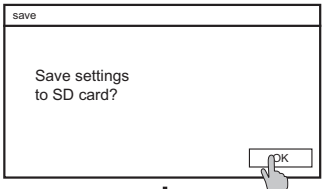
Make sure that an industry-standard SD card (max. 2 GB) with free storage space is plugged into the instrument.



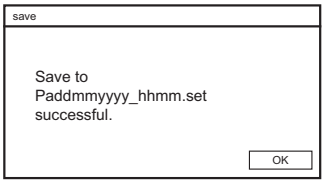

In the menu IN / OUT => MEMORY select the symbol SAVE.




Select the symbol SETTINGS.



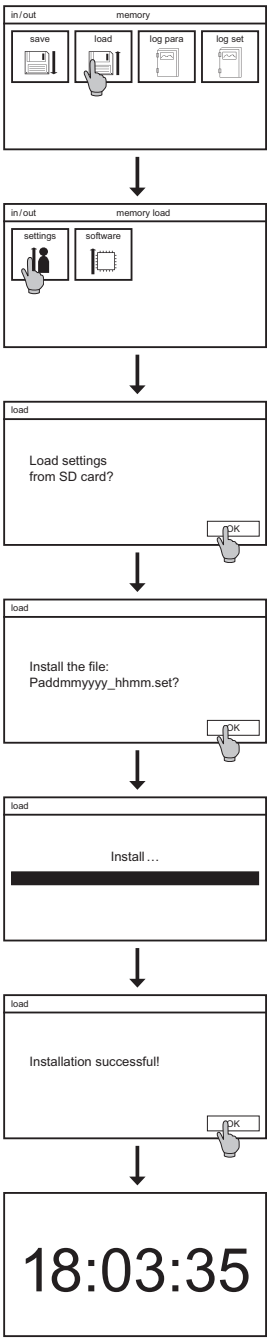

Acknowledge with OK.




The display shows the name of the created file. The name consists of the parameter and the date, for example pH210812_2339.set. Acknowledge with OK.

### *11.1.2. How to load settings*

Make sure that the SD card with the settings-file is plugged into the instrument.




In the submenu MEMORY select the symbol LOAD.

In the submenu select the symbol SETTINGS.

Acknowledge with OK.

The display shows the name of the file that will be loaded. The name consists of the parameter and the date, for example pH210812_2339. set. Acknowledge with OK.

Progress is indicated by a status bar.

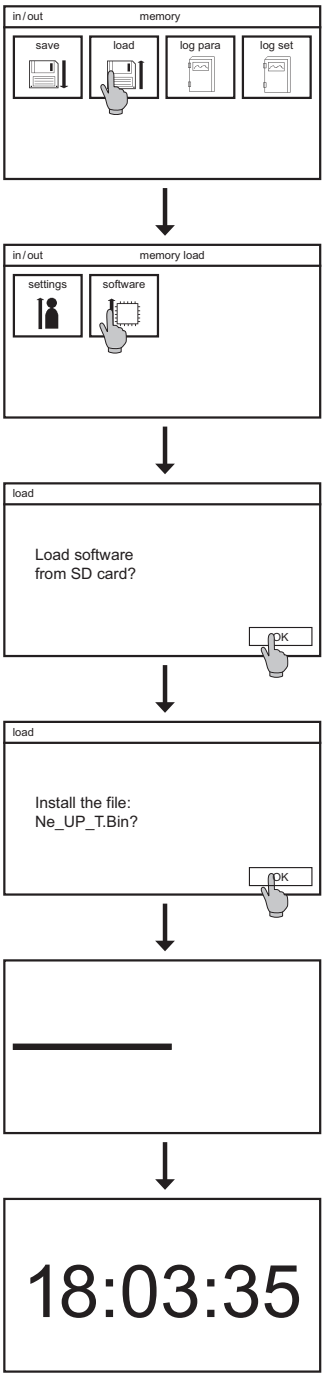
Acknowledge with OK.

After installation, the instrument initializes. During that process, the time is displayed on the desktop.

**Note** **You can only load settings files for the same parameter.**

## 11.2. Software update

For a software-update we will send you two files. Save both files on an industrystandard SD card – directly, use no subfolder! Plug the SD card into the instrument.




In the submenu MEMORY select the symbol LOAD.

Select the symbol SOFTWARE.

Acknowledge with OK.

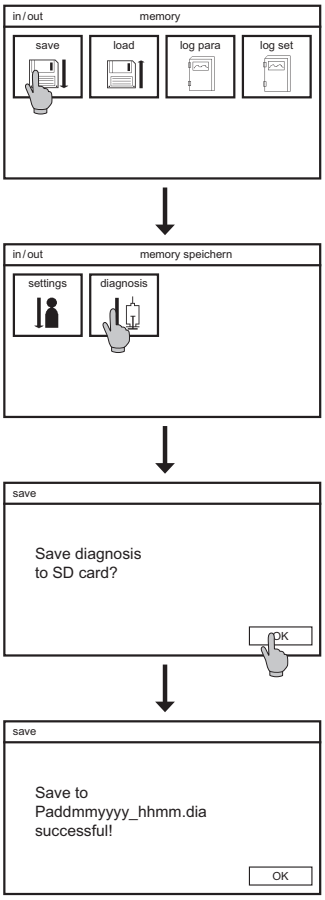
The display shows the name of the file that will be loaded. Acknowledge with OK.

Progress is indicated by a status bar.

After installation, the instrument initializes. During that process, the time is displayed on the desktop.

## 11.3. How to save the diagnosis file

If the measurement does not run as planned, it is useful to assess the situation by checking all settings and current values. To collect all the information and maybe have it ready for a contact person, you can save a diagnosis file on the SD card.




In the submenu MEMORY select the symbol SAVE.

Select the symbol DIAGNOSIS.

Acknowledge with OK.

The display shows the name of the created file. The name consists of the parameter and the date, for example pH210812_2339.dia. Acknowledge with OK.

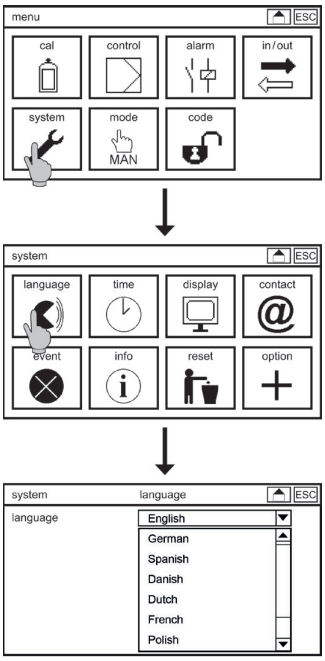
**Note** **The .dia file is a binary file and can only be read with an appropriate configuration program.**

# 12. System functions

**Note** **System settings can only be changed with the full access code.**

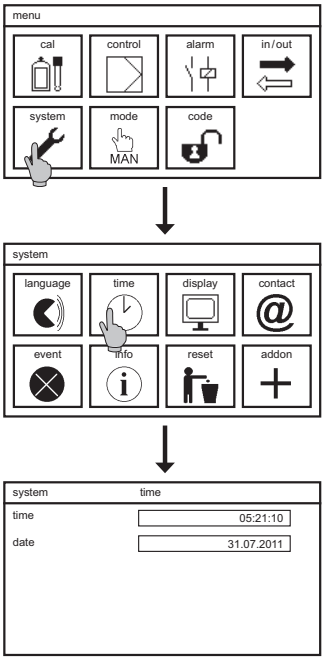
## 12.1. Language

For the menu, a variety of languages are available: Englisg, German, Spanish, Danish, Dutch, French and Polish.




To change the language, select the symbol SYSTEM in the main menu and in the submenu the symbol LANGUAGE. A drop-down list shows all languages that are available on your instrument.

## 12.2. Time




To set the internal clock, select the symbol SYSTEM in the main menu, and in the submenu the symbol TIME.

When you select the field of either time or date, a keyboard appears to enter the desired time or date.

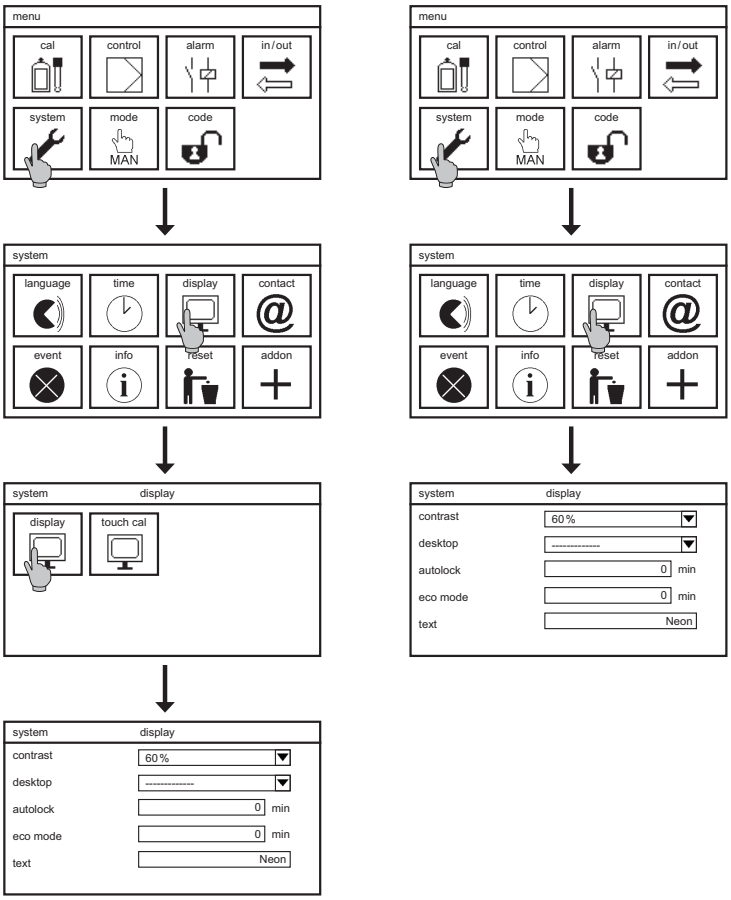
For your convenience, the instrument adds zeros automatically. If you enter 6, for example, the time will be set to 06:00:00.

**Note** **If the batterie is missung or empty, the date shows 01.01.2012 after start-up.**

## 12.3. Display

All settings concerning the display are found in the submenu SYSTEM=>DISPLAY. If you have a touch screen instrument, the touch screen calibration is also found in this submenu.

### *12.3.1. Settings*




**Contrast**

With CONTRAST you can adjust the brightness of the display, between 0% and 100%.

**Desktop**

This submenu contains a drop-down list of various desktop designs. The selection is activated as soon as you leave the menu.

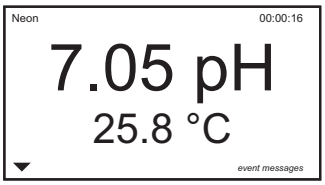
You can switch the display design by touching the instrument name on the desktop. To ensure that this selection is permanent, set the display design in the DESKTOP submenu to --------. Otherwise the design will be reset to the one specified in this menu whenever you enter any menu.

**Selection: ----------**

If you select the line (---------), the desktop remains in its previous design.

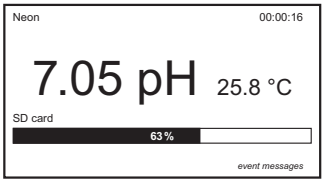
**Note** **Text, time, the triangle, and the event messages are part of all desktop designs.**

**Selection: default**



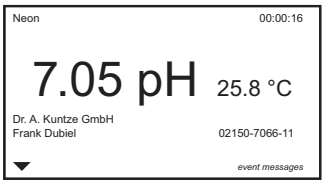

The default design shows the measured value and the temperature.

**Selection: SD card**



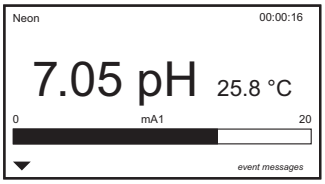

This adds a status bar indicating the remaining storage space on the SD card.

**Selection: Contact**



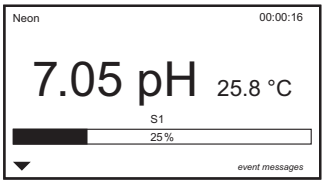

This adds the contact data that is stored in the submenu SYSTEM => CONTACT.

**Selection: mA1 or mA2 (add-ons)**



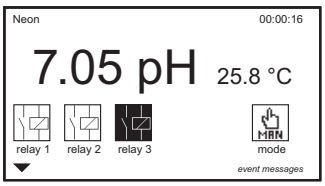

This adds an analog bar indicating the mA output of output 1 or 2, respectively.

**Selection: S1 or S2 (add-on controlller)**



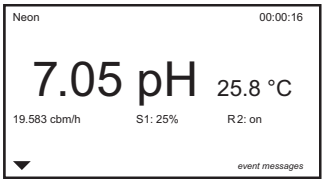

This adds an analog bar indicating the controller output for set point 1 or 2, respectively, in %.

**Selection: Relays (add-on controller)**




This adds the status of all three relays and the mode. Active relays are shown white on black, and the symbol shows whether the relay is open or closed. See relay 3 in the example shown.

**Selection: Flow (add-on volume based dosing)**




This adds the calculated flow rate, the controller output in %, and the status of relay 2.

**Autolock**

The autolock function ensures that an invalid code is set after an adjustable interval without operation, even if you have forgotten to change the code manually before leaving the instrument. Autolock sets the code back to 0000, and the display shows the desktop with the measured values. If you set the interval to 0, the autolock function is deactivated.

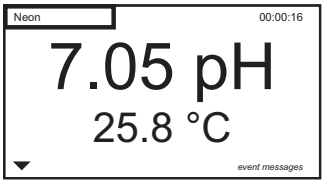
**Eco mode**

Eco mode turns off the display illumination after an adjustable interval. If you set the interval to 0, eco mode is deactivated, and the illumination remains on permanently.

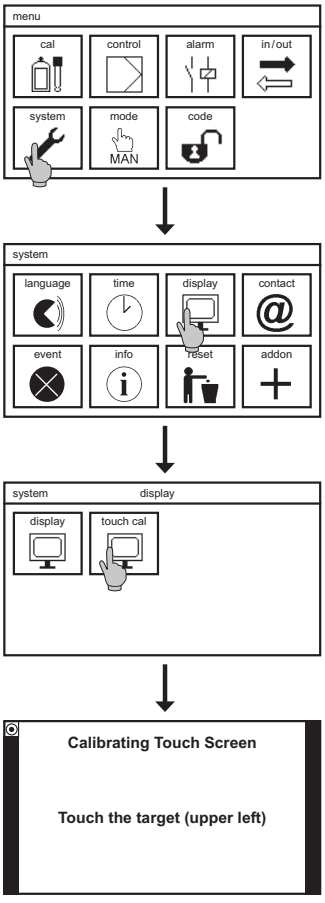
**Note** **The eco mode not only saves energy, it also extends the life span of the display.**

**Text**

Here you can enter an identification or location, which will be shown on the left side of the top line of the desktop.



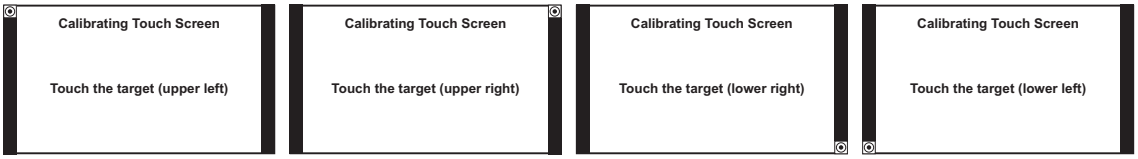

### *12.3.2. Touch Cal*




To calibrate the touch screen, select in submenu SYSTEM => DISPLAY the symbol TOUCH CAL to start the calibration. The touch screen calibration texts are available in English only.

**Note** **When started, the calibration routine cannot be left until it is finished, it has to be carried out completely.**

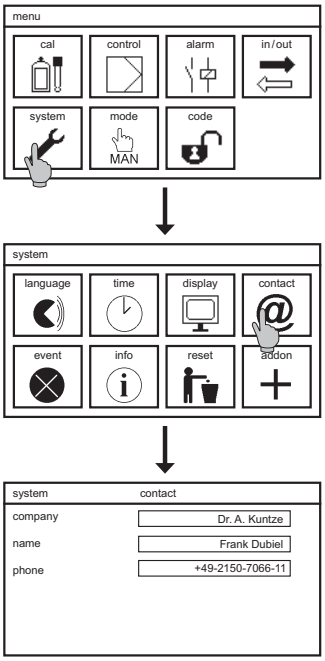
The routine comprises five steps. You have to touch each corner of the display.




**Note** **The touch screen calibration can also be started by touching the screen for more than 30 seconds.**

## 12.4. Contact

In the submenu SYSTEM => CONTACT you can store contact data of your contact person, including company name, personal name, and phone number.




Select in the submenu SYSTEM the symbol CONTACT. For each field a keyboard opens to enter the name or number.

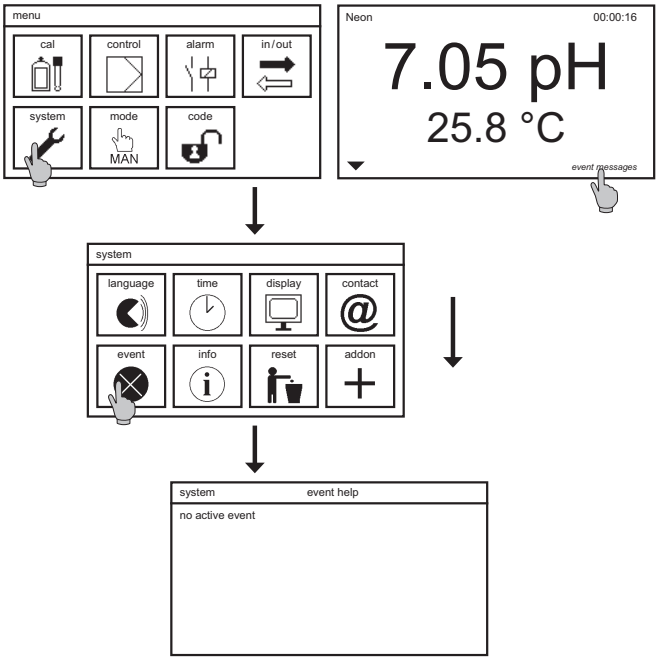
**Note** **Contact data can be shown on the desktop, if you select the display design “Contact”.**

**Note** **With restricted access (Code 0202) you can view this menu but not change the settings.**

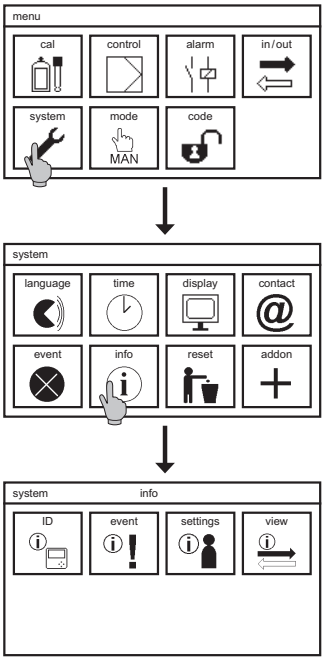
## 12.5. Event-related support

If an event message appears on the desktop, the submenu SYSTEM => EVENT provides information on the event and suggestions how to solve it.

Select in the submenu SYSTEM the symbol EVENT. You can reach this submenu directly by touching the event message on the desktop. If there are no event messages, the event help will only show “no active event”. If more than one event is currently indicated, you can scroll up and down to view all events.



## 12.6. Info




The submenu INFO is found in the submenu SYSTEM.
It contains four symbols:

**ID**

This shows the serial number, the software version, and the operating hours of the instrument.

**Eventlog**

The event log stores up to 100 events, with the time they appear (*) or leave (#).

**Settings**

This submenu shows a complete list of all settings. Press UP and DOWN to view the complete list.

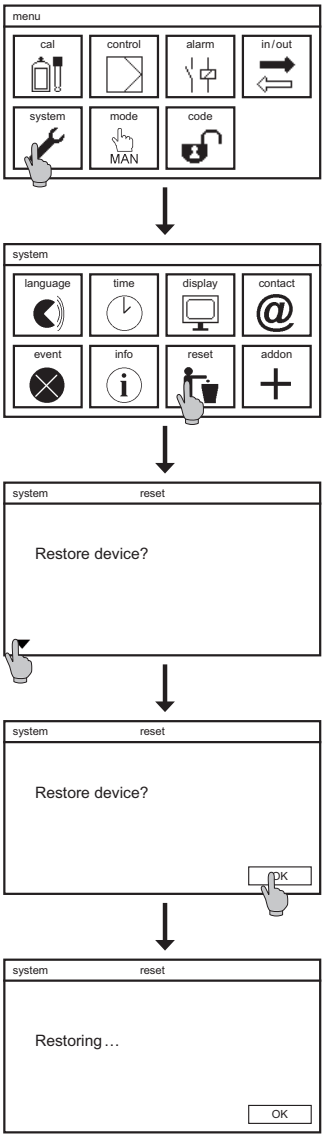
**View**

This submenu shows the raw signals of the sensors, the output signals of the mA outputs, and the status of the digital inputs.

**Note** **The analog outputs and the second digital output are add-ons, and are shown only if the instrument is equipped with these features.**

## 12.7. Reset to factory settings

The reset resets all settings to factory settings, except the time, date, and contact. Activated add-ons will remain activated, of course.




Select the symbol SYSTEM in the main menu, and in the submenu the symbol RESET.

Go DOWN as indicated.

Acknowledge with OK.

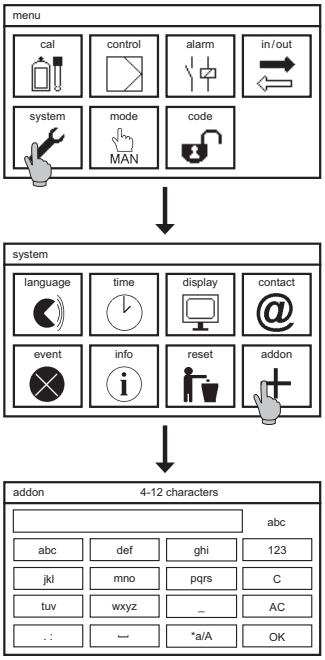
All settings are reset, and the instrument initializes.

**Note** **The touch screen has to be calibrated after reset. The calibration routine starts automatically.**

## 12.8. Add-on activation

In this menu you can activate add-ons. Enter the 4-character code you have received with the purchase to add one or more of the following features:

- Second digital input
- Analog output
- Second analog output
- Data log
- PID controller or volume based dosing
- Modbus RTU (RS 485) – needs additional hardware




To activate add-ons, select the symbol SYSTEM in the main menu, and in the submenu the symbol ADD-ON.

A keyboard appears to enter the code.

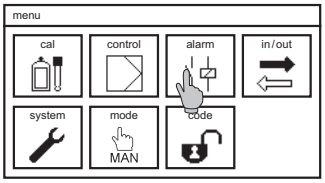
**Note** **The input is case-sensitive! Observe capital and small letters.**

After a successful activation, the display shows which features have been activated, and the instrument initializes. If the entered code was incorrect, no message appears, and the previous settings are maintained.

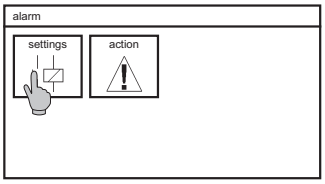
**Note** **We recommend to reset all settings to factory settings after activating add-ons.**

# 13. Alarm relay

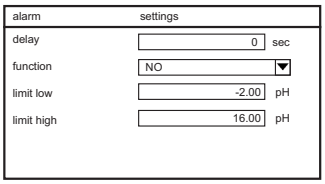
## 13.1. Settings




Select the symbol ALARM in the main menu.




In the submenu, select the symbol SETTINGS.




Here you can set the following parameters:

**Delay**

This defines a delay time – in case of an event, the alarm relay switches only after a specified interval. Display of the text message on the desktop and output of 22mA error current are not affected by this setting and will occur immediately.

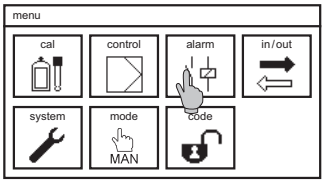
**Function**

Here you can turn the normally open contact into a normally closed contact. That means that the relay is actively closed in case of normal operation and opens in case of alarm – with the advantage that power failure also leads to an alarm.

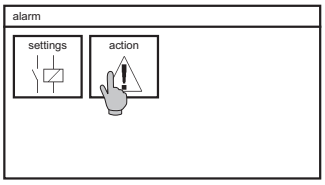
**Lower limit / upper limit**

You can define an upper and a lower limit. If the measured value is higher than the upper limit or lower than the lower limit, an alarm is issued via the alarm relay– if you have specified the limits as alarm actions.

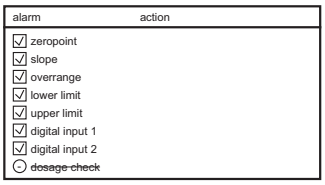
## 13.2. Alarm action




Select the symbol ALARM in the main menu.




Select the symbol ACTION.




A list of all possible actions appears.

By activating the check boxes you can define actions as alarm actions. If a box is marked with a tick, the action or event will cause the alarm relay to switch. An empty box means that the action or event does not cause the alarm relay to switch. Overrange refers to both inputs, the message and alarm will occur if either input is affected.

**Note** **If an action concerns an add-on that you have not activated, the box is crossed out and cannot be selected.**

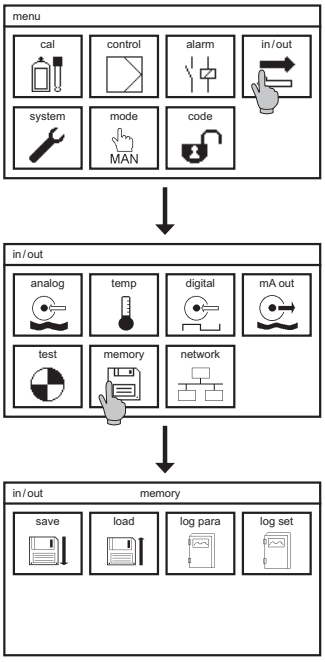
The following events always cause the alarm relay to switch:

> Communication error
> Unknown measuring module

# 14. Add-on Datalog

**Note** **The symbols DATALOG and STATUS are shown only if the add-on datalog has been activated.**

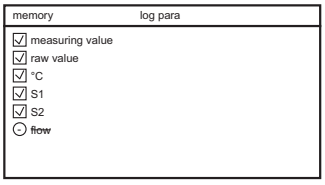
**Note** **The Microsoft FAT (FAT16) file system root folder can manage a maximum of 512 entries. The use of long file names can significantly reduce this number of available entries. Always use an empty SD-Card or a SD-Card with limited entries in the root folder and an appropriate directory structure. Log files will be saved in a folder LOG.**




Select the symbol IN/OUT in the main menu, and in the submenu the symbol MEMORY.

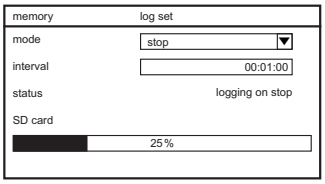
If the datalog add-on is activated, four symbols appear. In the menu LOG PARA you define which parameters you want to log. In LOG SET you define interval and log mode, and view the log status.

### Log para




You decide which parameters are logged. Tick the boxes to log the parameter.

### Log set




In the submenu LOG SET you can make the following settings:

**Mode**

Start data logging by setting the mode to either stop or ring. Stop means that the logging stops when the card is full. Ring means that when the card is full, the oldest data will be overwritten.

**Note** **Never remove the SD card while the logging is running! Always set the mode to OFF (not stop!) before removing the card. Otherwise data loss might occur, and an error message will appear.**

**Note** **Always use a card with sufficient storage space, even with ring mode, otherwise the logging will not start.**

**Interval**

The INTERVAL defines the time between subsequent data logs. You can enter an interval of 1 second up to 24 hours.

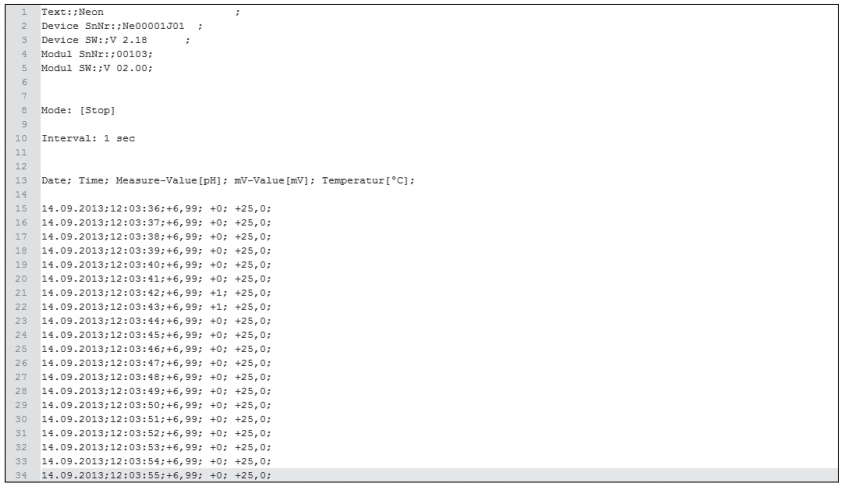
**Example:**
*00:00:01 means that each second the values are logged.*
*00:01:00 means that each minute the values are logged.*
*01:00:00 means that once every hour the values are logged.*

**Note** **The instrument fills in zeros automatically.**
***Example: 1 is interpreted as 00:00:01 / 1: is interpreted as 00:01:00/ 1:1: is interpreted as 01:01:00***

## 14.1. View logged data

To remove the SD card, first set mode to OFF, then press the SD card to take it out of the instrument.

**Note** **If you remove the card without deactivating the logger, data loss might occur, and the instrument displays an error message.**



```
Text:;Neon                    ;
Device SnNr:;Ne00001J01  ;
Device SW:;V 2.18      ;
Modul SnNr:;00103;
Modul SW:;V 02.00;


Mode: [Stop]

Interval: 1 sec


Date; Time; Measure-Value[pH]; mV-Value[mV]; Temperatur[°C];

14.09.2013;12:03:36;+6,99; +0; +25,0;
14.09.2013;12:03:37;+6,99; +0; +25,0;
14.09.2013;12:03:38;+6,99; +0; +25,0;
14.09.2013;12:03:39;+6,99; +0; +25,0;
14.09.2013;12:03:40;+6,99; +0; +25,0;
14.09.2013;12:03:41;+6,99; +0; +25,0;
14.09.2013;12:03:42;+6,99; +1; +25,0;
14.09.2013;12:03:43;+6,99; +1; +25,0;
14.09.2013;12:03:44;+6,99; +0; +25,0;
14.09.2013;12:03:45;+6,99; +0; +25,0;
14.09.2013;12:03:46;+6,99; +0; +25,0;
14.09.2013;12:03:47;+6,99; +0; +25,0;
14.09.2013;12:03:48;+6,99; +0; +25,0;
14.09.2013;12:03:49;+6,99; +0; +25,0;
14.09.2013;12:03:50;+6,99; +0; +25,0;
14.09.2013;12:03:51;+6,99; +0; +25,0;
14.09.2013;12:03:52;+6,99; +0; +25,0;
14.09.2013;12:03:53;+6,99; +0; +25,0;
14.09.2013;12:03:54;+6,99; +0; +25,0;
14.09.2013;12:03:55;+6,99; +0; +25,0;
```

Logged data are stored in CSV files. The file name consists of the measuring parameter, the date, and the time, for example pH060812_1322.csv for pH, or mV060812_1345 for ORP measurements.

Each file starts with the device name, the instrument number, and the software versions, followed by the log mode and the interval. Measured values are listed line by line, separated by semicolons.

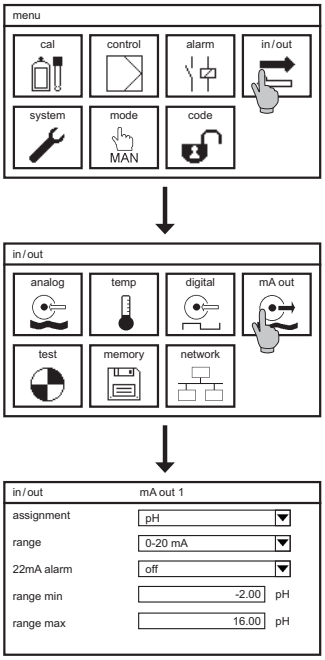
CSV files can be opened with commercially available spreadsheet software such as OpenOffice Calc or Microsoft Excel or in a simple text program.

For each day, a new file is created. Additionally, a new file is created if:

> Power was turned off
> The measuring parameter changed, for example from pH to ORP
> The logging was stopped and restarted
> Other parameters for the datalogging were selected

# 15. Add-ons mA output

Up to two analog outputs are available as add-ons. As soon as at least one mA output has been activated, the symbol mA OUT appears in the submenu IN/OUT.




Select the symbol IN/OUT in the main menu and then select the symbol mA OUT. Here you can set the following parameters:

**22 mA alarm**

If you activate this function, the mA output rises to 22 mA whenever the measuring inputs receive no proper signals.

**Range**

Select either 0-20mA or 4-20mA from the drop-down list.

**Note** **While 4-20 mA gives slightly less resolution, it helps identifying cable breaks.**

**Assignment**

Select which parameter you want to read out via the mA output: measured value, temperature, flow (volume based Dosing) or controller output (controller).

**Note** **If the mA output is assigned to the controller there is not 22 mA alarm alarm. By changing the assignement back to measured value the 22 mA alarm has to be activiated again.**

**Range min and max**

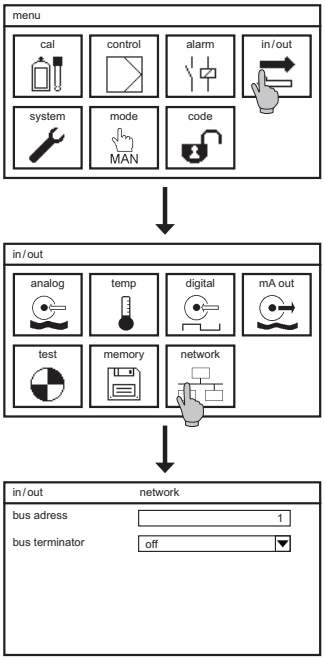
You can zoom by defining which measured values correspond to 0/4mA and which to 20mA. With these settings you can even invert the output, by assigning 20mA to a smaller value than 0/4mA. In case of controller output the output is in %, so you cannot set range min and max.

# 16. Add-on Modbus RTU

Neon® instruments are optionally available with a serial interface RS 485 Modbus RTU. To use this function you have to install the RS 485 circuit-board, observing the ESD-directive, and activate the software with the appropriate add-on code obtained from Dr. Kuntze.

When setting up a bus with several instruments, mind that the instruments are connected in line, not radially. Both ends of a long bus connection should be terminated with termination resistors of 120 Ohm. With Neon® instruments, you can activate the termination via menu.

**Note** **Activate the bus termination only at the ends of the line. If you activate terminations somewhere inbetween, this might cause malfunction in the bus communication.**




Select the symbol IN/OUT in the main menu and in the submenu, select the symbol NETWORK. Here you can set the following parameters:

**Bus address**

Assign a different number to each instrument in your bus system. With this number, you can address the instrument from the master instrument to read out data.

**Bus termination**

If you select ON from the drop-down list, the termination is activated for this instrument.

## 16.1. How to read out data

**Request**

| | | |
|---|---|---|
| Function code | 1 Byte | 0x03 |
| Start register | 2 Bytes | 0x0000 to 0xFFFF |
| Quantity of registers | 2 Bytes | 1 to 125 (0x7D) |

**Response**

| | | |
|---|---|---|
| Function code | 1 Byte | 0x03 |
| Bytes | 1 Byte | 2 x N* |
| Register value | N* x 2 Bytes | |

*N = quantity of registers

**Write single register**

| | | |
|---|---|---|
| Function code | 1 Byte | 0x06 |
| Register | 2 Bytes | 0x0000 to 0xFFFF |

**Write multiple registers**

| | | |
|---|---|---|
| Function code | 1 Byte | 0x10 |
| Start register | 2 Bytes | 0x0000 to 0xFFFF |
| Quantity of registers | 2 Bytes | 1 to 125 (0x7D) |

## 16.2. Communication parameters

Baudrate: 19200 bps

Data bits: 8

Stopp-Bits: 1

Parity: even

MODBUS address: selectable between 1 - 31, factory settings: 1

## 16.3. Registers

The instrument provides the following variables:

- Measured values: measuring parameter, temperature, and raw value
- Controller outputs: S1 and S2 for add-on controller and S1 for add-on volume based dosing
- Status of digital inputs and outputs: digital inputs 1 and 2, relays 1-3
- Event messages
- Calibration results as in the Cal/Info menu
- Instrument data incl. activated add-ons

All parameter settings can be read and most parameters can be set via the interface.

All test functions can be activated via the interface.

### *16.3.1. How to read variables*

Each variable has at least three registers. The first register contains the value, the second in the lower 8 bit the number of decimal places and in Bit 8 the percentage flag, which is set if a value is expressed as percentage of a given range. In that case, the value of the first register lies within 0 (0%) and 10000 (100%). The third register conatins a code indicating a unit or text – refer to table “units and texts”.

Numerical values with a limited range have two additional registers specifying the minimum and maximum value of the range.

Example for a numerical value without percentage flag:

The temperature is listed as follows:

1. register: 4160, quantity of registers: 5

If you read these five registers, the response is as follows:

| Reg. 1 (4136) | Reg. 2 (4137) | Reg. 3 (4138) | Reg. 4 (4139) | Reg. 5 (4140) |
|---|---|---|---|---|
| 250d | 1d | 1001d | -300d | 1400d |
| Value | Number of decimal places | Code of unit (°C) | Minimum of range | Maximum of range |

The 1 in the second register means:

> Value and range limits have to be divided by 10 to achieve one decimal place.
> The percentage flag is not set. Otherwise the number in the second register would be 257 (=256+1; expressed as hexadecimal value 0101h). The value is not a percentage of the range but already the true measured value.

The first register gives the value 250. This represents a temperature of 25.0 and from the third register the unit °C.

Registers four and five show the range of the temperature measurement, which is -30.0…140.0°C.

*Example* *for a numerical value with percentage flag:*
*The lower limit is listed as follows:*
*1.register: 6304, quantity of registers: 5*
*If you read these five registers, the response is as follows:*

| Reg. 1 (6304) | Reg. 2 (6305) | Reg. 3 (6306) | Reg. 4 (6307) | Reg. 5 (6308) |
|---|---|---|---|---|
| 1111d (0457h) | 258d (0102h) | 1422d (058Eh) | 65336d (FF38h) | 1600 (0640h) |
| Value | Number of decimal places | Code of unit (pH) | Minimum of range | Maximum of range |

The 258 in the second register means:

> Percentage flag is set, the value is increased by 256 (expressed as hexadecimal value 0102h). The value is a percentage of the range. The true value has to be calculated from the range.

> After deducting the 256, in the second register remains a 2. Measured value and range limits have to be divided by 100 to achieve two decimal places.

Registers 4 and 5 show the range of the lower limit, which is -2.00…16.00, and the third register shows the unit pH.

The value of the first register is 1111, which is 11.11% of the range. Calculate 11.11 * (18) / 100 and you will find that the value is 2 pH above the minimum of the range = pH 0.

**Note** **Text variables have 25 registers, each containing one character expressed in Ascii code. Text variables have no registers for decimal place, unit, or range.**

### *16.3.2. Measured values, controller outputs and status of digital inputs and outputs*

For measured value and temperature, an additional HOLD-value is given out. The HOLD-Value equals the true value in the operation modes MAN and AUTO but is frozen whenever the instrument is set to HOLD. We recommend the use the HOLD-value if you have set alarm values in the PLC that you do not want to be activated during maintenance.

**Note** **The operation mode can be found in register 2240, refer to table “parameters”.**

| Name | 1. register | Quantity of registers | Type | Bytes |
|---|---|---|---|---|
| Measured value | 4136 | 5 | i_16 | 2 |
| HOLD-value | 4568 | 5 | i_16 | 2 |
| Temperature<br>(Gas: measured value 2) | 4160 | 5 | i_16 | 2 |
| HOLD-value of temperature<br>(Gas: Hold-value measured value) | 4584 | 5 | i_16 | 2 |
| Raw value Measuring input 1 | 4440 | 3 | i_16 | 2 |
| Raw value Measuring input 2 | 4648 | 3 | i_16 | 2 |
| Add-on controller:<br>controller output S1 | 6848 | 5 | i_16 | 2 |
| Add-on controller:<br>controller output S2 | 7128 | 5 | i_16 | 2 |
| Add-on volume based dosing:<br>controller output S1 | 7296 | 5 | i_16 | 2 |
| Status digital input 1 | 6152 | 3 | u_8 | 1 |
| Status digital input 2 | 6184 | 3 | u_8 | 1 |
| Status relay 1 (controller) | 6544 | 3 | u_16 | 2 |
| Status relay 2 (controller) | 6568 | 3 | u_16 | 2 |

| Name | 1. register | Quantity of registers | Type | Bytes |
|---|---|---|---|---|
| Status relay 3 (alarm relay) | 6592 | 3 | u_16 | 2 |

### *16.3.3. Event messages and calibration results*

Up to 100 event messages (current and logged) as well as the up to 10 logged calibration results of the Cal/Info menu are available via interface.

The index (registers 200 and 100) shows which entry is the first.

The time has three registers: Day+month contains the day in the upper 8 bits and the month in the lower 8 bits. Year+hour contains the year in the upper 8 bits and the hour in the lower 8 bits. Minute+second contains the minutes in the upper 8 bits and the seconds in the lower 8 bits.

For event messages, a code indicates the nature of the event – refer to table „event codes“.

| Name | Register | Type | Bytes |
|---|---|---|---|
| Event log, index first entry | 200 | u_8 | 1 |
| first entry day + month | 201 | u_16 | 2 |
| first entry year + hour | 202 | u_16 | 2 |
| first entry minute + second | 203 | u_16 | 2 |
| first entry code<br>(refer to the following table) | 204 | u_16 | 2 |
| second entry day + month | 205 | u_16 | 2 |
| … | | | |
| 100. entry code | 600 | u_16 | 2 |
| | | | |
| Calibration log, index first entry | 100 | u_8 | 1 |
| first entry day + month | 101 | u_16 | 2 |
| first entry year + hour | 102 | u_16 | 2 |
| first entry minute+second | 103 | u_16 | 2 |
| First entry slope | 104 | u_16 | 2 |
| First entry zero-point | 105 | u_16 | 2 |
| second entry day + month | 106 | u_16 | 2 |
| … | | | |
| 10. entry zero-point | 150 | u_16 | 2 |

**Table event-codes**

| Code | Event |
|---|---|
| 1, 2 | Memory fault |
| 5 | Start |
| 10, 11, 13, 14 - 18 and 45 | Internal error |
| 20 | No communication with the measurement module |
| 25 | Unknown measurement module |
| 30 | Check measuring input |
| 35 | Check temperature input<br>Gas: Check measuring input 2 |
| 40 | Out of measuring range (below range) |
| 41 | Out of measuring range (above range) |
| 49 | Zero-point |
| 50 | Slope |
| 51 | Slope C-value invalid |
| 52 | TDS factor invalid |
| 53 | Check wiring of anlaog input 1 |
| 54 | Sensor test failed measuring input 1 (Gas) |
| 55 | Sensor test failed measuring input 2 (Gas) |
| 56 | No sensor measuring input 1 (Gas) |
| 57 | No sensor measuring input 2 (Gas) |
| 58 | Wrong sensor measuring input 1 (Gas) |
| 59 | Wrong sensor measuring input 2 (Gas) |
| 60 | No SD card for saving |
| 61 | No SD card |
| 62 | SD card: write error |
| 63 | SD card: read error |
| 65 | SD card: invalid format |
| 66 | SD card: load error |
| 70 | SD card: logger stopped |
| 82 | Lower limit |

| Code | Event |
|---|---|
| 83 | M1 limit value 1 (Gas) |
| 84 | M1 limit value 2 (Gas) |
| 85 | Lower limit |
| 86 | M2 limit value 1 (Gas) |
| 87 | M2 limit value 2 (Gas) |
| 90 | Dosage check |
| 92 | Digital input 1 „no water“ |
| 93 | Digital input 1 „level“ |
| 94 | Digital input 1 „External Stopp” |
| 95 | Digital input 1 switched (Gas) |
| 96 | Digital input 2 „no water“ |
| 97 | Digital input 2 „Behälter leer“ |
| 98 | Digital input 2 „External Stopp" |
| 99 | Digital input 2 switched (Gas) |
| 105 | Relay 3 (alarm relay) |
| 115 | mA 1 out of range |
| 116 | mA 2 out of range |
| 118 | Sensor test measuring input 1 (Gas) |
| 119 | Sensor test measuring input 2 (Gas) |
| 120 | Calibration |
| 121 | Start delay controller |
| 122 | Start delay cleaning |
| 123 | Cleaning |
| 124 | Cleaning – base load dosing |

**Note** **For events listed as „going“ in the eventlog, the numerical value is increased by 126.**

### *16.3.4. Instrument data*

Via the interface, all information on the instrument is available, including which add-ons are activated (read-only). Information on the measurement module and the add-ons are coded as 32-bit, refer to tables “Add-ons” and “Measurement module type”.

| Name | Register | Quantity of registers | Type | Bytes |
|---|---|---|---|---|
| Serial number | 1024 | 12 | string | 24 |
| Hardware version | 2464 | 4 | u_32 | 4 |
| Production date | 2448 | 4 | u_32 | 4 |
| Activated add-ons | 2128 | 4 | u_32 | 4 |
| Software version | 1056 | 10 | string | 20 |
| Operating hours | 2080 | 4 | u_32 | 4 |
| Measurement module | | | | |
| Type | 2088 | 4 | u_32 | 4 |
| Serial number | 4272 | 3 | u_16 | 2 |
| Software version | 4280 | 3 | u_16 | 2 |
| Hardware version | 4304 | 3 | u_16 | 2 |

**Table activated add-ons (register 2128)**

The add-ons are coded as 32-Bit value as follows:

| Bit number | Option |
|---|---|
| 17 | Add-on Second digital input |
| 18 | Add-on First analog output |
| 19 | Add-on Second analog output |
| 20 | Add-on Controller |
| 21 | Add-on volume based dosing |
| 22 | Add-on Modbus RTU |
| 24 | Add-on datalog |
| 25 | Add-on ASR® |

**Table measurement module type (register 2088)**

The measurement module type is coded as 32-Bit value as follows:

| Bit number | Option |
|---|---|
| 10 | Module pR |
| 11 | Module DIS |
| 12 | Module EC |
| 13 | Module EC IL |
| 14 | Module GAS |

### *16.3.5. How to read and write parameter settings*

Parameter registers are similar to the registers described above, but here you can change the settings via interface. Mind the ranges and the percentage-flag – if a variable is expressed as percentage of a range, a new value must also be expressed that way. Besides the percentage calculation, the range indicates what values are possible for a variable. Since the ranges can change according to settings or selections, the range has to be read prior to writing, to get the range, the percentage-flag setting, and the number of decimal places.

Text variables contain one character per register, in ASCII code. Mind the maximum text length.

**Note** **The parameters are listed in the order of their description in this manual, i.e. Code, Mode, IN/OUT, System, Alarm, and Add-ons. Mind that not all parameters listed are available in your instrument, according to settings and activated add-ons.**

| Digital inputs | 1. register | Quantity | Type | Bytes | Read/ write | range |
|---|---|---|---|---|---|---|
| Code | 2096 | 8 | u_32 | 4 | no | yes |
| Operation mode | 2240 | 3 | u_8 | 1 | yes | no |
| **Settings for the measurement:** | | | | | | |
| **Parameter: pR** | | | | | | |
| Buffer 1 | 4400 | 5 | i_16 | 2 | yes | yes |
| Buffer 2 | 4408 | 5 | i_16 | 2 | yes | yes |
| Internal buffer | 4416 | 5 | i_16 | 2 | yes | yes |
| Connection | 4336 | 3 | u_16 | 2 | yes | no |
| Measure | 4552 | 3 | u_8 | 1 | yes | no |
| Averaging | 4328 | 3 | u_16 | 2 | yes | no |
| **Parameter: DIS** | | | | | | |
| Measure | 4464 | 3 | u_16 | 2 | yes | no |
| Unit | 4616 | 3 | u_8 | 1 | yes | no |
| Measuring range | 4536 | 3 | u_16 | 2 | yes | no |
| Averaging | 4328 | 3 | u_16 | 2 | yes | no |
| Cleaning | 4624 | 5 | u_8 | 1 | yes | yes |
| Start time | 4632 | 4 | u_32 | 4 | yes | no |
| Start date | 4648 | 4 | u_32 | 4 | yes | no |
| Base-load | 4640 | 3 | u_8 | 1 | yes | no |
| **Parameter: EC and EC IL** | | | | | | |
| Measurement | 4464 | 3 | u_16 | 2 | yes | no |
| Measuring range | 4536 | 3 | u_16 | 2 | yes | no |
| Averaging | 4328 | 3 | u_16 | 2 | yes | no |
| C-value | 4664 | 5 | u_16 | 2 | yes | yes |
| TDS unit | 4616 | 3 | u_8 | 1 | yes | no |
| TDS factor | 4656 | 5 | u_16 | 2 | yes | yes |

| Digital inputs | 1. register | Quantity | Type | Bytes | Read/ write | range |
|---|---|---|---|---|---|---|
| **Parameter: GAS** | | | | | | |
| Measurement analog 1 | 4464 | 3 | u_16 | 2 | yes | no |
| Slope analog 1 | 4496 | 5 | u_16 | 2 | yes | yes |
| Sensor test analog 1 | 7544 | 5 | i_16 | 2 | yes | yes |
| Measurement analog 2 | 4688 | 3 | u_16 | 2 | yes | no |
| Slope analog 2 | 4504 | 5 | u_16 | 2 | yes | yes |
| Sensor test analog 2 | 7552 | 5 | i_16 | 2 | yes | yes |
| **Temperature compensation** | | | | | | |
| Mode | 4352 | 3 | u_16 | 2 | yes | no |
| Sensor type | 4360 | 3 | u_16 | 2 | yes | no |
| Reference temperature | 4376 | 5 | u_16 | 2 | yes | yes |
| Correction | 4384 | 5 | i_16 | 2 | yes | yes |
| Manual value | 4392 | 5 | i_16 | 2 | yes | yes |
| Temperature compensation | 4672 | 3 | u_16 | 2 | yes | no |
| Temperature coefficient (DIS / EC/EC IL) | 4472 | 5 | u_16 | 2 | yes | yes |
| **Digital inputs** | | | | | | |
| Dig. input 1 event | 6176 | 3 | u_8 | 1 | yes | no |
| Dig. input 1 contact | 6168 | 3 | u_8 | 1 | yes | no |
| Option: Add-on dig. input 2 event | 6208 | 3 | u_8 | 1 | yes | no |
| Option: Add-on dig. input 2 contact | 6200 | 3 | u_8 | 1 | yes | no |
| **System** | | | | | | |
| Language | 2200 | 3 | u_8 | 1 | yes | no |
| Time | 0 | 2 | u_32 | 4 | yes | no |
| Displaycontrast | 2208 | 3 | u_8 | 1 | yes | no |

| Digital inputs | 1. register | Quantity | Type | Bytes | Read/ write | range |
|---|---|---|---|---|---|---|
| Desktop design | 2216 | 3 | u_8 | 1 | yes | no |
| Autolock time | 2224 | 5 | u_8 | 1 | yes | yes |
| Eco-mode time | 2232 | 5 | u_8 | 1 | yes | yes |
| Text | 1216 | 10 | string | 50 | yes | no |
| Company | 1120 | 12 | string | 50 | yes | no |
| Name | 1152 | 12 | string | 50 | yes | no |
| Phone | 1184 | 12 | string | 50 | yes | no |
| **Alarm** | | | | | | |
| Lower limit | 6304 | 5 | i_16 | 2 | yes | yes |
| Upper limit | 6312 | 5 | i_16 | 2 | yes | yes |
| Gas: M1 limit value 1 | 7560 | 5 | i_16 | 2 | yes | yes |
| Gas: M1 limit value 2 | 7568 | 5 | i_16 | 2 | yes | yes |
| Gas: M2 limit value 1 | 7576 | 5 | i_16 | 2 | yes | yes |
| Gas: M2 limit value 2 | 7584 | 5 | i_16 | 2 | yes | yes |
| Alarm relay function | 6320 | 3 | u_8 | 1 | yes | no |
| Alarm delay | 6328 | 5 | u_16 | 2 | yes | yes |
| Gas: delay relay 1 | 7520 | 5 | u_16 | 2 | yes | yes |
| Gas: delay relay 2 | 7528 | 5 | u_16 | 2 | yes | yes |
| Gas: delay relay 3 | 7512 | 5 | u_16 | 2 | yes | yes |
| Alarm action | 6336 | 4 | u_32 | 4 | yes | no |

The alarm action list (register 6336) is coded as 32 Bit-value as follows:

| Bit number | Alarm action |
|---|---|
| 0 | Dig. input 1 / Gas: sensor error |
| 1 | Dig. input 2 / Gas: sensor error |
| 4 | Zeropoint |
| 5 | Slope |
| 6 | Overrange |
| 8 | Lower limit / Gas: limit value 1 |
| 9 | Upper limit / Gas: limit value 2 |
| 12 | Dosage check |

**Activated add-ons**

Register 2128 indicates which add-ons are activated, as recently described.

Dependent on that, some or all of the following parameters are available:

| Name | 1. register | Quantity | Type | Bytes | Read/ write | Range |
|---|---|---|---|---|---|---|
| **Add-on: datalog** | | | | | | |
| Interval | 6488 | 8 | u_32 | 4 | yes | yes |
| Mode | 6496 | 3 | u_8 | 1 | yes | no |
| Logparameter Meas. value / Gas: measured value 1 | 6504 | 3 | u_8 | 1 | yes | no |
| Logparameter Temperature / Gas: measured value 2 | 6512 | 3 | u_8 | 1 | yes | no |
| Logparameter Raw value | 6520 | 3 | u_8 | 1 | yes | no |
| Logparameter S1 | 7456 | 3 | u_8 | 1 | yes | no |
| Logparameter S2 | 7464 | 3 | u_8 | 1 | yes | no |
| Logparameter Flow | 7472 | 3 | u_8 | 1 | yes | no |

| Name | 1. register | Quantity | Type | Bytes | Read/ write | Range |
|---|---|---|---|---|---|---|
| **Add-on: analog outputs** | | | | | | |
| mA1 22mA alarm | 6368 | 3 | u_8 | 1 | yes | no |
| mA1 range | 6376 | 3 | u_8 | 1 | yes | no |
| mA1 assignment | 6384 | 3 | u_8 | 1 | yes | no |
| mA1 range min. | 6392 | 5 | i_16 | 2 | yes | yes |
| mA1 range max. | 6400 | 5 | i_16 | 2 | yes | yes |
| mA2 22mA alarm | 6432 | 3 | u_8 | 1 | yes | no |
| mA2 range | 6440 | 3 | u_8 | 1 | yes | no |
| mA2 assignment | 6448 | 3 | u_8 | 1 | yes | no |
| mA2 range min. | 6456 | 5 | i_16 | 2 | yes | yes |
| mA 2 range max. | 6464 | 5 | i_16 | 2 | yes | yes |
| **Add-on: Modbus RTU** | | | | | | |
| Bus address | 6608 | 5 | u_16 | 2 | no | yes |
| Bus termination | 6640 | 3 | u_8 | 1 | yes | no |
| **Add-on: controller** | | | | | | |
| Start delay | 6680 | 5 | u_16 | 2 | yes | yes |
| S1 control type | 6704 | 3 | u_8 | 1 | yes | no |
| S1 direction R1 | 6712 | 3 | u_8 | 1 | yes | no |
| S1 setpoint | pH: 6720<br>ORP: 7392<br>DIS : 7488<br>EC/EC IL: 7488 | 5 | i_16 | 2 | yes | yes |
| S1 hysteresis | pH: 6728<br>ORP: 7424 | 5 | i_16 | 2 | yes | yes |
| S1 p-range | pH: 6736<br>ORP: 7440 | 5 | i_16 | 2 | yes | yes |
| S1 integral time | 6744 | 5 | i_16 | 2 | yes | yes |
| S1 differential time | 6752 | 5 | i_16 | 2 | yes | yes |
| S1 dosage check | 6784 | 5 | u_16 | 2 | yes | yes |
| S1 pulse type | 6864 | 3 | u_8 | 1 | yes | no |
| S1 pulse-frequency | 6872 | 5 | u_16 | 2 | yes | yes |
| S1 pulse-pause | 6880 | 5 | u_16 | 2 | yes | yes |

| Name | 1. register | Quantity | Type | Bytes | Read/ write | Range |
|---|---|---|---|---|---|---|
| S1 pulse min | 6888 | 5 | u_16 | 2 | yes | yes |
| Rel. 1 on/off | 6904 | 3 | u_8 | 1 | yes | no |
| S1 motor run time | 6920 | 5 | u_16 | 2 | yes | yes |
| S2 control type | 6984 | 3 | u_8 | 1 | yes | no |
| S2 direction R2 | 6992 | 3 | u_8 | 1 | yes | no |
| S2 setpoint | pH: 7000<br>ORP: 7400<br>DIS: 7496<br>EC/EC IL: 7496 | 5 | i_16 | 2 | yes | yes |
| S2 hysteresis | pH: 7008<br>ORP: 7432 | 5 | i_16 | 2 | yes | yes |
| S2 p-range | pH: 7016<br>ORP: 7448 | 5 | i_16 | 2 | yes | yes |
| S2 integral time | 7024 | 5 | i_16 | 2 | yes | yes |
| S2 differential time | 7032 | 5 | i_16 | 2 | yes | yes |
| S2 dosage check | 7064 | 5 | u_16 | 2 | yes | yes |
| S2 pulse type | 7144 | 3 | u_8 | 1 | yes | no |
| S2 pulse-frequency | 7152 | 5 | u_16 | 2 | yes | yes |
| S2 pulse-pause | 7160 | 5 | u_16 | 2 | yes | yes |
| S2 pulse min | 7168 | 5 | u_16 | 2 | yes | yes |
| Rel. 2 on/off | 7184 | 3 | u_8 | 1 | yes | no |
| **Add-on: volume based dosing** | | | | | | |
| Dosage l/l (pR/LF) | 7256<br>(higher bits)<br>7257<br>(lower bits) | 8 | i_32 | 4 | yes | yes |
| Pulses | 7264 | 5 | u_16 | 2 | yes | yes |
| Pump output | 7280 | 5 | u_16 | 2 | yes | yes |
| Concentration (DES/Std) | 7288 | 5 | i_16 | 2 | yes | yes |
| Setpoint (DES/Std) | 7504 | 5 | i_16 | 2 | yes | yes |

| Name | 1. register | Quantity | Type | Bytes | Read/ write | Range |
|---|---|---|---|---|---|---|
| Circulation stop delay | 7312 | 5 | u_16 | 2 | yes | yes |
| Pulse type | 7320 | 3 | u_8 | 1 | yes | no |
| Pulse-frequency | 7336 | 5 | u_16 | 2 | yes | yes |
| Pulse-pause | 7344 | 5 | u_16 | 2 | yes | yes |
| Pulse min | 7352 | 5 | u_16 | 2 | yes | yes |
| Rel. 1 on/off | 6904 | 3 | u_8 | 1 | yes | no |
| Rel. 2 on/off | 7184 | 3 | u_8 | 1 | yes | no |

### *16.3.6. Units and texts*

The following table contains the codes of the units and texts of register 3 of the variables:

| Code | Unit |
|---|---|
| 1001 | °C |
| 1054 | s |
| 1058 | min |
| 1059 | h |
| 1211 | mA |
| 1243 | mV |
| 1283 | MOhm |
| 1302 | mS/cm |
| 1342 | % |
| 1353 | l/h |
| 1422 | pH |
| 1423 | ppm |
| 1552 | µS/cm |
| 1558 | mg/l |
| 1559 | µg/l |

| Code | Unit |
|---|---|
| 1660 | Times per week |
| 1662 | g/l |
| 1663 | cbm/h |
| 1664 | nA/ppm |
| 1993 | Pulses/h |
| 1994 | l/Pulse |
| 1995 | l/l |
| 1996 | – (no unit) |
| **Text as enumeration, variable value determines which text applies, starting with 0:** | |
| 3001 | NC / NO |
| 3002 | ON / OFF |
| 3003 | pH / mV |
| 3004 | Off / low / medium / high |
| 3005 | Coax / Triax |
| 3006 | PT100 / PT1000 |
| 3007 | Man / auto |
| 3008 | No water / level / ext. stopp<br>Gas: relay 1, relay 2, relay 3, relay 1 and relay 2, all relays |
| 3009 | normal |
| 3010 | 4-20 mA / 0-20 mA |
| 3011 | 20% / 40% / 60% / 80% / 100% |
| 3012 | ---- / default / SD card / contact / mA 1 / mA 2 / S1 / S2 / Relay / Flow |
| 3013 | Stop / Ring / OFF |
| 3014 | ON/OFF / P / PI / PID / 3point |
| 3015 | Pulse-pause / pulse-frequency |
| 3016 | Reduce / raise |
| 3017 | 1 = 0-1000 / 2= 0-5 / 4= 0-10 / 8= 0-20 / 16 = 0-30 |

| Code | Unit |
|---|---|
| 3018 | µg/l / mg/l / ppm |
| 3019 | Chlorine / Chlorine dioxide / Ozone / $H_2O_2$ |
| 3022 | no sensor, Chlorine, Chlorine dioxide, Ozone |
| 3023 | 0-20 mA, 4-20 mA, 0-2000 mV |
| **from here bit mask** | |
| 3802 | 0-9.999 mg/l, 0-99.99 mg/l, 0-999.9 mg/l,<br>0-9.999 ppm, 0-99.99 ppm, 0-999.9 ppm,<br>0-99.99 NTU, 0-999.9 NTU |
| 3803 | -,-,-,-,0-2.000 mS, 0-20.00 mS, 0-200.0 mS,<br>0-2000 mS, 0-9999 ppt, 0-9999 ppm, 0-9999 ppb |
| 3804 | 0-2.000 µS, 0-20.00 µS, 0-200.0 µS, 0-2000 µS ,<br>0-2.000 mS, 0-20.00 mS, 0-200.0 mS, 0-2000 mS,<br>0-9999 ppt, 0-9999 ppm, 0-9999 ppb |

### *16.3.7. Test functions*

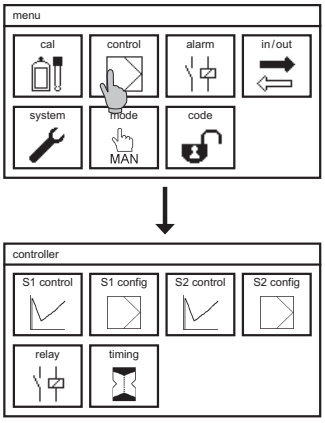
To test the installation, you can operate all relays and current outputs manually, provided that these add-ons are activated in your instrument, and define relay status and current values via interface as in the test menu.

With register Test mode you switch the test mode on and off.

| Name | 1. register | Quantity | Type | Bytes | Read/ write | Range |
|---|---|---|---|---|---|---|
| Test mode | 2152 | 3 | u_8 | 1 | yes | no |
| Relay 1 | 6552 | 3 | u_16 | 2 | yes | no |
| Relay 2 | 6576 | 3 | u_16 | 2 | yes | no |
| Relay 3 | 6600 | 3 | u_16 | 2 | yes | no |
| mA 1 | 6360 | 5 | u_16 | 2 | yes | yes |
| mA 2 | 6424 | 5 | u_16 | 2 | yes | yes |

# 17. Add-on Controller

The add-on Controller offers a concentration-based controller with two independently configurable control relays. When you activate the add-on, the main menu shows an additional symbol CONTROL.




In the main menu select the symbol CONTROL. In the CONTROL menu you find the following submenus:

S1/S2 CONTROL, in which you can define the set point, the controller type, and its corresponding parameters.

S1/S2 CONFIG, in which you define the controller output via the relays, i.e. pulse-pause or pulse-frequency.

In the submenu RELAY you define the acting direction, i. e. whether dosing should happen when the measured value is above or below the set point. In this menu you can also turn off relays if you want to use the current outputs as controller output.

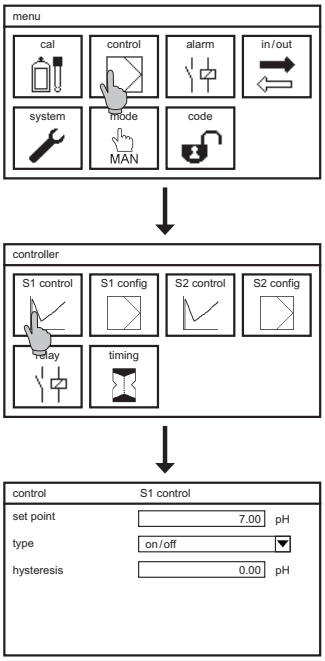
In the submenu TIMING you can define a start delay and dosage-check times.

## 17.1. S1/S2 control – set-point configuration

**Note** **S1 refers to relay 1, S2 to relay 2.**

**Note** **Although the description always refers to S1, the procedure for S2 is the same.**

**Note** **If S1 was configured as 3-point controller, S2 cannot be used, since relay 2 is used for S1.**




In the menu CONTROL select the symbol S1 CONTROL. Here you can set the following parameters:

**Set point**

Define which value the measured value should reach.

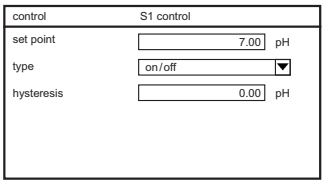
**Type**

Choose between on/off, P, PI, PID, and 3-point controller. This selection defines the parameters displayed in this menu and in CONFIG. Only those parameters relevant for the selected controller are shown.

**Note** **To help you with the configuration, Neon only shows those parameters relevant for your controller choice. Same for the CONFIG menu which shows only the required information.**

### *17.1.1. ON/OFF controller*

The ON/OFF controller doses with 100% until the measured value reaches the set point, and then stops.



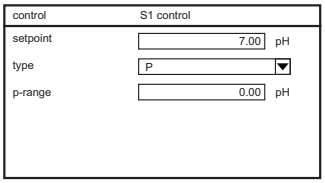

Besides set point and controller type you can set the following parameter:

**Hysteresis**

For the on/off controller you can define a hysteresis. This prevents constant switching of the relays in the vicinity of the set point – the relay switches only when the difference between set point and measured value exceeds half the hysteresis value.

### *17.1.2. P controller*

The P controller reduces the dosing when the difference between set point and measured value is smaller than the specified P range. Within the p range, the controller output is proportional to the remaining deviation. When the measured value reaches the set point, dosing stops.




Besides set point and controller type you can set the following parameters:

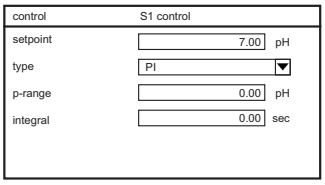
**P range**

The P range or proportional range is the range in which dosing is reduced proportional to the deviation between set point and measured value. The bigger the P range, the softer the control.

To find the ideal setting, start with a big P range and reduce it until the measured value oscillates around the set point in a stable manner. The ideal value is then twice the current value. If the measured value still oscillates, use a slightly higher value.

### *17.1.3. PI controller*

The PI controller is a P controller with additional I function. The I function sums up the previous dosing, so that the controller output drops to zero only after the measured value already exceeds the set point. This eliminates in applications with constant inflow the otherwise unavoidable control deviation.




Besides set point and controller type you can set the following parameters:

**P range**

For settings and information refer to P controller.

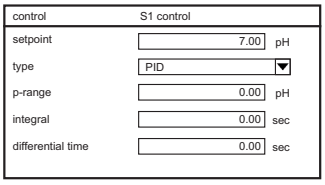
**Integral time**

The shorter the integral time, the stronger the I function.

Start by setting a P controller, then reduce the proportional range until the measured value fluctuates constantly around the set point. Measure the time between subsequent maximum measured values. The ideal P range is then 2.2times the current setting and the ideal integral time is 0.85 times the measured time between maximum values. If the measured value still oscillates set slightly higher values.

### *17.1.4. PID controller*

The PID controller is a PI controller with additional D function. The d function acts swifter and compensates the inertia of the I function. This allows the controller to react faster to large control deviations.




Besides set point and controller type you can set the following parameters:

**P range**

For settings and information refer to P controller.

**Integral time**

For settings and information refer to PI controller.

**Differential time**

The higher the differential time, the stronger the D function.

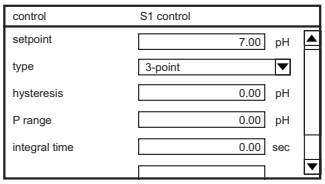
Start by setting a P controller, then reduce the proportional range until the measured value fluctuates constantly around the set point. Measure the time between subsequent maximum measured values. The ideal P range is then 1.66 times the current setting, the ideal integral time is 0.5 times and the ideal differential time 0.12 times the measured time between maximum values. If the measured value still oscillates set slightly higher values for P and I and slightly lower values for D..

### *17.1.5. 3-point controller*

**Note** **Set point S2 cannot be used when S1 is configured as 3-point controller.**

**Note** **Relay 1 is assigned to OPEN and relay 2 to CLOSE.**

The 3-point controller is used for actuators that have not only two states (ON and OFF) but three: OPEN, OFF, and CLOSE, such as motor-operated valves.




Besides set point and controller type you can set the following parameters:

**P range, integral time and differential time**

3-point controllers can be configured as PI or PID controller. Settings are the same as described above. If you set the differential time to zero, the controller type is PI.

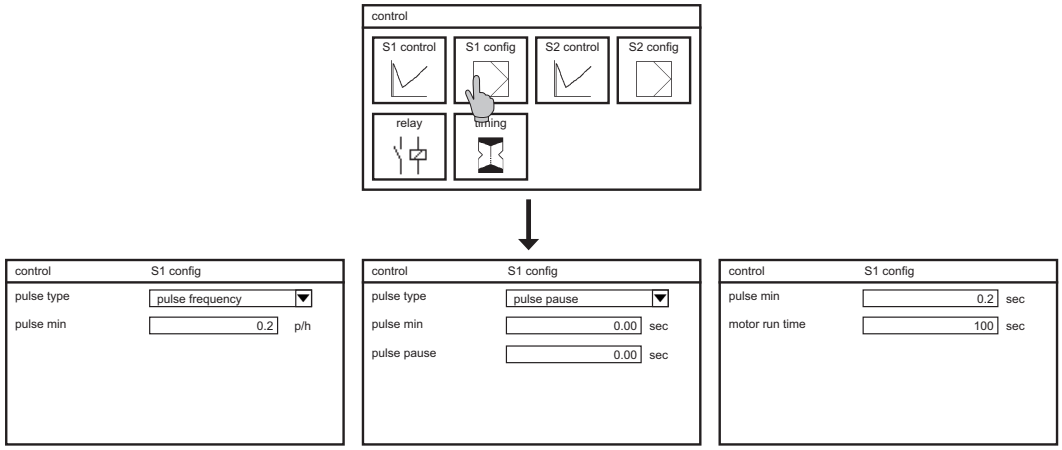
**Hysteresis**

For 3-point controllers you can define a hysteresis to prevent constant movement of the actuator in the vicinity of the set point. The relay switches only when the difference between set point and measured value exceeds half the hysteresis value.

## 17.2. S1/S2 CONFIG – configurating the controller output

**Note** **In this menu you define the controller output via relays. If you want to use an analog output as controller output, you can ignore the CONFIG menu. Instead, you have to assign the analog output to control variable S1 or S2 in the menu IN/OUT-> mA OUT. In that case you can shut off the relay completely in the menu CONTROL->RELAYS.**

In the menu CONTROL select the symbol S1 CONFIG. Depending on your choice of controller type, the CONFIG menu shows parameters for P /PI /PID or 3-point controller.




**Note** **To help you with the configuration, Neon® only shows those parameters relevant for your controller choice.**

**Note** **If you have selected an ON/OFF controller, no configuration is required, and you cannot access the CONFIG menu.**

### *17.2.1. CONFIG – pulse-pause or pulse-frequency for P/PI/PID*

Select the controller type P or PI or PID in the menu S1/S2 CONTROL. Enter the menu S1/S2 CONFIG and set the following parameters:

**Pulse type**

When using the relays to control actuators, proportional reduction can be achieved in two ways: via time frames in which the relay is ON (pulse) and OFF (pause) in relation to the controller output (pulse-pause controller) or via the switching frequency of the relay (pulse-frequency controller).

**Pulse min (only for pulse type = pulse pause)**

Define a minimum pulse, i.e. the minimum time the relay has to be on to allow the actuator to react.

**Pulse pause (only for pulse type = pulse pause)**

For a pulse-pause controller define as Pulse-Pause time a time-frame in which the relay is on (pulse) and off (pause) according to the control variable.

**Note** **The pulse-pause time must be at least twice as long as the minimum pulse.**

**Pulse frequency (only for pulse type= pulse frequency)**

Enter the frequency that corresponds to maximum dosing.

### *17.2.2. CONFIG – Motor run time and minimum pulse for 3-point controller*

Select the controller type 3-point controller in the menu S1 CONTROL. Enter the menu S1/S2 CONFIG and set the following parameters:

**Pulse min**

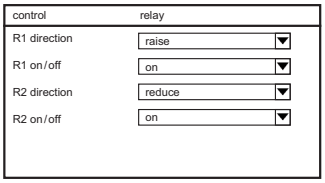
Define a minimum pulse, i. e. how long the relay has to be ON to allow the actuator to react.

**Motor run time**

To control a motor-operated valve, the instrument needs to know how long it takes the motor to completely open the valve when it had been completely closed.

Determine that time by closing the valve completely and then opening it in manual operation, or vice versa. This time is the motor run time.

## 17.3. Configuration of the relays




In the menu CONTROL select the symbol RELAYS. In the submenu you can define the following parameters:

**R1/R2 direction**

With this setting you define whether dosing occurs above or below the set point.

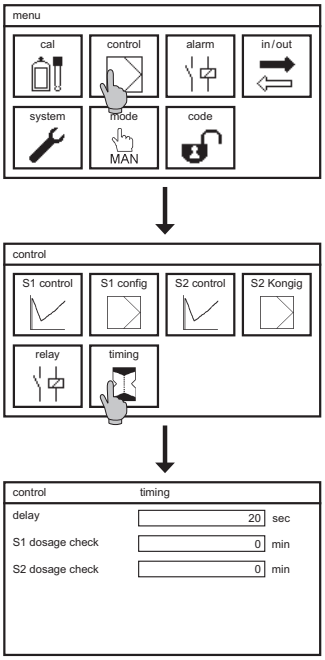
Select RAISE if the dosing increases the measured value. The controller doses whenever the measured value is lower than the set point.

Select REDUCE if the dosing decreases the measured value. The controller doses whenever the measured value is higher than the set point.

**R1/R2 on/off**

You can shut off the relays completely to prevent unnecessary wear and tear. This is useful if you use the analog outputs as controller output.

## 17.4. Start delay and dosage control




Select CONTROL in the main menu, and in the control menu the symbol TIMING. In this you can define three important times for the controller:

Delay

The delay is the time that has to pass after a controller stop before dosing starts. A controller stop happens when the power is cut off or as a result of certain events, for example the switching of a digital input. At the end of this chapter you will find a list of these events.

**Note** **Changing the operation mode does not activate the start delay.**

**Dosage check**

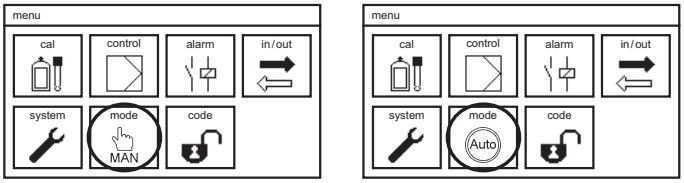
With the parameter dosage check you define how long the instrument may dose with 100% feed rate without raising alarm. If after that time the measured value still has not reached the set point or at least the P range, so that the controller output is still 100%, an alarm is issued and the controller is stopped. This is a safety measure to prevent the release of hazardous chemicals in case of damaged feed lines – if the dosing does not seem to have any effect, the reason might be that there is a leak somewhere and the chemicals do not reach the water.

**NOTE** **Dosage check alarm stops only the corresponding controller/set point. The other remains active.**

**NOTE** **If you set the time to 0 min, the function is deactivated for the corresponding controller.**

## 17.5. Activating and deactivating the controller

To activate or deactivate the controller you have to change the operation mode. You can change the mode in the main menu by pressing the symbol MODE. The symbol changes its design according to the selected mode.




In the AUTO mode the controller is active and operates the relays and/or current outputs and ultimately the connected actuators. Manual operation of the relays and current outputs via the test function is not possible.

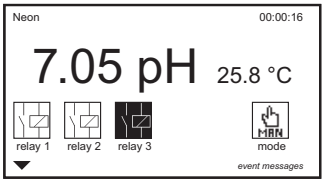
In the manual mode the controller is deactivated and you can operate the relays and current outputs manually via the test function.

In the maintenance mode – HOLD – the controller is deactivated.

**NOTE** **More information on the operation modes can be found in chapter 5 – Mode.**

## 17.6. Relay display and manual operation of the control relays

For control applications, we advise to use the desktop design “Relay” in the menu SYSTEM.




Below the measured values the configuration and status of the relays are displayed, and a button appears with which you can change the operation mode.

**Note** **More information on the various display designs can be found in chapter 12 – system functions.**

In the manual mode you can operate the relays manually. With touch screen instruments press the symbol of a relay to switch it. With instruments with key operation press key up until the desired relay is highlighted, then switch the relay with the OK key.

**Warning** **Manually activated relay remain activated until they are manually switched off or the operation mode is set to automatic!**

## 17.7. Automatic controller stop

The instrument provides various safety measures to recognize problems and to stop the dosing if no reliable measured values are available. Such situation occurs in case of the following events:

> If the measuring input or the temperature input receives no signal (no measured value available)
> If a digital input switches (no water, no reagent, or external controller stop – while the last option is not a problem it still means that the dosing has to be stopped)
> Dosage check (possible damage on the feed lines)

It is your responsibility to ensure through set-up and settings that all these safety features can work as planned and to check their proper function through regular tests! Also use the safety features that are not controller-related, such as the alarm relay, the limits, and the 22mA alarm current.

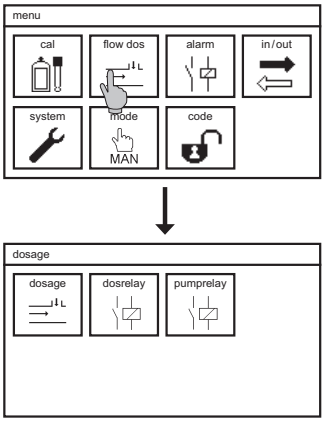
**WARNING** **In the AUTO mode the controller actuates the dosing of possibly hazardous chemicals! Check all connections, feed lines, and all settings before you activate the controller, and make sure that the control works properly before leaving the instrument!**

# 18. Add-on volume based dosing

The add-on volume based dosing offers a control version that is based on the volume and flow rate of the water that is to be treated. Relay 1 is used to operate the dosing pump. With relay 2 you can operate the circulation pump that provides water for the concentration measurement.

**Note** **It needs a flow meter that turns the flow rate into digital pulses, connected to the digital input 2. (NPN, max 180 Hz)**

If you have activated the add-on, the main menu shows the symbol DOSAGE.



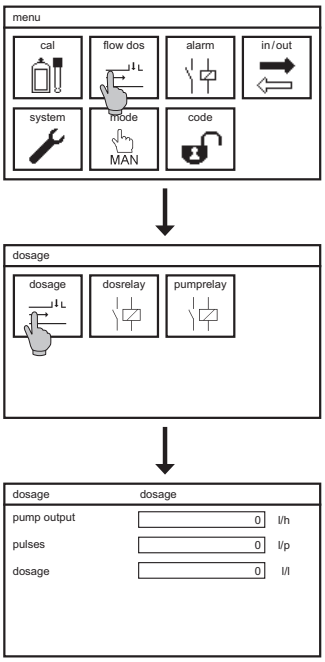

In the menu DOSAGE you will find the following submenus:

DOSAGE, where you define all parameters necessary to calculate the flow and the dosing volume.

DOSRELAY, where you define the output as pulse-pause or pulse-frequency.

PUMP RELAY, where you define parameters for your circulation pump.

## 18.1. Dosing parameters




In the DOSAGE menu select the symbol DOSAGE. Here you have to set the following parameters:

**Pump output**

Define how many liters per hour the pump feeds.

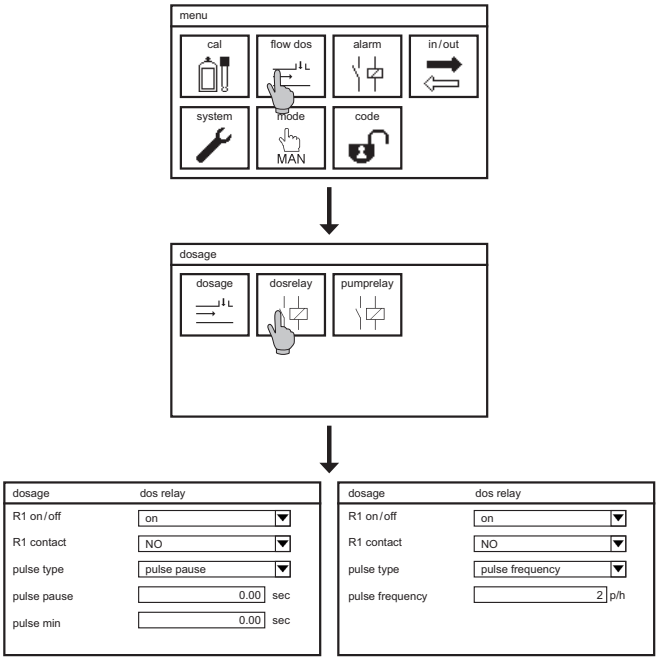
**Pulses**

Define how many pulses the flow meter gives per liter. This information allows the instrument to calculate and display the flow rate.

**Dosage**

Define how many liters of reagent should be dosed per liter of water. Based on this setting and the pump output the controller calculates how long or how fast the pulses must be to dose the proper amount of chemicals.

## 18.2. Configuration of the dosing relay




In the DOSAGE menu select the symbol DOS.RELAY.

**R1 on/off**

If you do not want to use the relay as controller output, you can switch it off completely.

**Relay 1 contact**

Relay 1 is a normally open contact. In the menu you can invert it so that it is actively closed. If you select NC (normally closed contact) the relay will open to dose and close to pause.

**Note** **To use an analog output as controller output you have to enter the mA menu in the IN/OUT menu and assign the mA output to control variable S1 or S2, respectively – see chapter analog output.**

**Warning** **If you invert the relay you must take precautions that the dosing is stopped in case of power interrupt! If the instrument does not get power, the relay will open, sending dosing pulses to the pump!**

**Pulse type**

The controller output via the relay can be realized in two ways: via time frames in which the relay is part-time ON and OFF (pulse-pause type), or via the switching frequency (pulse-frequency type).

**Pulse min (only for pulse type = pulse pause)**

Define a minimum pulse, i.e. the minimum time the relay has to be on to allow the actuator to react.

**Pulse pause (only for pulse type = pulse pause)**

For a pulse-pause controller define as Pulse-Pause time a time-frame in which the relay is on (pulse) and off (pause) according to the control variable.

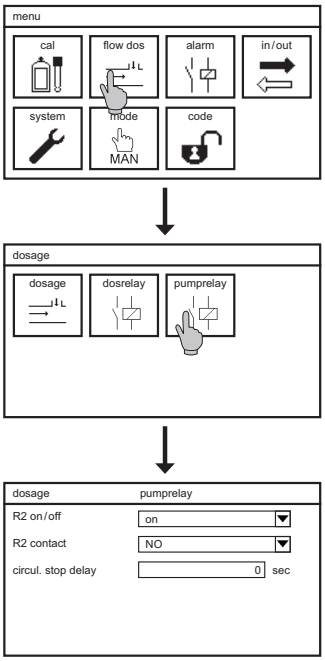
**Note** **The pulse-pause time must be at least twice as long as the minimum pulse.**

**Pulse frequency (only for pulse type= pulse frequency)**

Enter the frequency that corresponds to maximum dosing.

## 18.3. Pump relay

In applications with volume based dosing, the measuring point is usually installed in a bypass, and measuring water is supplied by a circulation pump. Via the pump relay you can switch off the pump if no water is available in the main pipe.




In the menu DOSAGE select the symbol PUMP RELAY.

**R2 on/off**

If you do not want to control the circulation pump with the relay, you can switch it off.

**Relay 2 contact**

Relay 2 is a normally open contact. In the menu you can invert it so that it is actively closed. If you select NC (normally closed contact) the relay will open to activate the pump and close to stop it.

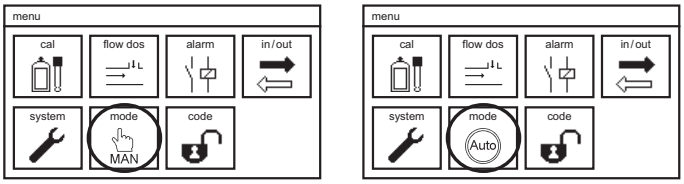
**Attention** **If you invert the relay and the instrument does not get power, the relay will open, turning on the circulation pump regardless of the water situation! In that case you have to take other precautions that the pump cannot run dry.**

**Circulation stop delay**

Here you can define how long the circulation pump should keep on running after the flow meter has indicated that the flow has stopped.

## 18.4. Activating and deactivating the controller

To activate or deactivate the controller you have to change the operation mode. You can change the mode in the main menu by selecting the symbol MODE. The symbol changes its design according to the selected mode.



In the AUTO mode the controller is active and operates the relays and/or current outputs and ultimately the connected actuators. Manual operation of the relays and current outputs via the test function is not possible.

In the manual mode the controller is deactivated and you can operate the relays and current outputs manually via the test function.

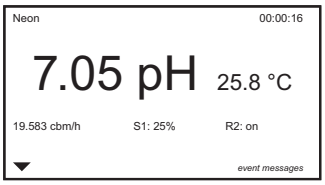
In the maintenance mode – HOLD – the controller is deactivated.

**NOTE** **More information on the operation modes can be found in chapter 5 – Mode. Durchflussanzeige**

## 18.5. Flow display

For applications with volume based dosing, we advise to use the desktop design “Flow” in the menu SYSTEM.

Below the measured values the flow rate, the controller output in % and the status of relay 2 are displayed.




**Note** **More information on the various display designs can be found in chapter 12 – system functions.**

## 18.6. Automatic dosage stop

Since the control is based on the flow measurement, the concentration measurement and the temperature measurement have no influence on the controller.

**Warning** **In the AUTO mode the controller actuates the dosing of possibly hazardous chemicals! Check all connections, feed lines, and all settings before you activate the controller, and make sure that the control works properly before leaving the instrument!**

Use all safety measures that the instrument provides, such as the alarm relay, the limits, the 22mA alarm current etc. We advise to take precautions that measurement-related events and limit alarms also lead to a dosing stop.

# 19. Operation and Maintenance of Neon® pR

## 19.1. Mode

Never carry out maintenance while the controller is set to automatic. Select either manual mode or Hold.

In the manual mode only the controller is deactivated. All other functions such as the alarm relay and the test functions are still active. This mode is ideally suited to test the wiring to your PLC and to check the alarm functions.

With Hold, all alarm functions are deactivated. This mode is ideally suited to carry out maintenance such as calibration without issuing an alarm. With Hold, the controller is deactivated, and all analog and digital outputs are frozen to the last value, in case you are using these outputs as inputs for an external control.

## 19.2. Maintenance of the measurement

Maintenance of the measurement comprises cleaning of the various components, regular testing of safety features and gaskets, regular exchange of consumables, and with pH the regular calibration of the measurement.

**Note** **Maintenance intervals depend on the application, the installation, the accuracy requirements etc.**

| Operation | Interval suggestion |
|---|---|
| Cleaning of sensors and assemblies | 2 weeks |
| Refilling the KCl vessel | Depends on vessel size |
| Cleaning of valves, filters, tubing etc. | 2 weeks |
| Calibration of the pH measurement | Weekly |
| Checking the gaskets | Weekly |
| Testing the safety features | 2 weeks |
| Exchange of consumables | Six months / yearly |

### *19.2.1. Cleaning of sensors*

Handle and clean sensors very carefully. Always use water and perhaps a soft paper tissue as the first cleaning agent. The pH-sensitive glass bulb of pH sensors is very thin and must not be mechanically damaged.

We recommend diluted hydrochloric acid to remove coatings of lime or hydroxides, and commercially available detergents to remove oil and grease. With organic coatings, hydrochloric acid with pepsine or thiourea is usually efficient, especially to open blocked junctions. Ceramic junctions can be cleaned mechanically, even abraded. Make sure not to scratch the glass membrane in the process.

Clean the metal electrodes of ORP sensors regulary to remove coatings and grease. Use commercially available detergents and rinse thoroughly with water. Mind that after cleaning, the measurement takes a while to recover. You can speed up the process by storing the sensor in KCl after cleaning.

### *19.2.2. Refilling the KCl vessel (with refillable sensors)*

When using refillable sensors, make sure that the level of the filling solution is always higher than the water level, and that the internal pressure is always slightly higher than the water pressure, to protect the sensor and to ensure its function.

Regular refilling of the vessel is especially important when the vessel is not visible, for example if it is installed in an immersion-type assembly.

**Note** **If due to neglected refilling, process water could enter the sensor, see the chapter “Trouble-shooting”.**

### *19.2.3. Cleaning of assemblies, filters, etc.*

An important part of maintenance is the cleaning of all parts that come in contact with the water. Besides the sensors, this includes assemblies, pipes and tubes, filters, flow meters, cocks, valves etc. Coatings, deposits, and biofilm can adulterate the measurement, impede the water flow and at worst even damage the sensor.

**Attention** **We recommend to use only water and perhaps a soft brush for cleaning. Many synthetic materials are affected by acids or organic solvents!**

### *19.2.4. Calibration of the pH measurement*

The response characteristics of pH sensors change over time, even without use, so the measurement has to be recalibrated at regular intervals.

The instrument checks the calibration results after calibration and displays an event message if the sensor has to be cleaned, regenerated, or replaced. Refer to Troubleshooting for more information.

### *19.2.5. Checking the gaskets*

Especially in pressurized applications all gaskets and sealing rings must be checked regularly and replaced at needs. Make sure to use only spare parts consistent with your application and your equipment. Check the proper placement before reapplying pressure!

### *19.2.6. Testing the safety features*

Regularly test all safety features, especially when using control functions. Check the function of water level or flow sensors and verify that the controller is automatically shut down in a low-water situation.

Simulate such an event by impeding the water flow temporarily or by lifting the level sensor out of the water. Switching of the level sensor or loss of the flow signal has to lead to the text message “low water” or “level” or “ext. controller stop” according to settings, and to an automatic controller stop.

Regularly test the function of the alarm relay and ensure that in case of an alarm, the instrument issues the alarm and the connected control center registers the alarm correctly. With the aid of the test menu, such test is easily accomplished.

**Note** **In the Hold mode, the alarm function is deactivated.**

### *19.2.7. Exchange of consumables*

Besides the sealing rings and the KCl solution, buffer solutions and sensors are typical consumables. Buffer solutions should always be kept cool and out of direct sunlight. Open bottles should not be stored for too long – alkaline solutions tend to absorb carbon dioxide from the air, and acidic solutions often contain organic acids, providing nutrients for microbiological growth.

Never put used solution back into the bottle. Nowadays a variety of single-use sachets with certified accuracy are available. These sealed sachets can be stored without changes over long periods of time and eliminate one of the mayor uncertainties in case of calibration problems.

The operating life of the sensor depends strongly on the application and the measuring conditions. The info menu of the calibration menu shows the results of the last 10 calibrations which gives you an idea on the condition of your sensor. If the slope and/or the zeropoint approach the tolerated limits, it can be expected that it will give a calibration error and has to be replaced in the near future.

If you have to exchange a sensor, make sure that the replacement fits your equipment and your application. Remember that you have to calibrate whenever you change a sensor!

Recalibration is also necessary if you exchange the instrument.

**Note** **Cables also tend to wear out, especially if they are frequently unplugged. Find more information in the “ Trouble-Shooting”**

## 19.3. Restarting

Restarting is to be carried out like the original start-up. Follow all steps described in this manual.

Before opening the water inlet, make sure that the flow is not impeded or interrupted anywhere. When using assemblies that can hold several sensors, make sure that all holders are occupied or closed with a blind. Make sure that all valves are in the right position (for example, inlet and outlet open, sampling point closed). Check that all screw connections are sealed tight before applying pressure.

pH measurements have to be calibrated at the beginning. Mind that the temperature has to match that of the buffer solutions by either placing the temperature sensor in the buffer or by setting the temperature manually.

After installing the sensors, wait until all measurements are stable, and check if the measured values are plausible, before activating the controller. Also check all settings, especially for controller and alarm, and make sure that the feed lines are properly connected and undamaged.

Use all safety features the instrument provides, such as the alarm relay, the limits, the dosage check, and the controller stop.

## 19.4. Decommissioning and disposal

If you want to take the measurement out of service for a while, mind the storage conditions listed in the data sheets, especially regarding temperatures. Store sensors always in solution, preferably in 3M KCl, never in deionized water or aggressive solutions. We advise to use for storage the protective covers in which the sensors were delivered. If you want to use other beakers, use plastic instead of glass to avoid damage to the glass membrane, and ensure that the storage solution always covers the junction.

Store instruments and cables in a cool, dry, and dark place, protected against dust.

If you want to dispose of the instrument permanently, mind that it contains electrical components that have to be disposed of following national directives.

## 19.5. Facilitating functions

### *19.5.1. Store and load settings via SD card*

You can store your settings on an SD card and reload them anytime to ensure that the settings are not lost during maintenance.

This function can also be used to duplicate settings into other instruments of the same type and parameter or to recover your settings after a software update or an upgrade via add-on. Additionally, you can do all settings comfortably on your PC, using the Kuntze configuration software, and then load the settings into the instrument via SD card. The configuration software is available free of charge.

### *19.5.2. Software-update via SD card*

With the SD card you can also install software updates. Copy the two software files you have received from us onto the SD card (not in a subdirectory). Plug the SD card in the instruments slot, and load the files via SYSTEM=>MEMORY=>LOAD=>SOFTWARE.

### *19.5.3. Test menu*

During start-up, or in case of an alarm in your control center inconsistent with the measured values, the test menu will help you test the communication between instrument and control center.

In the test menu you can operate all relays manually, and set fix values for each available mA output.

The test menu can only be used in the Manual mode. The test menu is a submenu of the menu IN/OUT.

# 20. Trouble-Shooting

In case of an event, the measuring instrument provides a variety of functions to assist you:

> Event messages on the display, declaring the nature of the event.

> An event help containing suggestions how to solve the problem.

> An event log that stores up to 100 event messages

> An info menu, showing all settings and current values

> A reset function to restore factory settings

> A diagnosis file in case that you need external help. The diagnosis file will allow your contact person to assess the situation.

## 20.1. Useful accessories for trouble-shooting

> PH-T: Our pH/mV simulator makes testing instruments and sensors easy, since you can use it to test sensors, check cables, and test instrument functions. On the next pages you will find detailed information on when and how to use the PH-T.

> Short-circuit wire: With pH meters, a simple wire bridge allows a simple test of the measuring input. If you short-circuit the terminals of the measuring input, the instrument will show 0mV or approx. pH 7, respectively. Attention: The pH value depends on the current calibration values! If you had last calibrated with an internal buffer of pH 2, for example, the displayed value will be approx. pH 2 instead of pH 7. However, the mV value will always be 0mV (+/-3mV).

> Spare sensor: Sensors are consumables, and fragile. Exchanging a sensor can speed up trouble-shooting: If the problem remains, it was probably not caused by the sensor. If it has vanished, the sensor needs to be replaced or at least cleaned and regenerated.

> Spare cable: Cables are frequently causing trouble – damaged contacts or insulations lead to malfunctions very similar to those caused by sensor defects. With a spare cable, such malfunctions can easily be identified and solved.

> Spare buffer solutions: If a buffer solution does not have the pH value that it is supposed to have, you can waste a lot of time on fruitless tests of all measuring components. Such deviations can for example be caused by absorption of carbon dioxide from the air, or by immersing a sensor without rinsing it off first. Nowadays, a variety of buffers are available as single-use sachets. They can be stored until needed and pack quite small.

> ORP buffer: For ORP sensors, buffer solutions are available as well. They are used just like pH buffers – when you immerse the sensor, the reading should be that indicated on the buffer bottle. Attention: ORP buffers can be very aggressive and can dissolve or damage plastic materials!

## 20.2. Contact

In SYSTEM=>CONTACT you can store contact data of a contact person who might help in case of problems. With restricted access (code 0202) this data can be viewed if not altered.

**Note** **You can have the contact data displayed on the desktop, if you select "contact" as desktop design in the menu SYSTEM=>DISPLAY.**

## 20.3. Diagnosis file

In case of problems, it might be useful to provide an external contact person with an overview of the current situation. To that purpose save the diagnosis file on your SD card. It contains all current values and settings and the eventlog.

## 20.4. Info

The Menu SYSTEM=>INFO contains all information on your instrument, the settings, and the current values, such as:

**ID**

Here you can find the instrument number, the software versions, and the operation hours. This information is important for repair, updates, etc.

**Eventlog**

The eventlog lists up to 100 events with the times of their appearance and disappearance. Further details are supplied on the following pages.

**Settings**

This menu lists all settings. In case of trouble, check if all settings are as you had intended, and check if the instruments behavior is consistent with the settings. If for example the alarm relay is not activated when the measured value drops below the lower limit, this might be because you have not activated the lower limit as an alarm action in the alarm action list.

**View**

This menu shows all current values of analog and digital inputs and outputs, including the raw signals of the sensors. The later are invaluable for trouble-shooting since they are not affected by any user settings such as calibration, temperature compensation etc. If for example you get a slope error after calibration, even though the raw signals of the sensor were plausible, then the problem might well be a defective or missing temperature measurement, and an exchange of the pH sensor would be quite useless.

The raw data is also especially useful if the instrument has been hopelessly miscalibrated.

The information on mA output values and status of the digital inputs help locating communication problems with the control center. mA values can be measured at the terminals of the instrument with an amperemeter.

**Note** **The mA outputs and the second digital input are add-ons. They are displayed only if the functions have been activated.**

## 20.5. Event messages

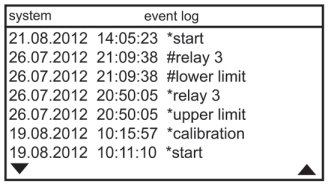
In case of trouble, the instrument displays an event message on the desktop. If there are more than one message, they are displayed alternately.

Not all events will cause the alarm relay to switch. For many events you can decide for yourself if the relay should switch by defining the event as an alarm action in the alarm action list – see Alarm relay.

## 20.6. Eventlog

Up to 100 events are saved in an eventlog. The *-sign indicates appearance, the #-sign disappearance. Besides the event messages, this also lists power interrupts, calibrations, and similar operations, with date and time.

This helps to interpret events – for example a deviation of the measured value shortly after a power interrupt may simply be due to the unfinished polarization of the measurement.




The eventlog provides information on frequency and duration of events. You can see what events have occurred in the past, and how long they lasted. The appearance and disappearance times allow to check what other events had happened at that time, for example the start-up of a dosing pump, frequency inverter, etc.

**Note** **You can save the eventlog by saving the diagnosis file.**

## 20.7. Event help

As an addition, the instrument provides help for all events: information on possible causes, and suggestions for possible remedies. These can be found in the menu SYSTEM=>EVENT, or – with touch screen instruments – by touching the event message on the desktop.

We advise to follow the suggestions in the order in which they are presented.

| Event message | Cause | Suggested remedies |
|---|---|---|
| Zeropoint | After calibration, the zeropoint was not within -60…60mV | Check settings buffer/internal buffer; repeat calibration<br>Change reference electrode/ change sensor |

If you get a zeropoint error, the zeropoint after calibration did not fit your calibration settings. This might simply be because the settings did not correspond to the buffers or the sensor that you used.

**Note** **The internal buffer is the buffer filled into the pH-glass bulb. The pH of this buffer represents the zeropoint of your sensor. You can find the pH of the internal buffer printed on the sensor, whenever it is not pH 7.**

If all settings were correct, the problem might still be caused by one of the solutions, if it does not have the expected pH. If you have a spare buffer at hand, you can check if it gives the same results.

With a zeropoint error, the menu SYSTEM=>INFO=>VIEW is helpful, since it displays the raw signal of the sensor, unaffected by the current calibration. The raw signal is displayed in mV. If the internal buffer is pH 7, then a calibration buffer of pH 7 should yield a signal around 0 mV. Deviations of less than 1 pH (approx. 60mV) are tolerated.

**Checking the zeropoint with the PH-T**

The raw sensor signal can be checked using the PH-T: Connect the sensor to the cable of the PH-T and set the PH-T to M2/mV read-out. Immerse the sensor in a buffer solution corresponding to the zeropoint of the sensor, usually pH7. The PH-T shows the sensor signal as mV, the value should be within -60…+60mV. Since you are now using a different instrument and a different cable, a comparison between the signals displayed by the instrument with those displayed by the PH-T helps to determine whether the problem lies with the sensor or with the cable or instrument.

If the signals found with the PH-T are fine, then you can use the PH-T to check the instrument and the original cable: Use the BNC/COAX adapter and connect the PH-T to the pH cable of the instrument as if it were a sensor. Set it to M1/mV output and the value to 0mV. Now the instrument should read 0mV (+/-3mV). If not, repeat with a different cable. Use more mV values to check the response of the instrument.

If the error is not caused by the instrument or the cable, it might be caused by the sensor. This might be due to a worn-out or poisoned reference or due to a worn-out or coated pH-membrane. Check the glass bulb and the reference, especially the junction and the reference element, for damages or discoloration. Clean the sensor if necessary. See Maintenance of the measurement. Check that the

bulb and the reference are filled with liquids. Gently shake the sensor to make sure that all filling solutions collect at the bottom of the sensor and that any captured air rises to the top.

It might help if you heat the sensor with hot tap water and let it cool immersed in 3M KCl (the filling solution of the protective cover the sensor was delivered in). This cleans the junction and fills it with salt to ensure a good electrical connection between measuring and reference electrode.

With refillable sensors, a high zero-point error occurs if the level of the filling solution dropped below the water level, and process water could enter the sensor. If the sensor still looks normal, it is worth the trouble to empty and refill it with fresh 3M KCl solution. Wait 24h and then check the zeropoint again.

If all your efforts did not lead to an improvement, you will have to exchange the sensor.

| Event message | Cause | Suggested remedies |
|---|---|---|
| Slope | After calibration, the slope was not within 50…65mV/pH | Check buffers,<br>check temperature<br>repeat calibration<br>change sensor |

Here again the problem might be caused by an improper or spoiled buffer. Furthermore, the slope depends on temperature – at low temperatures it is smaller than at high temperatures. Therefore, an improperly set temperature compensation or a defective temperature sensor will lead to a slope error.

As with the zeropoint, the raw signal of the sensor helps interprete slope problems. The sensor emits 50-60mV per pH at room temperature. If you keep in mind that pH 7 is your zeropoint, giving 0mV, then each pH unit that you move away from pH 7 will give you 50-60mV – positive for acidic solutions, negative for alkaline solutions. In buffer pH 4 for example you should find approx- 150-180mV more than in buffer pH 7. If you divide the difference between the two mV readings by three (the pHdiffference of the two buffers), you will get the slope of the sensor– uninfluenced by temperature compensation or any previous calibration.

***Example::***

| | |
|---|---|
| *In pH 7* | *12mV* |
| *In pH 4* | *186mV* |
| *Difference* | *186-12 = 174mV* |
| *pH difference* | *7-4 = 3* |
| *Slope 1* | *74 / 3 = 58 mV/pH* |

**Note** **Slope error might also occur if you have neglected to pay attention to the temperature influence on the pH values of the calibration buffers – see Calibration – settings.**

A low slope can also be the result of contact problems, or more accurately if the insulation is not as high as it has to be. Damaged cable insulations, or water inside the connector, or worse, inside the instrument, can cause signal loss. These possibilities can be checked with the PH-T. Besides the functions described so far it provides a high-impedance test, during which the displayed values will change dramatically if there is any problem with the insulation.

**High-impedance test with PH-T**

Connect the PH-T to the pH cable of the instrument like a sensor. Select the function M1 / mV output, and set the output to approx. 180mV. Enter the menu SYSTEM=>INFO=>VIEW to see if the instrument displays this value +/-5mV. Activate the high-impedance test of the PH-T by pressing the key MOhm, and see if the value displayed by the instrument drops dramatically. If it does not, instrument and cable are probably okay.

**Note** **The high-impedance test consumes a lot of energy. Deactivate the test after some seconds.**

If these causes can be ruled out, then the focus turns towards the sensor, especially towards the pH-membrane which might be coated or worn out. Check it for discoloration and damages, and clean it if necessary. Information on sensor cleaning can be found in the “Maintenance of the measurement”.

Some pH glasses can be reactivated with aggressive solutions such as acids. However, this should only be done by trained personnel.

If cleaning or regeneration did not improve the results, you will have to exchange the sensor.

**Note** **Zeropoint and slope error messages will remain until a new calibration yields values within the tolerances – or until somebody resets all settings to factory settings.**

**Note** **If the instrument issues a calibration error (zeropoint or slope), check the INFO menu in the calibration menu. It lists the results of the last calibrations with date and time and helps determine whether the current results are following a general trend or if the current results differ greatly from previous results, making a damage or some calibration error more likely.**

| Event message | Cause | Suggested remedies |
|---|---|---|
| Check measuring input 1 | The measuring input receives no proper signal | Check sensor plug, check cable, check sensor |

This message appears if the measuring circuit is interrupted.

Here again the cause may be quite simple – the connector might not be properly plugged to the sensor, or the wires of the cable might not be properly screwed into the terminals. The cable might be broken somewhere, typically at the uninsulated ends. You can check the cable with a common multimeter and cable and measuring input of the instrument with the PH-T.

**Testing the input with the PH-T**

Connect the PH-T with the BNC/Coax adapter to the pH cable of the instrument, as if it were a sensor. Select the function M1/ mV output, and check if the mV values you set with the PH-T are properly recorded by the instrument in the menu SYSTEM=>INFO=>VIEW. Deviations up to 5mV are irrelevant. If you find large deviations, repeat the test with a different cable. Also check if the signal changes abruptly if the cable is gently moved in the vicinity of the sensor head.

If all tests turn out well, the problem is probably located at the sensor. The simplest explanation is that the sensor is not sufficiently immersed. Make sure that the sensor is immersed at least so that the junction is completely covered.

With refillable sensors, the measuring circuit is interrupted if the level of the filling solution drops below the reference element or, with double-chamber sensors, below the internal junction. In that case refill the sensor and remove any air bubbles within the internal junction by gently shaking the sensor.

The easiest way to check if a sensor is defective is to connect another sensor or the pH-T to the instrument to see if it shows the same results. If the measurement works fine with the other sensor, check the contact in the original sensor´s connector and open the spring parts of the central pin slightly and carefully to ensure good contact to the cable.

If the problem lies with the sensor but not with the connector, try to clean the junction to open it up in case it is blocked. Ceramic junctions can even be abraded. If you heat the sensor under hot tap water and let it cool in 3M KCl, the junction fills with salt solution to give good contact via the junction.

Check for air bubbles inside the sensor – any bubbles in the area of the junction and the glass bulb have to be removed. Shake the sensor gently to make the bubbles rise to the top of the sensor so that the bottom part of both measuring and reference electrode are completely filled with liquid.

If all these measures do not solve the problem, the sensor has to be exchanged.

If the sensor is no older than six months, we strongly advise to send it in for examination. If the examination shows a defect that you could not have caused, you will receive a replacement free of charge, and if not, then at least you will know the cause of the trouble and be able to prevent a repetition.

| Event message | Cause | Suggested remedies |
|---|---|---|
| Check temperature input | The temperature input receives no proper signal | Check Pt100/Pt1000<br>Check cable<br>Without sensor use manual compensation |

If the temperature input does not receive an appropriate signal, you may have selected automatic temperature compensation although no temperature sensor is connected. In that case switch to manual compensation. It is also possible that a Pt100 was connected but the compensation was set to Pt1000, or vice versa.

If you have connected a Pt100 or Pt1000, check if you have used the right terminals for connection and the right settings in the temperature menu.

As with the measuring input, a defective cable or sensor can be the cause for this message. You can check temperature sensors with an Ohmmeter – a Pt100 has a resistance of approx. 109 Ohm at room temperature, a Pt1000 approx 1080 Ohm.

| Event message | Cause | Suggested remedies |
|---|---|---|
| Out of measuring range | Measured values exceed the measuring range | Trend indication only |

If the measured value lies outside the measuring range but can still be processed by the instrument, it will be displayed together with this message. Please note that all information on accuracy, linearity, influences of temperature etc specified in the data sheets, only apply to values within the measuring range. Outside this range, the deviations and cross-influences might be higher, and the measurement can only be used as an indication.

If your instrument allows to select from a variety of measuring ranges, select the next higher range.

If the measured value gets so high that it can no longer be processed, the message „check measuring input" will appear.

| Event message | Cause | Suggested remedies |
|---|---|---|
| Upper limit (or lower limit, respectively) | The measured value is higher than the upper limit (or lower than the lower limit, respectively) | Check dosage<br>check controller parameters<br>keep in mind delay settings |

If the measured value exceeds the limits, this might mean that the feeding of control chemicals has been interrupted, because a reagent is empty, or the controller was stopped, or a feed line is damaged.

**Warning** **If this message was caused by a defective feed line, hazardous chemicals might leak from the break!**

**Note** **In that case a second message „dosage check" is probably displayed, if you have activated this function and your controller settings do not impede the function.**

If the message occurs shortly after start-up and possibly quite frequently, please check the settings for control and limits to make sure that they match both each other and the requirements and conditions of your equipment. Perhaps the controller has to be set to slower reactions by choosing a larger proportional range to prevent overdosing.

**Note** **Temporary limit exceedance that might happen regularly during normal operation can be ignored by setting a delay time in the menu Alarm relay.**

| Event message | Cause | Suggested remedies |
|---|---|---|
| Digital input 1<br>Low water<br>Level<br>Ext. controller stop | The digital input was closed by a connected sensor or switch | Digital input 1 / low water:<br>check water flow,<br>check sensor/connection<br>Digital input 1 / level:<br>check container level,<br>check sensor/connection |

The digital input allows connection of a flow sensor or level sensor or an external switch. According to its intended function, you can assign the digital input one of three different texts: „Low water“ if you have connected a flow or water level sensor, „level“, if you use a level sensor to control the level of a chemical, or „ext. controller stop“, if you use an external switch to activate and deactivate the controller.

**Note** **Independent of what text you have selected, the controller is automatically shut down whenever the digital input switches.**

Depending on these settings, the suggested remedies differ: If you have selected „low water“ or „level“, the instrument suggests checking the availability of water or reagent, and if that is ok, the proper function of the flow or level sensor.

**Note** **If you have activated a second digital input, this will lead to similar messages, starting with „digital input 2“.**

Further messages with activated add-ons:

| Event message | Cause | Suggested remedies |
|---|---|---|
| mA out of range | The current measured value corresponds to an output outside the 0(4)-20mA range | Check settings |

This message appears if the measured value is higher than the one assigned to 20mA or lower than the one assigned to 0/4mA.

***Example:***
*You have set the mA output to pH 2-12. The output is 0(4)mA at pH 2, and 20mA at pH12. If your measured value is pH 12.8, this message will appear.*

Check the settings for the analog outputs, and change the settings if necessary.

| Event message | Cause | Suggested remedies |
|---|---|---|
| Dosage check | Controller ouput was 100% for longer than the specified time | Check dosing, especially feed lines and pump |

Dosage check is a safety measure to shut down the controller in case of defective feed lines to prevent leaks of hazardous chemicals.

The instrument monitors the time of dosing with 100% controller output – if you are using the instruments controller and have activated this function by setting the time to a value >0. If within that time the controller output does not go below 100%, the instrument shuts down the controller, stops the dosing, and displays this message.

So if you read this message on the display, you have to expect problems with the feed lines, including the release of dangerous chemicals!

**Warning** **The dosage check monitors only those times when the controller is dosing with 100%! If your proportional range is higher than the maximum possible difference between set point and measured value, this condition can never be met!**

Finally, there are some event messages indicating fundamental problems that you cannot solve on site:

| Event message | Cause | Suggested remedies |
|---|---|---|
| Communication error | The internal communication between instrument parts does not work | Contact your supplier |
| Unknown measurement module | The measurement module does not fit the instrument or does not work properly | Contact your supplier |

If such a message appears, the instrument has to be sent in for repair.

## 20.8. Events with Popup messages

In some events, a window pops up, displaying a message. Take note of its contents and follow the instruction. To close the window, you have to acknowledge with OK.

| Popup message | Cause | Suggested remedies |
|---|---|---|
| Check measuring input | Calibration without measuring signal. | No measuring signal, check measuring input and rerun calibration with valid signals. |

If you try to calibrate while the event message „check measuring input" ist displayed and the measured value shows ?, this message appears. Without valid measuring signal calibration is not possible. Check the sensor connection, that the sensor is immersed in the buffer up to the junction and that it is not damaged.

Rerun calibration only when the event message and the question marks have disappeared.

| Popup message | Cause | Suggested remedies |
|---|---|---|
| Check temperature input | Calibration without temperature signal. | No temperature signal, check temperature input or switch to manual temperature. |

If you try to calibrate while the event message „check temperature input" ist displayed and the temperature shows ?, this message appears. Without valid temperature signal calibration is not possible. Check the sensor connection, that the right sensor type was set and that it is not damaged.

Rerun calibration only when the event message and the question marks have disappeared.

Or switch to manual temperature compensation.

| Popup message | Cause | Suggested remedies |
|---|---|---|
| SD card error | The instrument cannot use the SD card | No SD card<br>Invalid format<br>Invalid file<br>SD card full |

Check if an industry-standard SD card has been plugged into the slot, and that it was plugged properly. If you want to load settings or update files, check that the files are available on the SD card directly and not in a subfolder. Delete and restore the files, if necessary. If you want to store settings on the SD card, check if there is enough storage space left on the card.

This message appears also if you remove the card without deactivating the logger first.

| Popup message | Cause | Suggested remedies |
|---|---|---|
| No appli | The software files cannot be loaded | Please renew the 2 data files on the SD card and try again. |

For updates, both files have to be stored on the SD card, not in a subfolder. Check that the files are available, and delete and restore them if necessary.

| Popup message | Cause | Suggested remedies |
|---|---|---|
| Memory stop data logging | The SD card is fulll. | SD card full, data logging stopped. |

If you have set the logger to STOP mode, then the instrument stops the logging when the SD card is full.

Change the SD card, or remove some of its contents, or select the mode RING to overwrite older data.

| Popup message | Cause | Suggested remedies |
|---|---|---|
| check batterie | No or empty batterie | Change batterie |

After start-up the instrument checks the batterie. If the batterie is missing or provides to low voltage a popup is shown. In this case please change the batterie.

## 20.9. Reset

As a last resort it is sometimes necessary to restore factory settings. With the RESET function you erase all settings by operators. Activated add-ons will of course remain activated.

With the Reset function, the system is set to a defined condition. User settings that might severely impede an evaluation of the measured values, such as a calibration gone wrong, are erased.

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