Operation manual

Krypton K Multi

Measuring system for monitoring and control of the concentration of free Chlorine
and pH with integrated temperature measurement and flow monitor, optionally with ORP measurement

DR. A. KUNTZE

GUTES WASSER MIT SYSTEM

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Contents

1. Your Krypton K Multi

is a product by Dr.A. Kuntze GmbH, Germany that offers high quality and reliability for years.

The system is delivered ready-to-use, all mounted on a board. It is pre-calibrated, so you will receive approximate measured values immediately after installation. Installation and measurement conditions are taken into account by on-site calibration - for pH with two buffer solutions, for Chlorine with a 1-point reference method. The system contains a temperature measurement for compensation and pH compensation for the Chlorine measurement. Optionally an ORP measurement can be added.

Krypton K Multi is equipped with our Automatic Cleaning function ASR for the Chlorine sensor. The patented electrochemical cleaning function prevents coatings of lime, rust, or grease, and drastically reduces maintenance requirements.

The Krypton´s instrument K 400 has two integrated controllers for Chlorine and pH with a priority function for the pH controller, to ensure that pH is adusted prior to Chlorine dosing. The working direction for the pH controller can be selected via menu.

The instrument contains three control relays with terminals for separate power supply as controller outputs. You can define a turn-on delay to prevent wrong dosage after power failure, and activate the controllers by remote control. A flow monitor will stop the controllers automatically in a low water situation. A third digital inputs allows connection of a level switch to shut off the dosing if the dosing chemicals are empty. Activate dosing control to get an alarm if dosage achieves no results, indicating damages in the feeding lines.

Let´s not forget the alarm function with minimum and maximum limit and turn-on delay...

You have certainly made a good choice. On the following pages you learn more about your Krypton K Multi. If, however, you have further questions or are looking for information not included in this manual or if you are interested in supplementing products like sensors or armatures or in our other instrument series, just give us a call - we will be delighted to help you!

1.1 General and Safety instructions

This manual applies to the following instruments:

Instrument and type	Revision date
Krypton K Multi	12 /10

It contains technical information for the installation, start-up and maintenance. If you have any questions not included in this manual please contact your supplier or the official representative of Dr. A. Kuntze GmbH in your country.

We would like to point out that the warranties specified in our general trading conditions are valid only if

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

Please check for damages immediately after receiving the instruments and report any damages within 24 hours to the delivering company. Never work with a damaged instrument.

Keep this manual at a safe place where you can always look up the safety instructions and the informations on handling and usage. According to DIN 61010 the manual is part of the product and must be maintained as long as the instrument is used, and given to the next owner if the instrument is sold.

This instrument was designed and built according to the safety measures for electronic devices and has left our company in perfect working condition. To preserve this condition and to ensure safe usage follow all instructions carefully and pay special attention to all warnings issued in this manual. If the instrument is visibly damaged or has been stored inappropriately or if there are any doubts concerning safe usage, shut it down and make sure it cannot be restarted by accident.

You will notice that important safety instructions are highlighted:

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

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

NOTE **is used to highlight interesting details.**

1.2 Application

Krypton K Multi systems are used to measure the concentration of free Chlorine, pH, ORP (optionally), and temperature in water. They have two integrated controllers with two set points each, assigned to the Chlorine and pH measurement. With these you can control actuators such as dosing pumps or valves to add chemicals until the desired concentration and pH are reached and maintained.

Applications are water treatment and disinfection.

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

For safety measures, both the measurement and the calibration are checked for failure. Failures are indicated in the display and via the alarm relay, which can set off a horn or lamp or relate to a central control. If that failure makes control unreliable, the controller is automatically switched off until the failure has been taken care off.

CAUTION **The instrument checks the input signals, the calibration results, and the water flow. 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.**

1.3 Intended use

Use these instruments only for monitoring and control of free Chlorine concentration and pH in water. Observe the specified measuring conditions, especially pH, flow, pressure, and temperature. Use only sensors, fittings, and accessories of Dr. A. Kuntze, since instruments and sensors are attuned.

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

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

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

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

1.4 Features

Measurement

Measuring ranges	0.00 ... 4.00 mg/l free Chlorine 0.00 ... 14.00 pH -1500 ... +1500 mV ORP (option) -30.0 ... +140.0 °C
Display	Measured values with dimension Status display sensors, calibration, controller & alarm
Temperature compensation	manual or automatic with Pt100
Calibration Chlorine	1-point calibration; zero-point-calibration possible
Calibration pH	2-point calibration with automatic recognition of buffers
ASR interval	1/day, 2/day, every 3 days, every 7 days, OFF

Controllers - for Cl2 and pH

Set points	2 set points, for pH with adjustable direction
Controller types	ON/OFF controller with hysteresis P controller as Pulse-Pause-, Impulse-Frequency- or steady controller PI controller as Pulse-Pause-, Impulse-Frequency- or steady controller for Chlorine also 3-point controller to operate a servo motor priority function for pH controller
Hysteresis	ajustable within the measuring range
P range X_P	adjustable within the measuring range
Integral time T_N	0 - 2000 sec.
Least pulse	0.1 - 9.9 sec.
Pulse+Pause time	02 - 99 sec.
Impulse frequency	100 - 7200 pulses/h
Turn-on delay	0 - 200 sec.
Dosage check	0 - 90 min
Alarm function	min. and max. limit and onset delay

Connections

Relays	3 potential-free contacts with terminals for power supply, 6 A, 250 V, max. 550 VA, 1 potential-free contact for alarm
Analog outputs (option)	4x 0/4-20 mA galvanically isolated, for Cl2, pH, ORP, and temperature max. loading 500 Ohm
Analog inputs	4 measuring inputs for Cl_2, pH, ORP (option), and temperature
Digital inputs	3x for ext. controller stop, level switch, and low water indication
Serial interface (Option)	RS485, Baud rate 9600, data formate 8Bit, 1start and 1stop bit, no parity
Water inlet/outlet	with stop-cocks and tube connectors DN6/8, filter on the inlet side
Sampling point	stopcock with hose nozzle

1.5 Technical data

Feature	Description
Dimensions	395 x 700 x 100 mm (W x H x D)
Weight	5.6 kg
Terminals	spring terminals max. 1.5mm2
Protection class	IP 65
Power supply	85 .. 256 V AC or DC
Internal fuse	1 A HRC
Fuse for the relays	6.3 A HRC
Power consumption	22 VA
Display	LCD, 2-line, 4x16 characters, illuminated background
Current outputs (option)	4x 0/4-20 mA, galvanically isolated, max. loading 500 Ohm
Interface (option)	RS485, Baud rate 9600, Data formate 8Bit, 1 Start / 1 Stop bit
Contact rating	6 A/ 250 V, max. 550 VA resistive load (with RC protective circuit)
Operation temperature	0 - 50°C
Storage temperature	-20 - 65°C (sensors: 0-30°C)
Humidity	max. 90% at 40°C non-condensing
Measuring conditions	flow rate 30 .. 200 l/h constant water pressure max. 6 bar water temperature 0 .. 50°C pH 6 .. 8 conductivity min. 200 microS/cm

1.6 Declaration of conformity

EC Declaration of Conformity

DR. A. KUNTZE
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ISO 9001

Hereby we declare that our instruments:

K 400

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

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

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

Applied standards:

- EN 61000 6-1(3), VDE 0839 Part 6-1(3): 2002 (residential environment)
- EN 61000 6-2(4), VDE 0839 Part 6-2(4): 2006 (industrial environment)
- EN 61326-1: 2006, VDE 0843-20-1: 2006 Electrical equipment for measurment, control and laboratory use- EMC requirements
- EN 61010-1 :2002-08 Safety requirements for electrical equipment for measurement, control, and laboratory use

Meerbusch, 07.04.2009

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

CE

2. Installation and connections

The measuring system is delivered ready-to-use. All you have to do is mount it on a suitable wall, install the sensors, and connect the water inlet and outlet. The positions of the sensors are shown on the next page.

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

Mind the protection class: IP65

ATTENTION Some sensors are delivered with protective covers to keep the sensor tips wet. Remove these before mouting them in the flow cell.

Connections:

You will find a detailed connection diagram on the following pages.

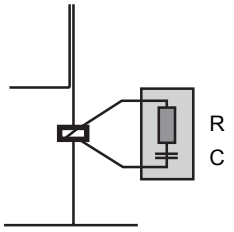
Before connecting the power supply check the information on the instrument label.

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

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

To protect the measurements against inferferences use only the special cables delivered for each measurement.

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

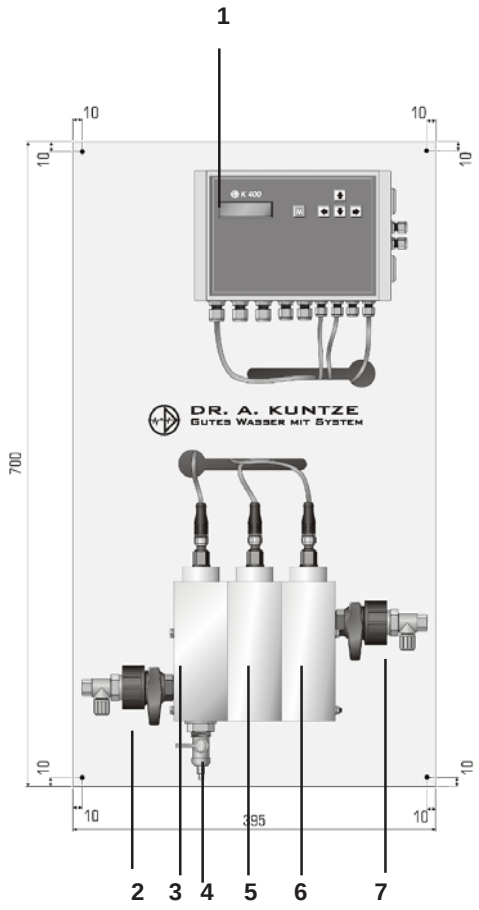


Current up to	capacitance C	resistance R
60 mA	10 nF 260 V	390 Ohm 2 Watt
70 mA	47 nF 260 V	22 Ohm 2 Watt
150 mA	100 nF 260 V	47 Ohm 2 Watt
1,0 A	220 nF 260 V	47 Ohm 2 Watt

Tube connections:

Connect the water inlet on the left side and the outlet on the right side of the flow cell. Water must be supplied at 30-200l/h with a constant flow rate. The outlet can be an open outlet, pressureless, or the water can be redirected into a pipe or basin.

2.1 Set-up



1	measuring and control instrument K 400 Cl2/pH/Rx/T
2	inlet with stopcock
3	Flow/temperatrue sensor
4	sampling point
5	pH sensor
6	Chlorine sensor
7	outlet with stopcock

Installed sensors:

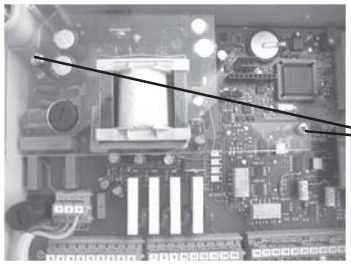
Flow/temperature	PT-55-W
Chlorine	AuAu-600-OO-2-1-PG
pH	AH-300-K-2-1-PG
ORP	Pt-500-O-PG (option)

ATTENTION **Some sensors are delivered with protective covers to keep the sensor tips wet. Remove these before mouting them in the flow cell.**

2.2 Installation of the optional mA board

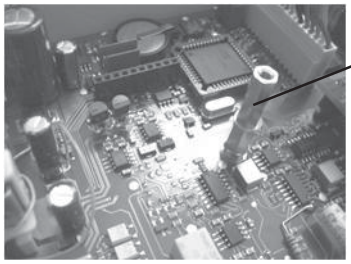
CAUTION **Switch off the instrument prior to opening!**

Remove the cover strips on the left and right side, unscrew the screws and open the instrument.



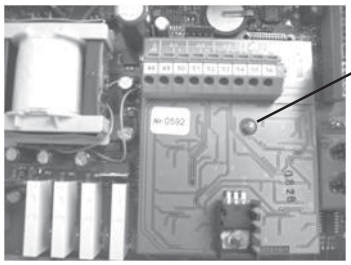
The mA board can be installed approx. in the middle of the instrument, next to the transformer.

Unscrew the two screws that hold the transparent cover and remove the cover.



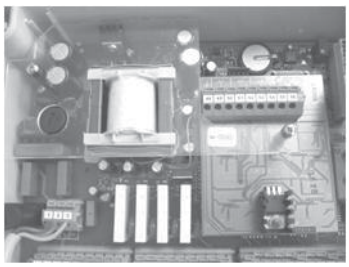
Unscrew the upper part of the hexagon distance bolt and take off the plastic ring beneath it.

Install the mA board with the 10-pin connector in the black 10-pin socket of the main board. Mind that the pins do not get bent or broken.



The hexagon distance bolt appears through the hole in the mA board.

Place first the plastic ring on the bolt and then screw the upper distance bolt back on.

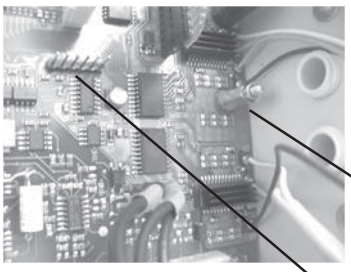


Reinstall the transparent cover and fix it with the two screws.

2.3 Installation of the RS board

CAUTION **Switch off the instrument prior to opening!**

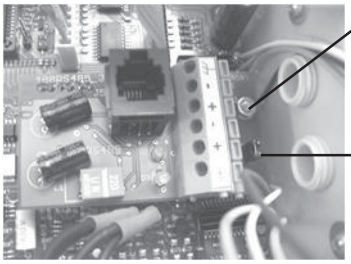
Remove the cover strips on the left and right side, unscrew the shrews and open the instrument.



The RS board is installed on the right side of the instrument.

Unscrew the nut from the hexagon distance bolt and take of f the plastic ring.

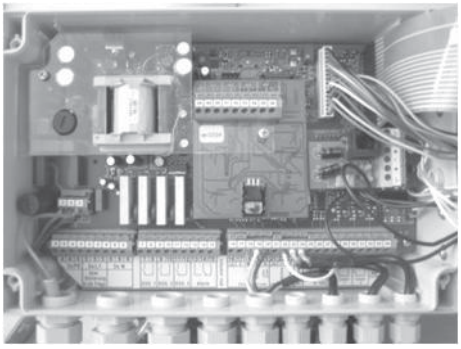
Install the RS board with the 6-pin socket over the 6-pin plug of the main board. Mind that the pins do not get bent or broken.



The hexagon distance bolt appears through the hole in the mA board.

Place first the plastic ring on the bolt and then screw the nut back on.

RS boards are delivered with a jumper that activates the terminating resistance. It should remain only in the first and the last instrument of a bus system. Remove it from all other instruments.

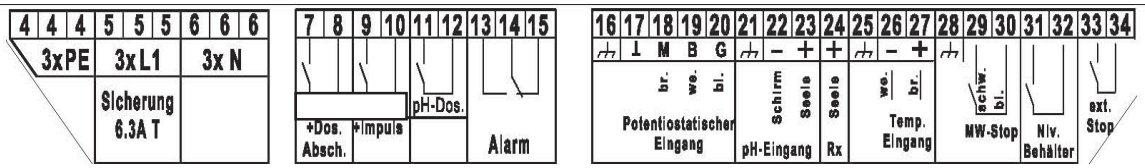


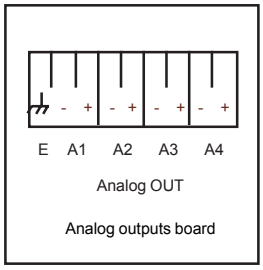
With both cards installed, the instrument looks like this.

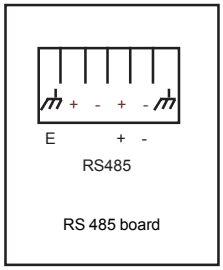
Do not forget to reinstall the transparent cover.

Close the instrument, screw it tight, and replace the cover strips.

2.2 Connection diagram







Connection	terminals	notes
Chlorine sensor	17 - 20	17 = screen 18 = Measuring electrode, brown 19 = Reference electrode, white 20 = Counter electrode, blue
pH sensor	22 + 23	22 = Reference electrode = screen 23 = Measuring electrode = core
ORP sensor (option)	24	24 = Measuring electrode = core
flow/temp. sensor	26 + 27 29 + 30	Pt100, brown + white flow sensor, black + blue
Relay 1	7 + 8	only with 3-point controller: Chlorine motor close
Relay 2	9 + 10	Chlorine motor open or Chlorine dosing
Relay 3	11 + 12	pH dosing
Alarm relay	13 - 15	13 + 14 = NO, 14 + 15 = NC contact
flow monitor	29 + 30	refer to flow/temp. sensor
level switch	31 + 32	digital contact, potential-free
ext. controller stop	33 + 34	digital contact, potential-free
Power supply	1 - 3	See information on instrument label!
Analog outputs board (option):		
Analog output 1	A1 +/-	Measured value Chlorine
Analog output 2	A2 +/-	Measured value pH
Analog output 3	A3 +/-	Measured value ORP (option)
Analog output 4	A4 +/-	Measured value Temperature
At works-settings. All outputs can be assigned to any measurement or controller.		
RS 485 board (option):		
Bus connection	+/-	two times, interconnected

2.3 Installation procedure

Mount the board on a suitable wall. Keep the water pipes going to the flow cell as short as possible.

NOTE **For good control results the measured water has to be representative for the water that is to be controlled. Do not place the measurement directly after the injection points, make sure that the chemicals had time to mix porperly with the water and keep all distances short to reduce delay times.**

Take the sensors out of their boxes and remove the protective caps. Mount the sensors in the appointed slots - flow/temperature left, ORP back, pH front, Chlorine right, and connect the cables according to their labels.

NOTE **To help you find the right places for the sensors: You can recognise Chlorine sensors by the twin Gold rings, ORP sensors by their single ring or pin, and pH sensors by their glass bulb. The flow/temperature sensor is much smaller than the other sensors.**

CAUTION **If no ORP sensor is installed, a plug must be installed instead.**

Connect the water inlet and outlet. Make sure that the outlet valve is open and the stop-cock at the bottom of the flow cell is closed.

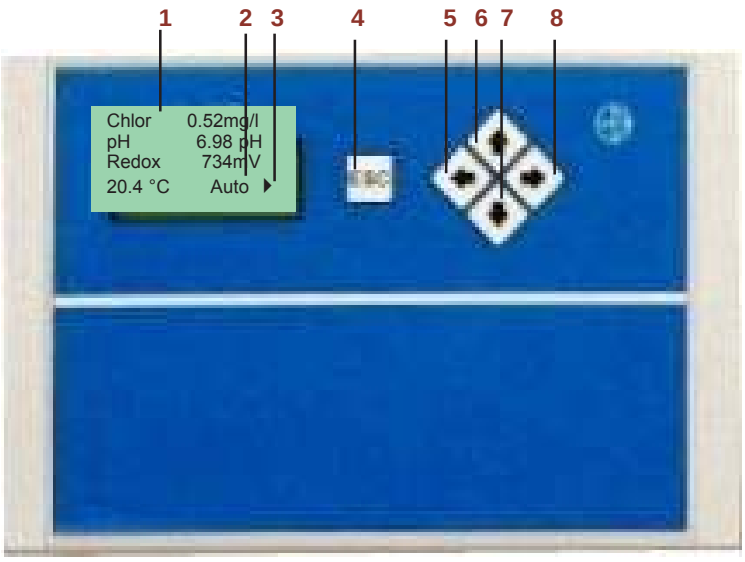
Open the inlet valve slowly until the water flows through the flow cell with the desired flow rate.

Switch on the power supply for the instrument..

Wait a few minutes until all readings are stable.

For calibration and settings follow the steps described in this manual.

3. Operation of the instrument



1	Measured values
2	status controller AUTO: controller ON MAN : controller OFF (manual operation of the relays)
3	Orientation aids
4	Key „Escape“
7	Key left (◂)
8	Key up (▴)
9	Key down (▾)
10	Key right (▸)

When turned on the instrument shows the measured values together with the controller mode (Man/Auto).

With five membrane keys you can move within the menu:

With key ▾ you enter the main menu.

With keys ▴ and ▾ you move up and down in the menu.

With key ▸ you adress a menu or parameter.

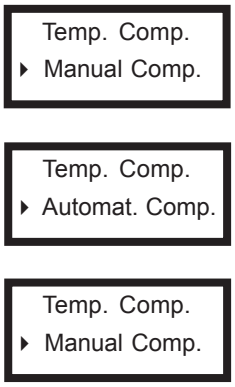
With key ◂ you leave a menu or store a change.

For your convenience triangles in the display indicate the directions you can take from your position in the menu.

From the display of the measured values you can switch the controller ON and OFF with key ▸ in the order: AUTO ▸ HOLD ▸ MAN ▸ AUTO.

With key „ESC“ you get back to the display of the measured values from any point in the menu. Changes that have not been stored will be lost.

3.1 How to adjust parameters



1) When you adress a parameter the actual setting is displayed.

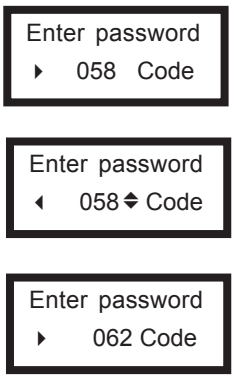
2) Switch to the next alternative setting with key ▸ .

3) When you have come to the last alternative, pressing the key once more will bring you back to the start.

Selection between alternatives

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

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



1) Adress the parameter with key ▸ .

2) A double triangle appears behind the number indicating that the number can be changed now with keys ▲ and ▼ .

3) Store the new value with key ◂ . The double triangle disappears - the new value is stored.

Adjustment of numerical parameters

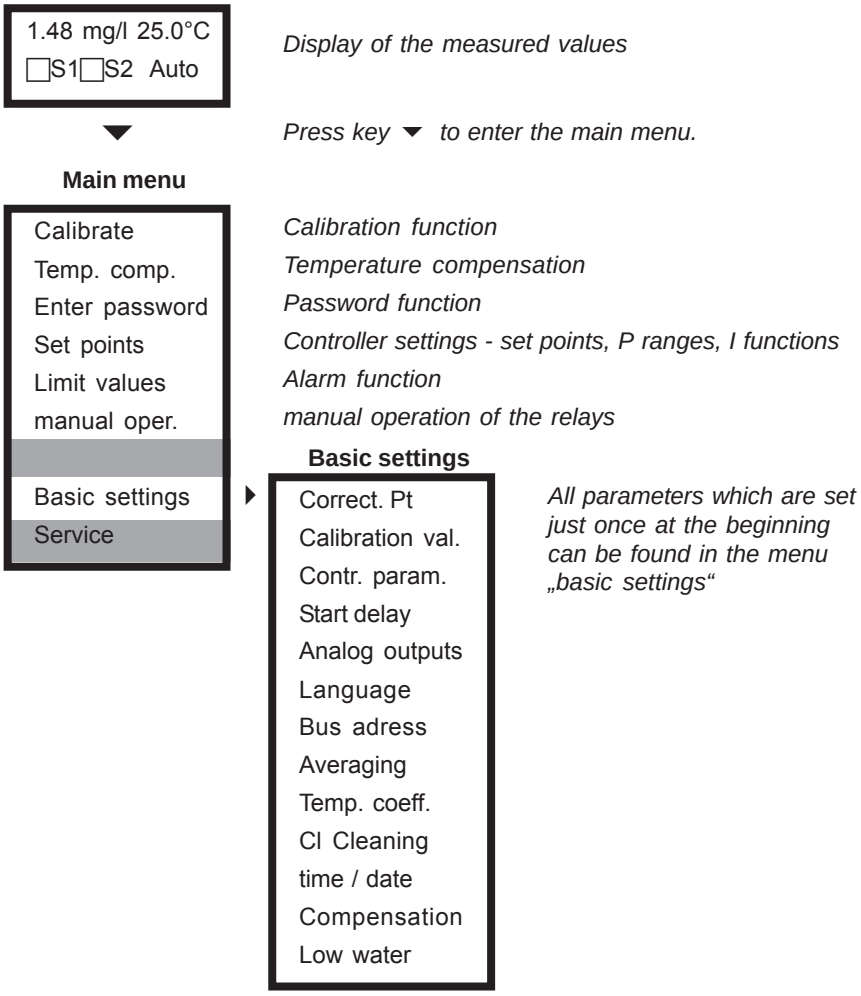
Numerical parameters can only be altered when a double triangle is visible behind the number. This double triangle appears when you adress the parameter with key ▸ .

Adjust the parameter with keys ▲ and ▼ . A short pressure on the key changes the last decimal by 1. If you keep the key pressed, the value will continue changing until the pressure is released.

Store the changes with key ◂ . The double triangle disappears.

NOTE **If you do not want to store the change, press key „ESC“ instead of key ◂ .**

3.2 Menu overview



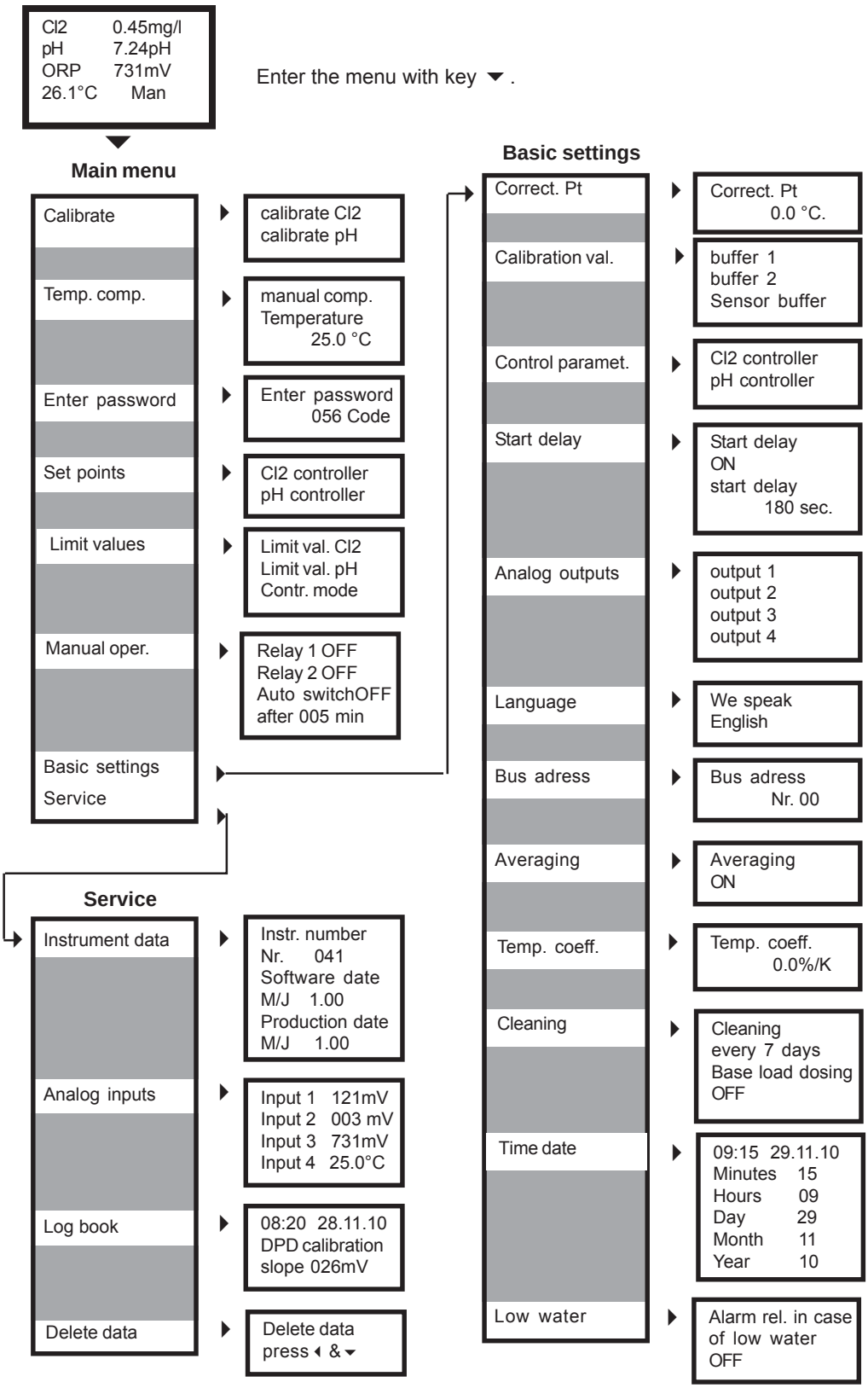
Main menu and basic settings

The parameters are sorted into two menus: In the main menu you will find all functions which are used regularly, such as calibration. The menu basic settings contains all parameters which are set just once during start-up.

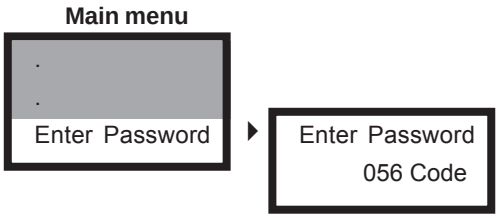
On the following pages you will find information on how to adjust parameters and which parameters you need for which application, in the following order:

1) General adjustments: password, language, and time / date
2) Adjustments for measurement: calibration, temperature compensation, pH compensation, averaging,and cleaning
3) Adjustments of the controller: selection of the controller version and corresponding parameters
4) Adjustments to read out data: analog, digitally and/or as alarm

3.3 Menu overview



4. Code,language, date, and time



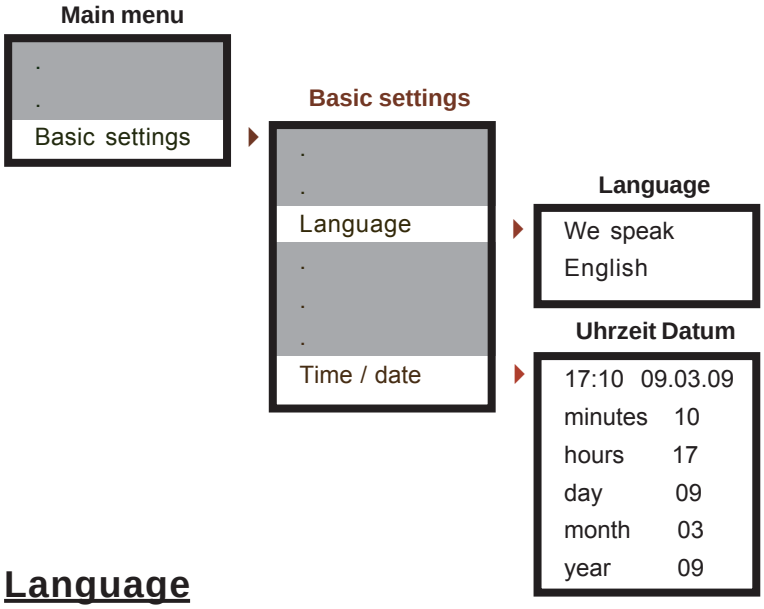
Enter password

To get access to the various parameters you have to enter the correct password:

Code 11 gives access to the parameters of the main menu.

Code 86 gives access to all parameters and functions.

With any other number it is impossible to select, view or change any parameter.



Language

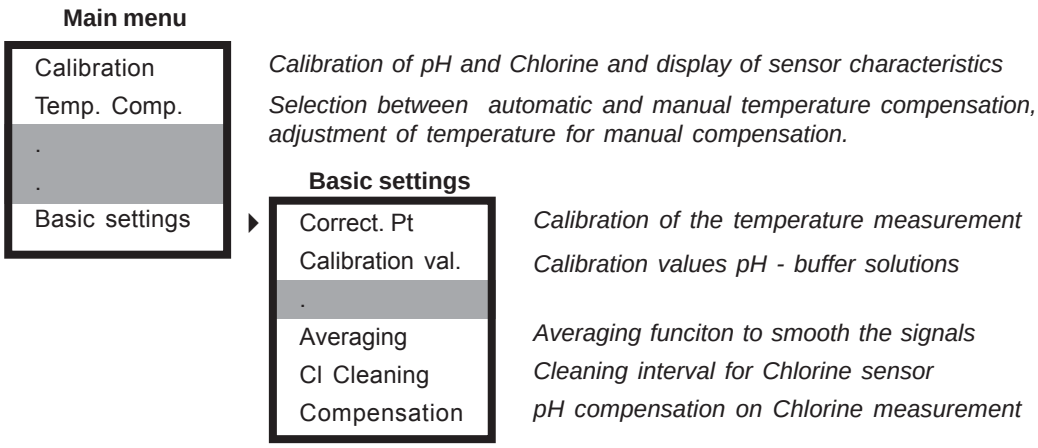
For the communication with the instrument you can choose from a variety of languages.

Since choosing a language is part of the basic settings, it requires code 86. If a different code is set, you will be asked to enter the correct password.

Time and date

The internal clock is used to time the automatic cleaning function. Cleaning always starts at 0:00h. Date and time are used for the internal log book which you find in the service menu.

5. Adjustments for measurement



The Chlorine measurement and the pH measurement need calibration to take into account the current measuring conditions and the sensor characteristics. For the pH sensor, calibration consists of measuring two buffer solutions of known pH. For Chlorine, a single-point calibration is sufficient:

Since the measurement depends upon the flow-rate and calibration solutions would not be stable anyway, the sensor cannot be taken out of the assembly for calibration, as is done with pH sensors. Instead the actual concentration of the test water is determined by an alternative method, for example photometrically with DPD, and this value is entered as calibration value.

Both measurements are influenced by temperature. This influence can be compensated manually or automatically. For manual compensation the temperature is entered manually, for automatic compensation temperature has to be measured with a temperature sensor.

With the averaging function you can smooth the signals, if necessary.

Krypton K OEM is equipped with our patented Automatic Sensor Cleaning ASR. This cleans the gold electrodes of the Chlorine sensors automatically. You can select the cleaning intervals via menu.

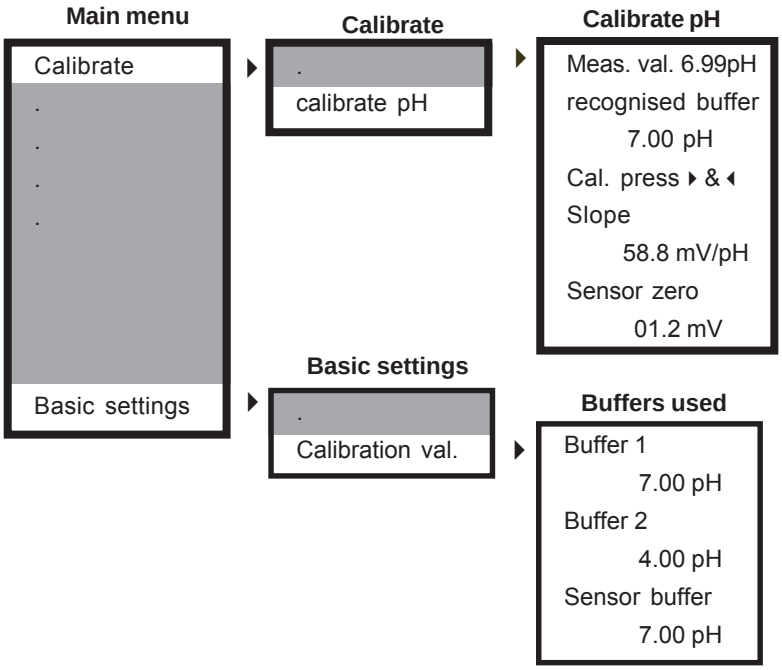
ORP (option)

If you have chosen an additional ORP measurement, the ORP values will be displayed in the main display, but the operation does not change. There are no additional adjustments for ORP. It needs no calibration nor temperature compensation.

NOTE **Since the reference of the pH sensor is used for ORP, too, changes in the reference are determined during the pH calibration and subsequently used for the ORP measurement, as well.**

NOTE **When the pH sensor is taken out of the assembly for calibration, the connection between ORP sensor and refence is interrupted, and the instrument shows „error input 3“. The message disappears automatically when the pH sensor is installed again.**

5.1 Calibration of the pH measurement



Calibration procedure

1) Switch the controller OFF and select manual temperature compensation. Enter the temperature of the calibration solutions.

2) Immerse the electrode in one of the calibration solutions. Wait until the measured value is stable, then calibrate by pressing keys ◂ and - while still applying pressure - additionally key ▾. The pH of the calibration solution is now displayed as measured value.

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

4) Check the slope and sensor zero-point, then put the electrode back into the assembly. Select automatic temperature compensation and switch ON the controller.

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

Calibration values

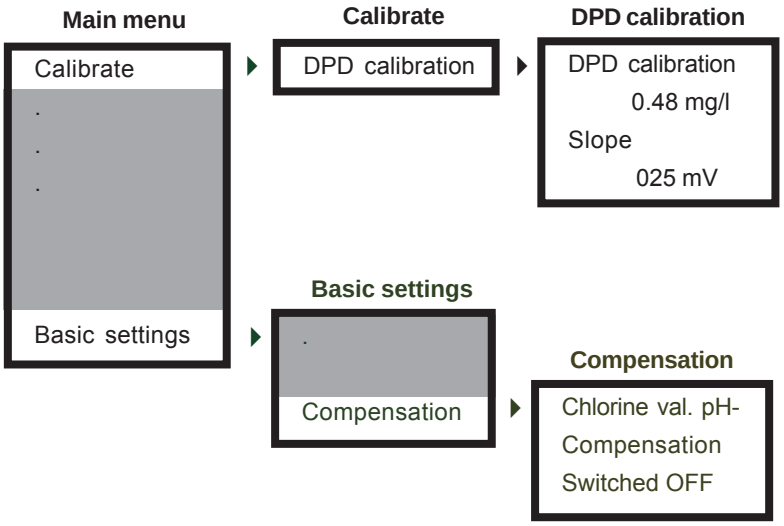
At works the following buffers are stored:

Calibration solutions: buffer solutions pH 4 and pH 7
Inner buffer of the electrode: pH 7

If you want to use other calibration solutions, adjust the values - it does not matter if you start with the higher or the lower pH.

If you are using electrodes with a special inner buffer, adjust the pH value of the sensor buffer, since this value is used as zero for the calculation of the measured values. You will find the pH of the sensor buffer printed on the electrode.

5.2 Calibration of the Chlorine measurement



Calibration of the measurement

1) Switch off the controller. Take a sample of the test water at the sampling point and determine the concentration by photometric DPD measurement or a similar reference method.

2) Enter the determined concentration and calibrate by pressing keys ▸ and ◂ : Start with key ▸ and then - while still applying pressure on this key - additionally press key ◂ .

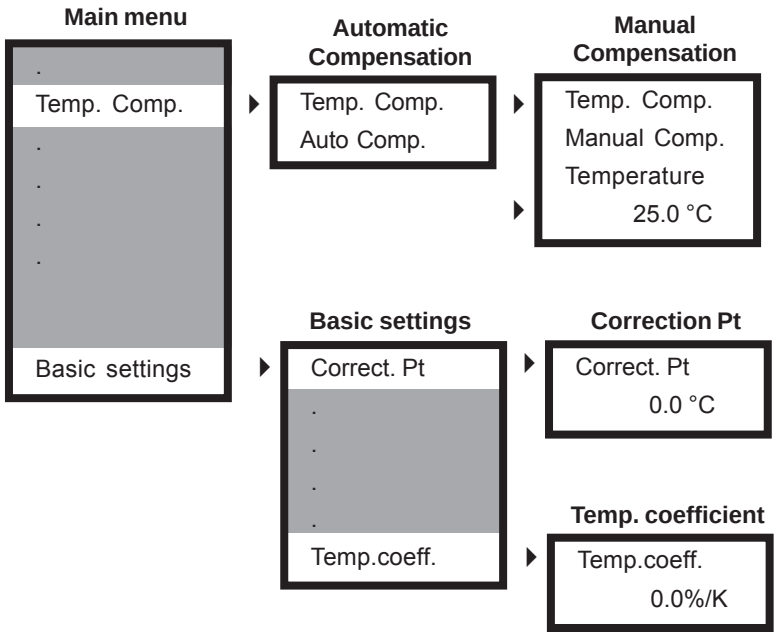
3) Check the displayed slope before switching on the controller.

5.3 pH compensation

With this function you can compensate the pH influence on the Chlorine measurement. This allows stable Chlorine measurement in water with changing pH values. However, the compensation cannot change the fact that the signal output at higher pH values decreases, nor that the disinfection power of Chlorine decreases with increasing pH values.

After activating the compensation, recalibration of the Chlorine measurement is necessary.

5.4 Temperature compensation



Choose between two types of temperature compensation:

1) Automatic compensation with temperature sensor

Mind that the temperature sensor should measure the temperature in the vicinity of the sensor. If temperature sensor and the other sensors are not immersed in the same solution, as is the case during pH calibration, better switch to manual compensation.

2) Manual compensation

If the temperature is more or less stable you can enter it manually. The instrument will then compensate the temperature effect of this temperature.

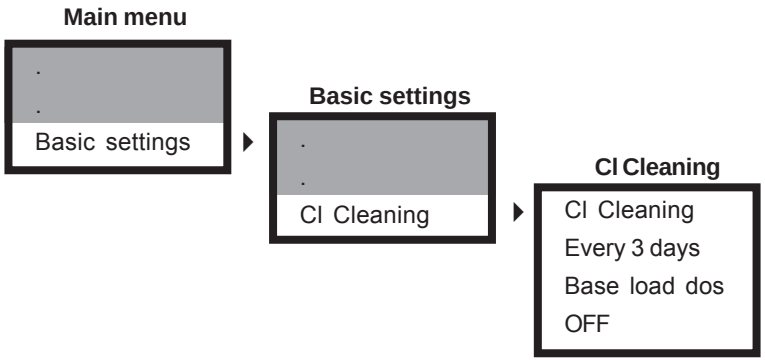
Since the temperature sensor is connected with a twin-core cable, slight deviations might occur between measured and real temperature. These deviations can be eliminated by calibration.

During start-up, measure the temperature manually and enter a correction term so that the display shows the exact temperature.

This has to be done only once after installation. Recalibration is unnecessary, the temperature sensor does not show ageing effects. However, if you exchange the temperature sensor, calibration might be necessary again.

The temperature compensation of the pH measurement is defined by a theoretical equation. FOr Chlorine you can adjust the compensation via a linear coefficient as % deviation per Kelvin. For many applications, a coefficient of 2%/K has prooved convenient. But mostly a compensation is unnecessary - by setting 0%/K the compensation is switched off.

5.5 Automatic Sensor Cleaning ASR



The patented Automatic Sensor Cleaning ASR prevents staining and passivating coatings and keeps the surface of metal sensors clean throughout the measurement.

The cleaning is an electrochemical one: In adjustable intervals the instrument applies a strong voltage to the electrode to produce Hydrogen and Oxygen from the surrounding water. This method needs no addition of chemicals. Both Hydrogen and Oxygen are ORP active substances that will destroy inorganic coatings such as rust, maganese oxide, or lime, and organic coatings such as fat or grease.

Activate the cleaning after completing the set-up to conserve the clean metal surface of the new sensor during subsequent measurements.

The cleaning process takes about 30 seconds. During this time measurement is not possible, and after cleaning the sensor needs some time for polarisation. Therefor the display and the analog output will show the last measured value for approx. five minutes, and the message „cleaning in progress“ is displayed. As a safety measure, access to the calibration menu within these five minutes is denied.

Activation and timing

The cleaning is activated by setting the cleaning function from 0 (never) to 1/day (every 24h), 2/day (every 12 h), every 3 days, or every 7 days. The first cleaning always starts at midnight, and subsequent cleanings are carried out after 24h, or 12h, or 3 days, or 7 days, according to settings. For many applications, once per week is sufficient.

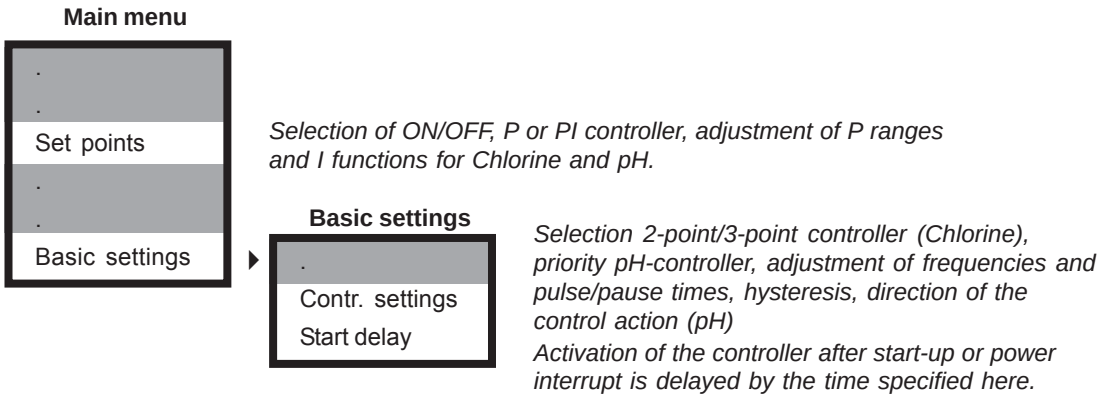
NOTE **Whenever the instrument indicates „ext.contr.stop“, cleaning is not carried out.**

Base load dosing

With at-works settings, the controller is deactivated during cleaning and the subsequent repolarisation. However, in applications with continuous flow where the Chlorine concentration will drop below minimum, base load dosing can be activated, to continue dosing after cleaning with the average controller ouput of the last 30min.

CAUTION **Since the base load dosing is not controlled by measurements, you have to make sure that overdosing cannot occur!**

6. Adjustments of the controller



For any type of controller you have to enter set points, and - for pH - the acting direction. The controller output is via the relays. Additionally, you can assign any of the analog outpus as controller output.

You can give the pH controller priority, so that the Chlorine controller starts only when the pH value is adjusted.

You can choose between three different controller versions:

ON/OFF controller

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

P controller

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

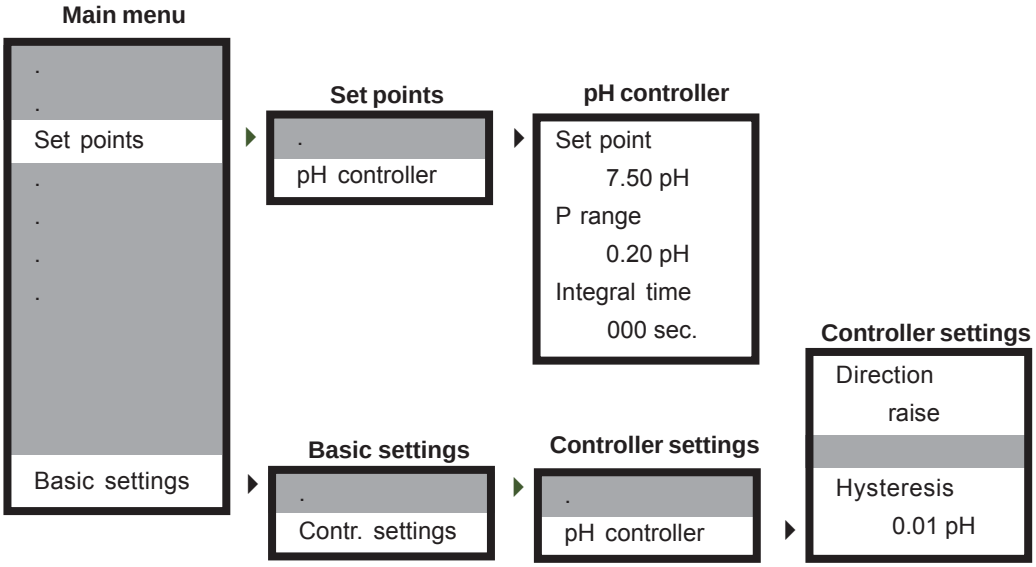
PI controller

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

With the PI controller, you can operate a servo motor (3-point controller). In that case you need two relays. As parameters you need to define the time it takes for the motor to open up completely, and a minimum pulse time.

The 3-point controller is available only for Chlorine.

6.1 pH controller as ON/OFF controller



Relay 3 is assigned to the pH controller.

To configure the pH controller as ON/OFF controller, you have to set the following parameters:

1) Set point

Enter the pH value you want to reach as set point.

2) P range and integral action time

For an ON/OFF controller set P range = 0 and integral time = 0.

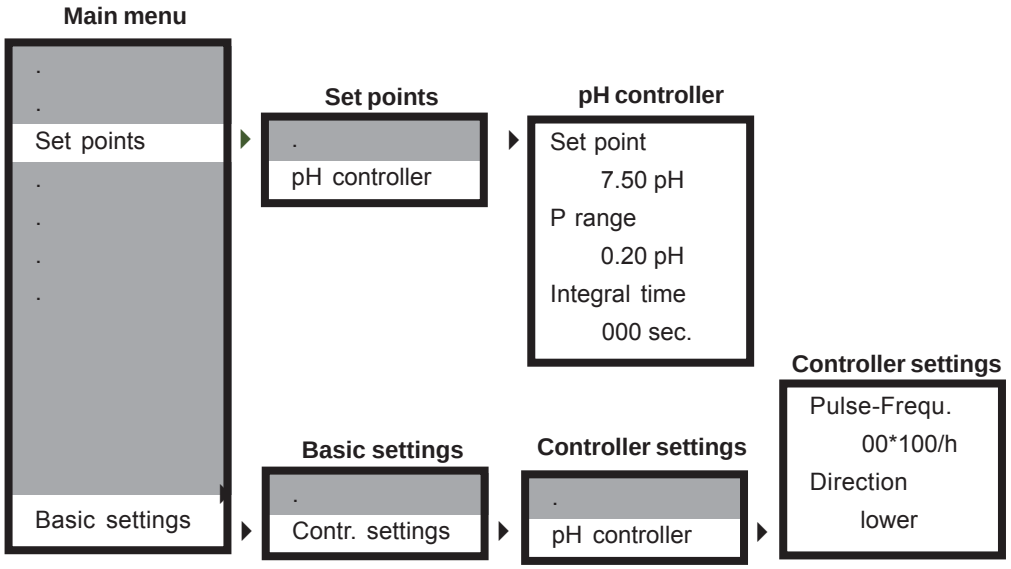
3) Acting direction

Select „raise“ if the dosage raises the pH value.
Select „lower“ if the dosage lowers the pH value.

4) optionally a hysteresis

The hysteresis prevents fast switching in the vicinity of the set point. If hysteresis is activated (by setting a value > 0) the relay switches only when the set point is exceeded by half the hysteresis.

6.2 pH controller as P/PI controller: impulse-frequency



Relay 3 is assigned to the pH controller.

For an impulse-frequency controller you have to set the following parameters:

1) set point

Enter the pH value you want to reach as set point.

2) P range and integral action time

Adjust a P range > 0. For a P controller set integral time = 0, for a PI controller set an integral time > 0.

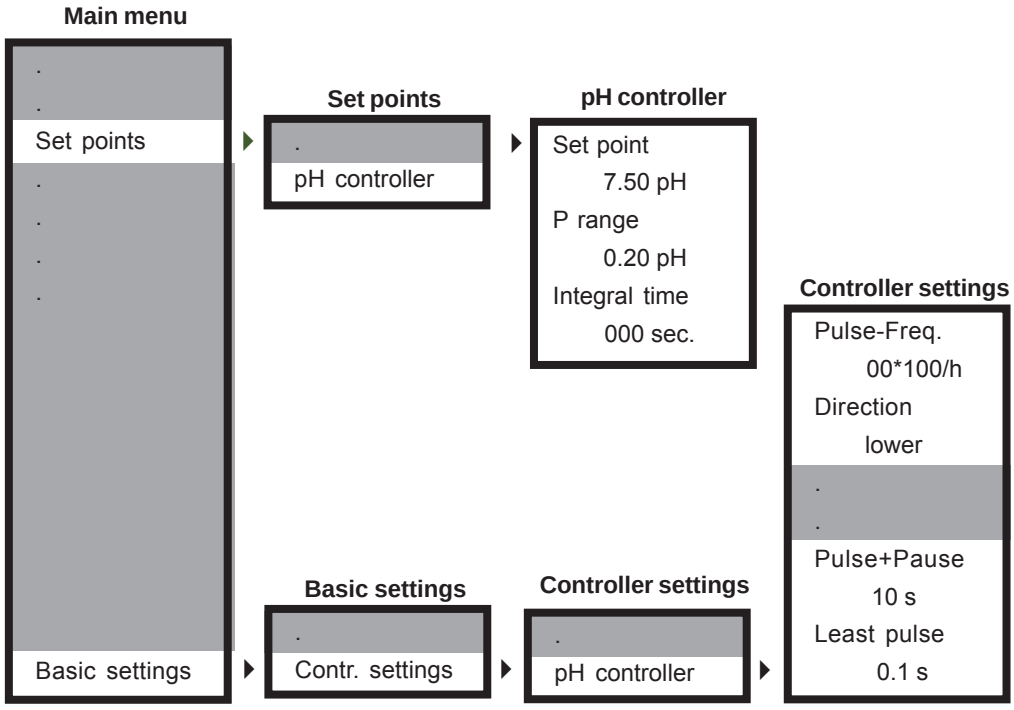
3) pulse-frequency

Enter the maximum pulse-frequency that corresponds to 100% dosage.

4) the acting direction

Select „raise“ if the dosage raises the pH value.
Select „lower“ if the dosage lowers the pH value.

6.3 pH controller as P / PI controller: pulse-pause controller



Relay 3 is assigned to the pH controller.

For a pulse-pause controller you have to set the following parameters:

1) set point

Enter the pH value you want to reach as set point.

2) P range and integral action time

Adjust a P range > 0. For a P controller set integral time = 0, for a PI controller set an integral time > 0.

3) pulse-frequency

The frequency must be set to 00, otherwise the controller will act as an impulse-frequency controller.

4) the acting direction

Select „raise“ if the dosage raises the pH value.
Select „lower“ if the dosage lowers the pH value.

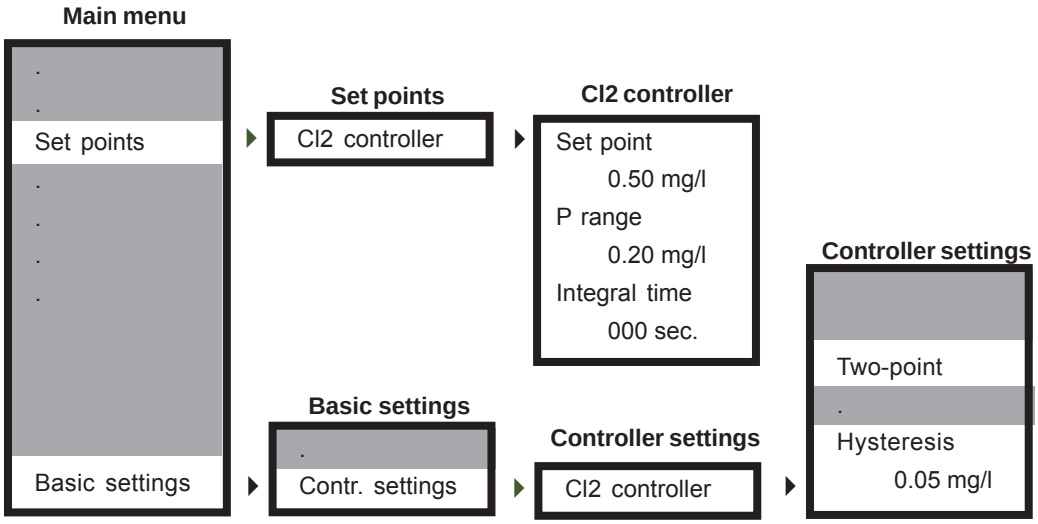
5) pulse+pause time

Define a period of time during which the relay is proportionally to the control deviation ON (pulse) or OFF (pause), respectively.

6) least pulse time

Set a minimum pulse time that the relay has to at least remain open to allow the actuator to react.

6.4 Chlorine controller as ON/OFF controller



Relay 2 is assigned to the Chlorine controller. Acting direction is always „raising“.

To configure the Chlorine controller as ON/OFF controller, you have to set the following parameters:

1) Set point

Enter the measured value you want to reach as set point.

2) P range and integral action time

For an ON/OFF controller set P range = 0 and integral time = 0.

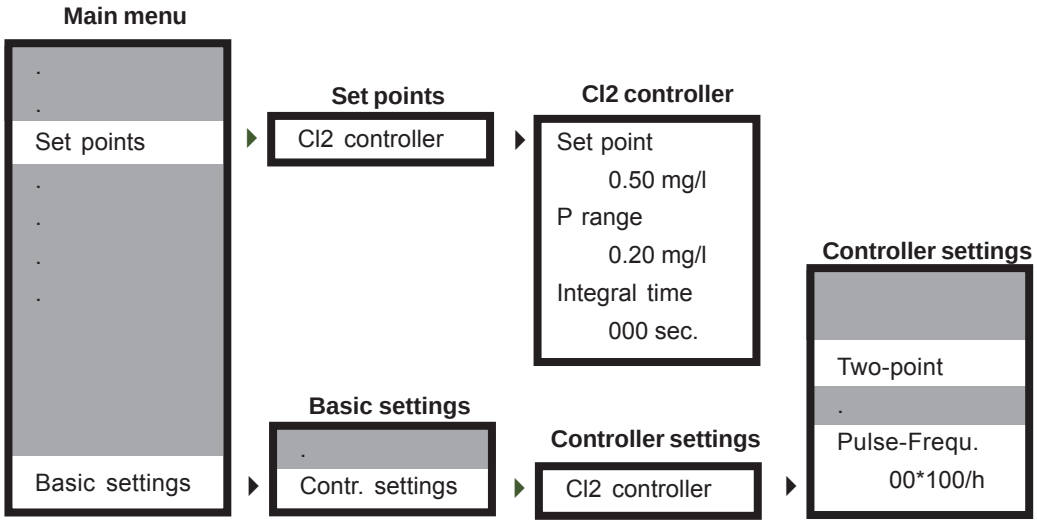
3) 2-point or three-point?

Select 2-point controller. 3-point is only used for servo motor control.

4) optionally a hysteresis

The hysteresis prevents fast switching in the vicinity of the set point. If hysteresis is activated (by setting a value > 0) the relay switches only when the set point is exceeded by half the hysteresis.

6.5 Chlorine controller as P/PI controller: impulse-frequency



Relay 2 is assigned to the Chlorine controller. Acting direction is always „raising“.

To configure the Chlorine controller as P/PI: pulse-frequency controller, you have to set the following parameters:

1) Set point

Enter the measured value you want to reach as set point.

2) P range and integral action time

Adjust a P range > 0. For a P controller set integral time = 0, for a PI controller set an integral time > 0.

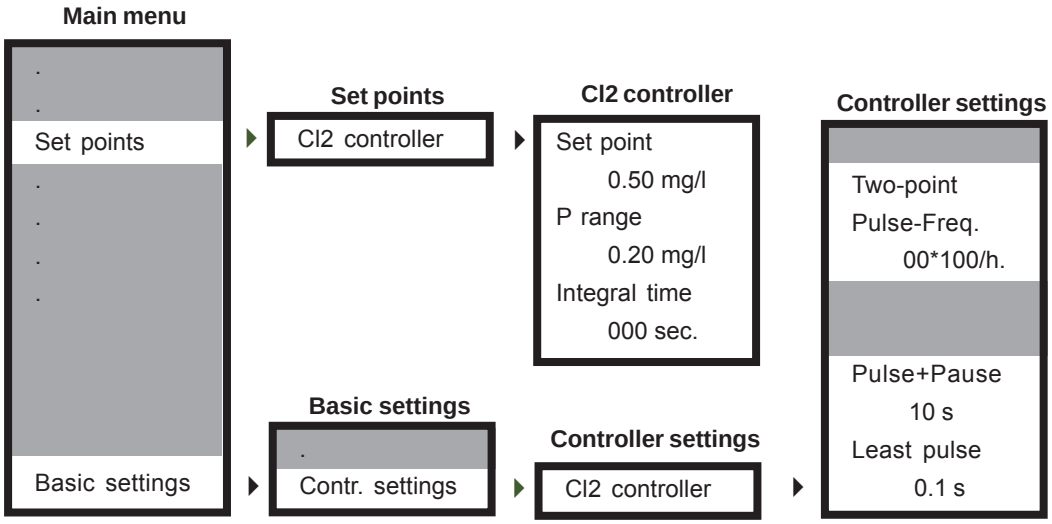
3) 2-point or three-point?

Select 2-point controller. 3-point is only used for servo motor control.

4) pulse-frequency

Enter the maximum pulse-frequency that corresponds to 100% dosage.

6.6 Chlorine controller as P/PI controller: pulse-pause



For a pulse-pause controller you have to set the following parameters:

1) set point

Enter the measured value you want to reach as set point.

2) P range and integral action time

Adjust a P range > 0. For a P controller set integral time = 0, for a PI controller set an integral time > 0.

3) pulse-frequency

The frequency must be set to 00, otherwise the controller will act as an impulse-frequency controller.

4) 2-point or 3-point?

Select 2-point controller. 3-point is only used for servo motor control.

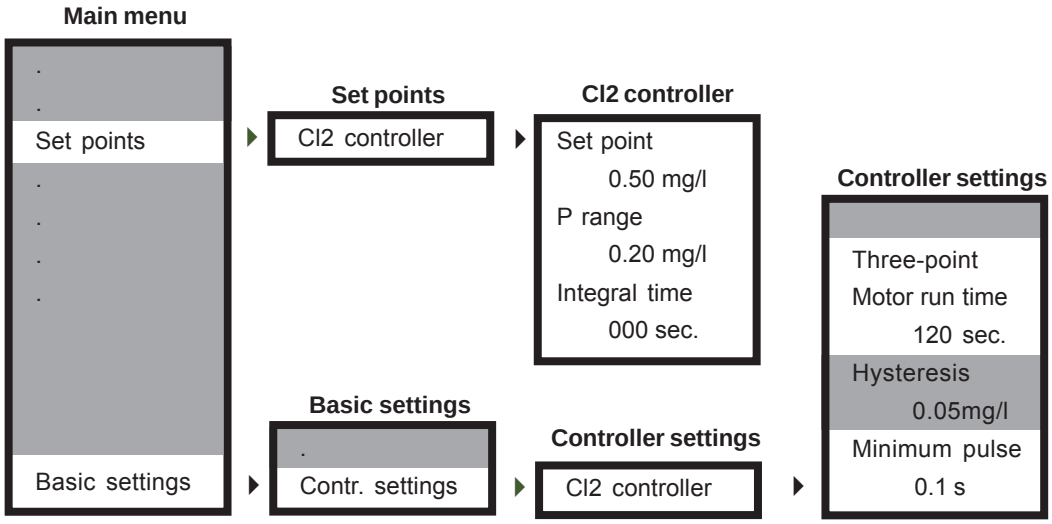
5) pulse+pause time

Define a period of time during which the relay is proportionally to the control deviation ON (pulse) or OFF (pause), respectively.

6) least pulse time

Set a minimum pulse time that the relay has to at least remain open to allow the actuator to react.

6.7 Chlorine controller for servo-motor control



For servo-motor control you need two relays. In that case, the assignment is: relay 1 = motor close, relay 2 = motor open. You need to select a PI controller.

To configure the Chlorine controller as servo-motor controller, you need to adjust the follwing parameters:

1) Set point

Enter the measured value you want to reach as set point.

2) P range and integral action time

Adjust a P range > 0 andan integral time > 0.

3) 2-point or 3-point?

Select 3-point controller.

4) Motor run time and minimum pulse

Enter the time it takes for the motor to go from „completely closed“ to „completely open“. Control is based upon this period of time. Enter a minimum pulse to say how long the relay must at least be open for the motor to react.

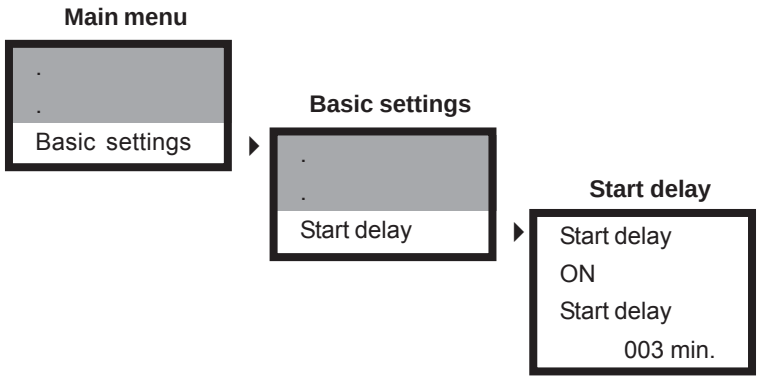
5) Hysteresis

The hysteresis prevents fast switching in the vicinity of the set point. If hysteresis is activated (by setting a value >0) the motor starts only when the set point is exceeded by half the hysteresis.

6.8 Activation and deactivation of the controller

You can activate and deactivate the controller without any menu. Press key ▸ to switch between manual operation (controller OFF), HOLD (maintenance mode), and automatic operation (controller ON). The actual operation mode is indicated in the display by MAN or AUTO or HOLD.

WARNING **Make sure that the controller is OFF when connecting dosing pumps or other actuators!**



6.9 Start delay

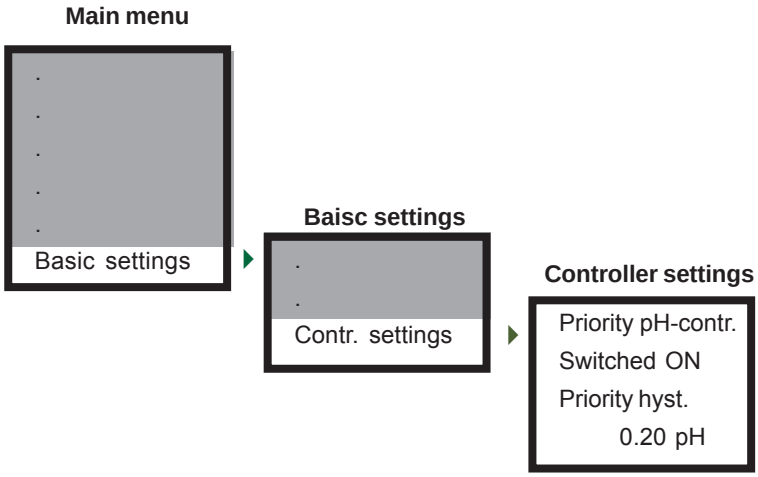
Set a delay time which has to pass before the controller is activated after start-up or power interrupt. This allows the measurement to settle and prevents inappropriate dosage of chemicals.

6.10 External controller stop

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

NOTE **Two more digital inputs allow connection of the flow monitor to indicate low water, and a level switch to monitor the level of dosing chemicals. If either switches, the controller is switched off.**

6.11 Priority function



With the priority function you can delay the Chlorine controller until the pH controller has reached its set point.

The Chlorine measurement shows a strong pH dependency. If at the beginning of the dosing, the pH value is high, then the signal output of the Chlorine measurement is lower than at the pH set point. If both controllers would start simultaneously, the Chlorine controller would dose too much. Therefor it is better first to adjust the pH value, and then start dosing Chlorine.

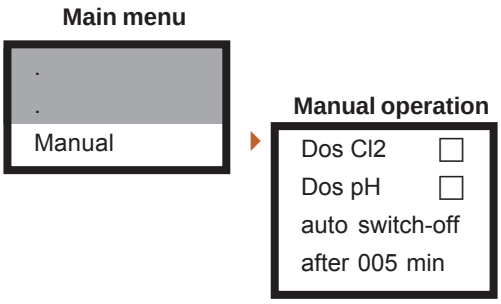
1) Priority pH controller

When you activate this function, the Chlorine controller starts only when the pH controller has reached its set point. This applies to start-up and any other situation in which the pH value differs from its set point, such as after low water or refill of dosing chemicals.

2) Priority hysteresis

With the hysteresis you can define a pH range around the set point, in which the Chlorine controller acts without delay. It prevents delaying the Chlorine controller with any small pH deviation during regular control fluctuations.

6.12 Manual operation of the relays



You can operate the relays manually to fill tubes or check the connections to the actuators.

Manual operation is only possible when the controller is set to MAN.

Set the controller from AUTO to MAN with key ▸ while the display shows the measured values.

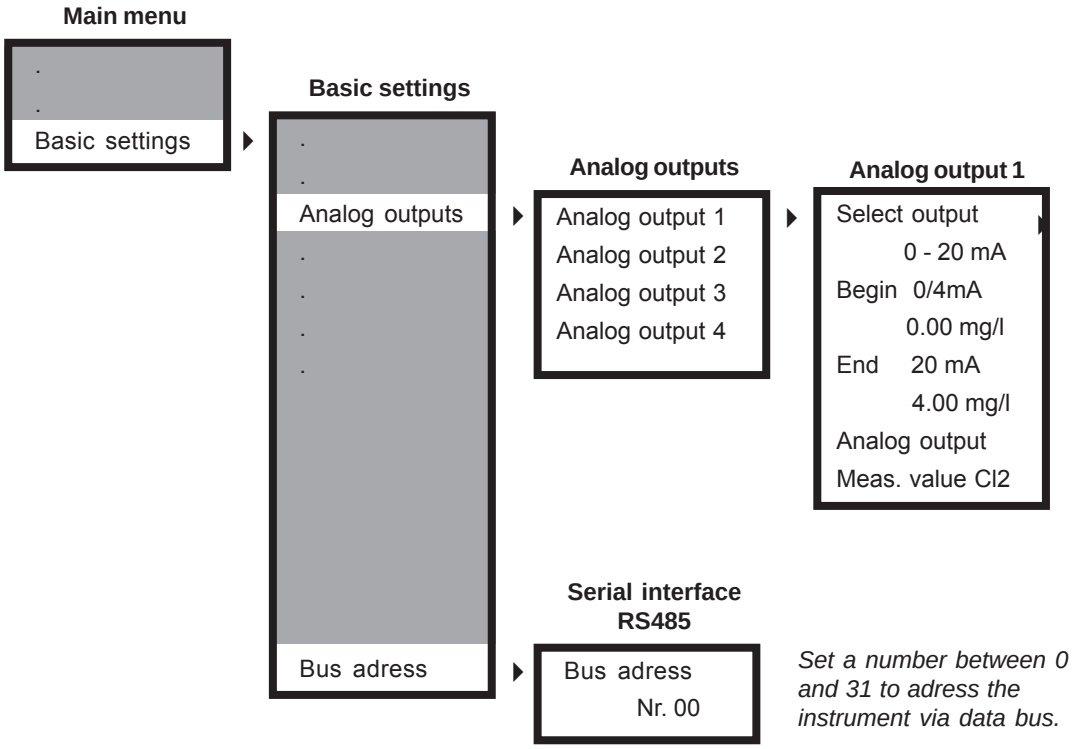
Then enter the menu and go to „Manual“. Set the cursor to one of the relays and switch the relay with key ▸. The square at the end of the line turns black to indicate that the relay is ON. Press the keay again to turn it OFF, the square turns white again.

CAUTION **When you switch a relay manually, it stays that way until you switch it off again!**

As a safety measure, the instrument provides an auto-switch-off function. Define a period of time after which a manually switched relay should switch OFF automatically.

CAUTION **If you set the time to „0 min“, the auto switch-off function is deactivated!**

7. Data output



7.1 Current outputs (option)

An analog output board can be added to these instruments, providing four analog outputs for the four measurements. When the board is installed, the menu „basic settings“ automatically shows the menu „analog outputs“.

With these analog outputs, you can read out the measured values as 0/4-20 mA signals. With the setting 4-20 mA the resolution is lower, but defective cable connections are immediately evident.

With parameters „Begin“ and „End“ you define which part of the measuring range you want to see.

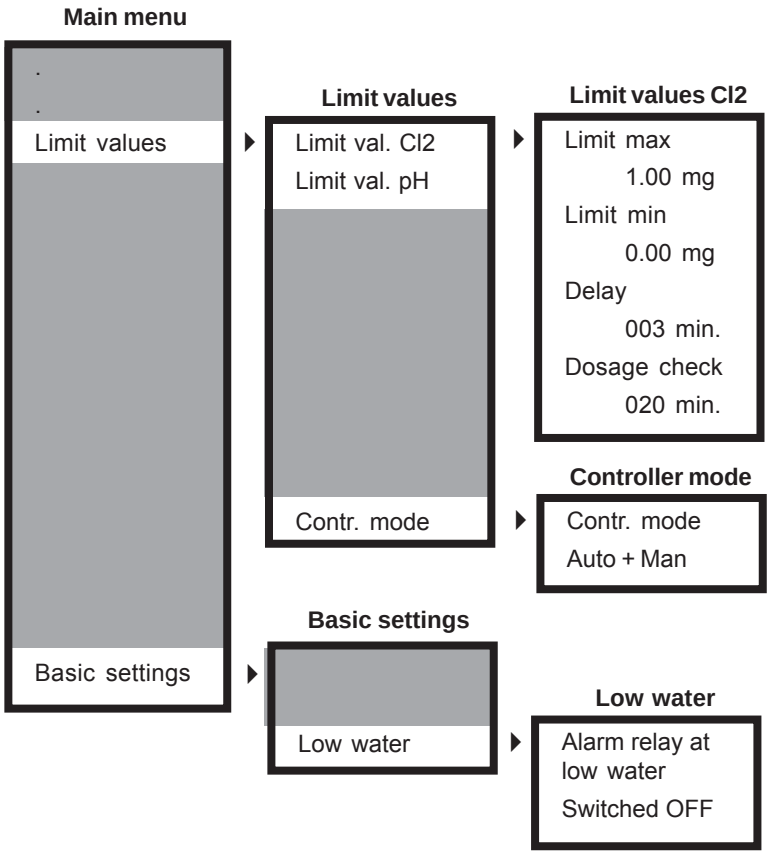
Alternatively, any analog output can be used as controller output and assigned to control. Cl2 or control. pH.

7.2 Serial interface RS485

The instruments are equipped with a serial interface RS485 by means of which they can be integrated in a data bus system. Via the interface, all settings, measured and control values as well as any error messages can be read out digitally.

Assign a different bus adress - between 0 and 31 - to each instrument to connect up to 32 instruments in one bus system.

8. Limit values and Alarm



For Chlorine and pH you can ajust an upper and a lower limit. If the measured value exceeds the maximum or drops below minimu, an alarm is issued.

In case of alarm the display shows the message „limit Cl2“ (or pH, respectively), and relay 3 is switched ON. This relay can be used to activate an external horn or lamp.

In some applications it happens regularly that the measured value exceeds a limit for a short period of time. To avoid having an alarm issued under these circumstances you can adjust a start delay which has to pass before an alarm is issued. If the start delay time is >0 then the alarm is issued only if the cause of alarm remains longer than the specified delay time.

Via „controller mode“ you define whether the limit function is active only when the controller is set to automatic mode, or whether it should also be active in the manual mode. During HOLD it is deactivated.

Dosage check is a safety measure that monitors the effects of the dosing. If the set point or at least the P range is not reached after a specified time of 100% dosing, an alamr is issued and the controller stopped, because there might be some damage in the feed lines.

In the basic settings you can define whether a low water situation should also be indicated via the alarm relay.

8.1 Alarm

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

Sensor check during calibration

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

Sensor check during measurement

During measurement all measuring inputs are checked. If an analog input does not receive a correct signal, an alarm is issued, and the controller deactivated. Alarm and controller stop remain until the analog input receives correct signals again.

Low water

In a low water situation the flow monitor will issue an alarm. The alarm remains until the flow monitor shows that water is again available. During the alarm the controller ist deactivated.

Dosage control

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

CAUTION **If your controller settings are such that the value of 100% cannot occur, e.g. because you have a set point of 0.3mg/l Chlorine and a P range of 0.6mg/l, so that the maximum output is 50%, this condition is never met! Make sure that dosage control is not made impossible by your settings before activating the controller!**

Cause of alarm	only active in AUTO mode	deactivates controller
Slope error Cl2	no	no
Slope error pH	no	no
Sensor zero pH	no	no
Error input 1 (Cl2)	no	yes
Error input 2 (pH)	no	yes
Error input 3 (Rx)	no	no
Error input 4 (T)	no	yes
Limit min/max Cl2/pH	selectable	no
Dosage check	yes	yes
Low water	no	yes

8.2 Error messages

Error message	Cause	Measures
Slope Cl2 / pH	The slope determined during calibration was less than 20% for Chlorine, or less than 50mV/pH or higher than 65mV/pH for pH.	Check the temperature and for Chlorine also flow and pH value, and the cables and connections, and calibrate again. If the error message remains, the sensor has to be cleaned, regenerated, or replaced.
Sensor zero pH	The zero point determined during calibration was higher than +/- 55mV.	Make sure that the calibration data stored in the basic settings correspond to the buffers used. If this has been the case, try to regenerate the sensor (exchange the KCl filling solution, store the sensor in 3M KCl for a few hours, mechanically clean the junction).
Error input 1 / 2 / 3 / 4 (1: Cl2, 2: pH, 3: Rx, 4: T)	The specified input does not receive a correct signal.	This message indicates a defective sensor, cable or a wrongful connection. It also appears if a measuring range is excceded. „Error input 4“ is also displayed if automatic temperature compensation was selected although no temperature sensor Pt100 was connected.
Limit min/max Cl2 / pH	The measured value exceeds the specified limit.	Please check the dosing and readjust the control parameters, if necessary.
Dosage check R1 / R2	Controller 1 or 2 gives out 100% for longer than the allowed period of time.	Please check the dosing, especially the feeding tubes and injection points. Caution! Carefully check for leaking chemicals!
Ext. controller stop	The digital input 3 has been short-circuited.	Open the input as soon as you want to continue the dosing.
No water	The digital input 1 has been short-circuited.	The flow has dropped below minimum. Check the flow at the outlet of the flow cell, and clean the integrated filter and the flow sensor, if necessary.
Level	The digital input 2 has been short-circuited.	The level sensor indicates that the dosing reagent is empty.

9. Operation and maintenace

Display contrast

With instruments in wall-mounting enclosures the display contrast can be adjusted to the actual light conditions by means of a potentiometer. It is indicated in the connection diagram with the word „display“.

Cleaning

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

Exchange fuse

WARNING! Disconnect the power supply before opening the instrument!

The instrument has an internal fuse and a separate fuse for the relays, both of which have to be replaced at need. You will find spare fuses fixed to the inside of the housing. Information on the fuses can be found in the chapter „Technical data“.

To exchange the fuses, open the front carefully. The fuses are located in the left hand side. They are kept in place by a Bayonet lock. Turn the lock to the left until the fuse pops up. Exchange it and fix the new fuse by turning the lock to the right. Put the front back on and fix it tightly.

Maintenance of the safety functions

Regularly check the alarm relay to make sure that in case of failure both the indication by the instrument and the recognition by the superior control (SPS etc.) work reliably.

You can set off the alarm for example by setting limit S1 to a value smaller than the current measured value.

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

Regularly check the function of the water level or flow sensor to make sure that in case of lack of water the sensor gives the signal that leads to the controller stop.

Simulate lack of water by briefly interrrupting the water supply. This must lead to a switch of the level sensor or a decrease of the flow signal, and the message „ext. controller stop“ or „no water“ must appear in the display.

Maintenance of the measurement

Apart from AUTO and MAN you can select the mode HOLD. In that mode, the controller is OFF, and additionally the current output is fixed, and the limit values are deactivated. This allows maintenance without causing alarm in a central control unit. The HOLD mode is selected from the main display with key ▸ just as the modes AUTO and MAN.

Regularly clean the metallic surfaces of the electrodes with a common dish detergent. Rinse carefully with water afterwards. Or use the automatic sensor cleaning function ASR. Mind that the measurement will take some time to repolarise after cleaning.

Recalibrate in regular intervals.

NOTE **The instrument checks the calibration data and indicates, if a sensor has to be cleaned or replaced.**

If you have to exchange a sensor, make sure that the replacement sensor is appropriate for your application and corresponds to the equipment used.

Mind that you have to calibrate whenever you change a sensor - or an instrument!

Regulalry clean filters, flow sensors, and fittings.

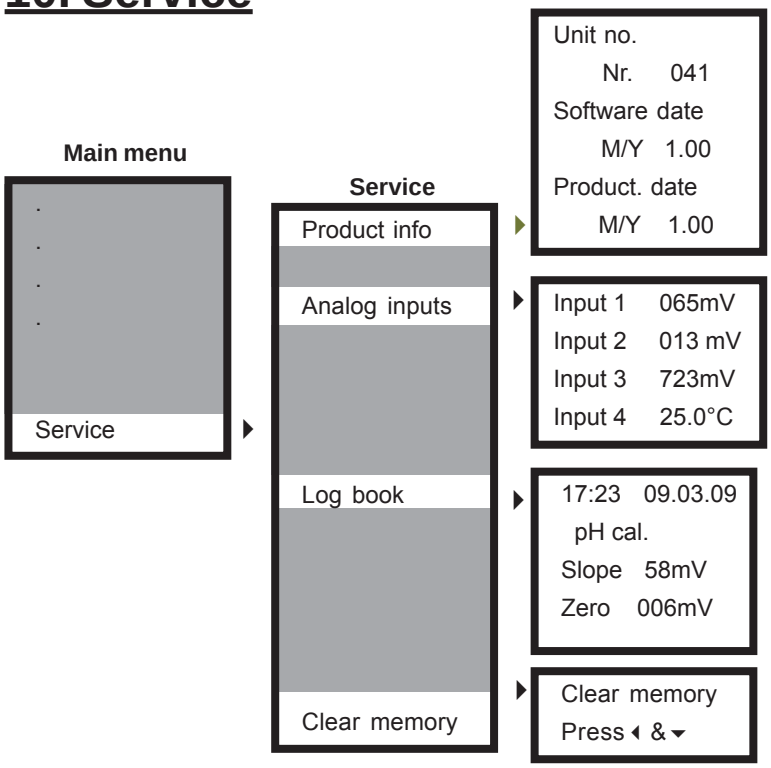
Set-up

Follow the instructions of this manual. Carry out all steps described. Check both the measured values and the settings before you activate the controller.

Disposal

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

10. Service



In this menu you will find information which is especially important for any inquiries, updates or problems.

Product info

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

Analog inputs

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

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

Log book

The log book shows the last 20 calibrations (Cl2 and pH) with date, time, and results. Use keys ▼ and ▶ to scroll backward and forward.

Erase settings (reset)

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

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

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Customer settings - for reference!

Instrument:

Identification / location: .....

Type: ..... Date of installation .....

Instrument no..... Software version .....

Measurement:

Cl2 cleanign: ☐ 1x/day ☐ 2x/day ☐ every 3 days ☐ every 7 days ☐ OFF

pH compensation: ☐ ON ☐ OFF Base-load dosing: ☐ ON ☐ OFF

Internal buffer: ..... Buffer 1: ..... Buffer 2: .....

Temperature compensation:

☐ Manual ☐ automatic

Temperature: ..... °C correction.....°C coefficient Chlorine: .....%/K

Current outputs:

mA1: ☐ 0-20mA ☐ 4-20mA mA2: ☐ 0-20mA ☐ 4-20mA

Begin/ End:..... Begin/ End:.....

for: ☐Cl2 ☐pH ☐Rx ☐T ☐S1 ☐S2 for: ☐Cl2 ☐pH ☐Rx ☐T ☐S1 ☐S2

mA3: ☐ 0-20mA ☐ 4-20mA mA4: ☐ 0-20mA ☐ 4-20mA

Begin/ End: ..... Begin/ End .....

for: ☐Cl2 ☐pH ☐Rx ☐T ☐S1 ☐S2 for: ☐Cl2 ☐pH ☐Rx ☐T ☐S1 ☐S2

Controller:

Controller Cl2	Controller pH
☐ Priority pH, Hysteresis.....pH	Direction: ☐ raise ☐ lower
Set point:	Set point: .....
Hysteresys	Hysteresys .....
P range	P range .....
Integral time .....sek.	Integral time .....sek.
Pulse pause time..... sek.	Pulse pause time ..... sek.
Min. pulse ..... sek.	Min. pulse ..... sek.
Pulse frequency .....*100 / h	Pulse frequency .....*100 / h
☐ 2-point ☐ 3-point	Motor run time ..... sec.

Start delay:

Delay time .....min.

Alarm:

Chlorine: max. .....mg/l	pH: max. .....pH
Chlorine: min .....mg/l	pH: min. .....pH
Delay ..... min.	Delay ..... min.
Dosage check ..... min.	Dosage check ..... min.
Contrl. mode: ☐ Auto ☐ Auto & Man	Low water alarm: ☐ yes ☐ no

Interface RS 485:

Bus adress .....