



DR. A. KUNTZE

GUTES WASSER MIT SYSTEM

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1. Your Krypton D

is a measuring system by Dr. A. Kuntze GmbH which offers high quality and reliability for years.

The system contains all components necessary for the measurement mounted on a board and ready-to-use.

Krypton D measures the concentration of free Chlorine, pH, ORP (option), and temperature. Additionally the water flow is monitored via digital input.

The meter/controller offers two independent controllers, assigned to the measurements of Chlorine and pH. For each you can choose between ON/OFF, P, PI, or PID controller. For each controller, up to two set points can be used, with adjustable acting direction, so that even bidirectional control is possible. Choose for yourself which of the three relays and the two or three analog outputs you want to use for control, limit supervision, and registration.

You can define a turn-on delay to prevent wrongful dosing after power failure and operate the controllers by remote control. The fail-safe stops the controller automatically in a low water situation. The extensive internal supervision includes the dosing time with 100% feed rate, to help detect defective dosing lines.

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

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

What's more, Krypton D is equipped with Automatic Sensor Cleaning ASR. This electrochemical cleaning function prevents coating of the metal surfaces of the Chlorine sensor.

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

1.1 General and safety instructions

This manual applies to the following instrument:

Instrument and type	revision date
Krypton D	3/08

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

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

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

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

Keep this manual in a safe place where you can always look up the safety instructions and the information on handling and usage.

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

You will notice that important safety instructions are highlighted:

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

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

NOTE is used to highlight interesting details.

1.2 Function and application

The measuring system Krypton D was designed to measure and control the concentration of free Chlorine and pH. It contains two integrated controllers with two set points each. With these you can operate actuators such as dosing pumps or valves, to adjust the Chlorine concentration and the pH value to suitable values by dosing appropriate chemicals.

Applications for Chlorine and pH measurements are mainly drinking water and pool water disinfection.

When switched on, the controllers operate the connected actuators and control the dosing of dangerous chemicals.

As safety measure, both the measurement and the calibration are checked by the instrument. Failures are displayed as text messages, and an alarm is issued via the alarm relay to activate an external signal. If the failure is such that the measured values cannot be used for control purposes, the controller is stopped automatically until the cause of the alarm is eliminated.

CAUTION **The instrument can only detect failures in the input signals, the calibration data, and the water flow. It cannot detect wrongful settings or handling, nor failures in the treatment plant operation!**

In accordance with DIN 61010 we point out that the safety of the plant in which the measuring system is installed is the responsibility of whoever built the plant.

1.3 Intended use

Use the measuring system only for the monitoring of free chlorine concentration and pH value in water. Use only sensors appropriate for your application. Make sure that the necessary measuring conditions such as water flow, pressure, temperature etc. are maintained.

For set-up and installation follow this manual. Carry out all steps as described and check all settings and all readings before activating the controller.

Use all safety measures the system offers, such as alarm relays, dosing control, and water fail-safe. Check the function of all safety measures at regular intervals.

Use only spare parts and replacements from Dr. A. Kuntze GmbH, so as not to lose the warranty.

CAUTION **The protective measures the system is equipped with can only work if you use it according to its intended use!**

1.4 Features

Meter

Measurements	Free Chlorine, pH, and temperature
Measuring ranges	0.00 - 4.00 mg/l Cl ₂ 0.00 -14.00 pH -1500 - +1500 mV ORP (option) -30 - 140 °C
Display	Measured values with units status of sensors, calibration, controllers & alarm
Temperature compensation	manual or automatic with Pt100

Controller

Set points	2 x 2 set points with adjustable direction
Controller types	ON/OFF, with hysteresis P-, PI- or PID controller as pulse-pause, pulse-frequency or continuous controller
Hysteresis	0.00 - 4.00 mg/l / 0.00 - 14.00 pH
P range XP	0.00 - 4.00 mg/l / 0.00 - 14.00 pH
Integral time TN	0 - 2000 sec.
Derivative time TV	0 - 500 sec.
Minimum pulse	0.0 - 9.9 sec.
Puls+Pause time	01 - 99 sec.
pulse frequency	100 - 7200 pulses/h
Motor running time	20 - 300 sec.
Turn-on delay	0 - 2000 sec.
Alarm function	2 x min and max limits and delay time
Dosage control	0 – 2000 sec.

Connections

Relays	3 potentialfree contacts configurable, 6 A, 250 V, max. 550 VA
Analog outputs	3 x 0/4-20 mA galvanically isolated, max. load 500 Ohm
Analog inputs	3 inputs, for Chlorine, pH, and temperature
Digital input	external controller stop, water level supervision or flow measurement
Digital interface	included, RS485, Baud rate 9600, data format 8Bit, 1 start bit, 1 stop bit, no parity
Water connections	Inlet and outlet female threads 1/2" with manual valve and tube connectors DN6/8 max. water pressure 6 bar, max. outlet pressure 1 bar Sampling point female thread 1/4" with stop-cock
Water flow	10 - 300 l/h, optimum 50-200l/h (switch-point flow sensor 30l/h)

1.5 Technical data

Feature	Krypton D
Dimensions	400 x 700 x 90 (WxHxD)
Weight	6.3 kg
Electr. connections	Spring-loaded terminals for cables with max. 1.5 mm ²
Protection class	IP65
Power supply	230 V +/-10%, 40/60 Hz, or 117 V or 24 V on request
internal fuse	230 V: 63 mA slow 117V: 125 mA slow 24 V: 800 mA semislow
Power consumption	10 VA
Display	LCD graphical 128x64, illuminated background Measured values with units, status messages
Current outputs	3 x 0/4-20 mA, galvanically isolated, max load 500 Ohm
Interfaces	RS485, Baud rate 9600, Data format 8Bit, 1 start bit, 1 stop bit
Controller	2 x for Chlorine and pH
Controller types	ON/OFF, with hysteresis, P-, PI- or PID controller as pulse-pause, pulse-frequency or continuous controller, turn-on delay, manual operation of the relays, controller stop via remote switch or flow sensor
Set points	2 x 2 adjustable within measuring ranges
Alarm function	2 x max. and min limits with delay
Contact rating	6 A/ 250 V, max. 550 VA resistive load (with RC protective circuit)
Operation temperature	0 - 50°C
Storage temperature	-20 - 65°C
Humidity	0 - 90 % non-condensing

2. Installation

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 various sensors etc. 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 (closed terminal cover)

ATTENTION The 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.

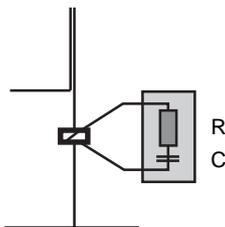
Before connecting the power supply check the information on the instrument label.

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 interferences 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.

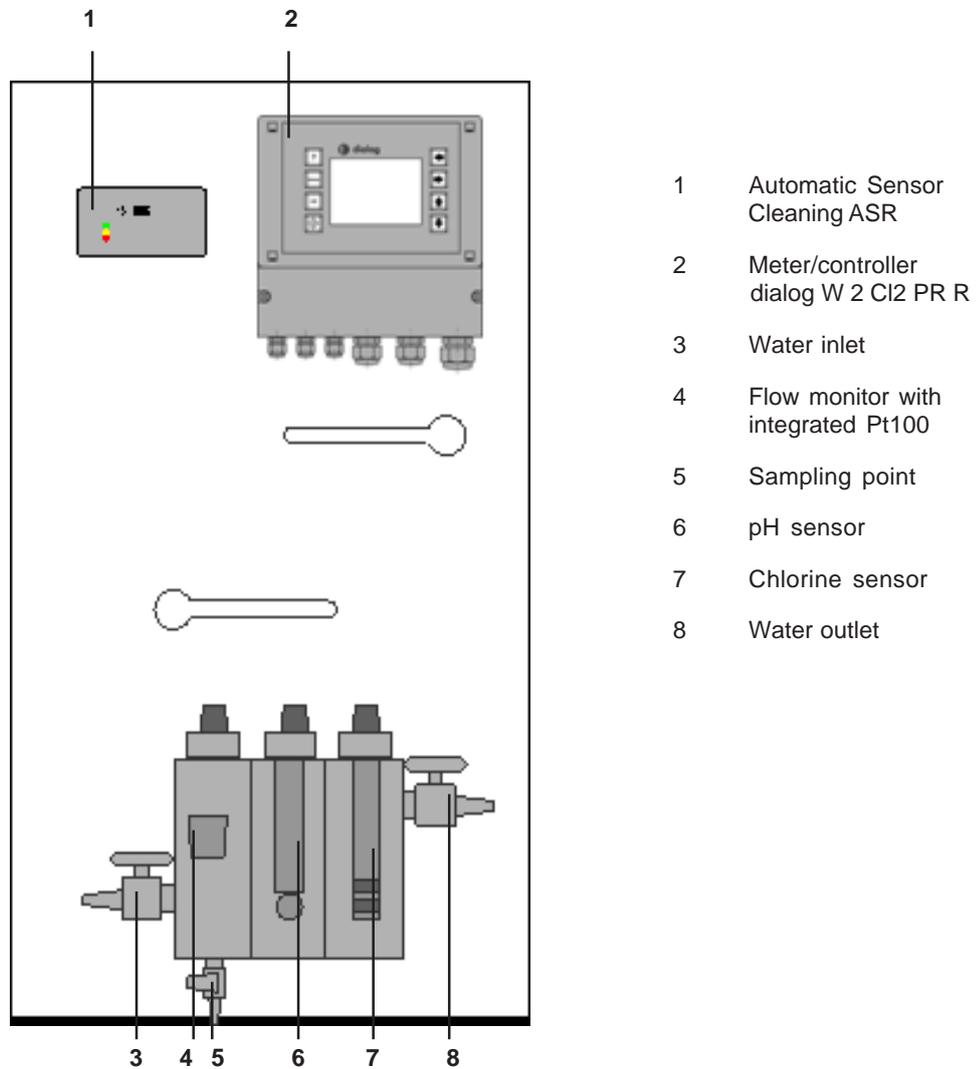


Strom bis	Kondensator C	Widerstand R
60 mA	10 nF 260 V	390 Ohm 2 Watt
70 mA	47 nF 260 V	22 Ohm 2 Watt
150 mA	100 nF 260 V	47 Ohm 2 Watt
1,0 A	220 nF 260 V	47 Ohm 2 Watt

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 10-300, ideally 50-200l/h. The outlet can be an open outlet, pressureless, or the water can be redirected into a pipe or basin.

2.1 Set-up



Sensors:

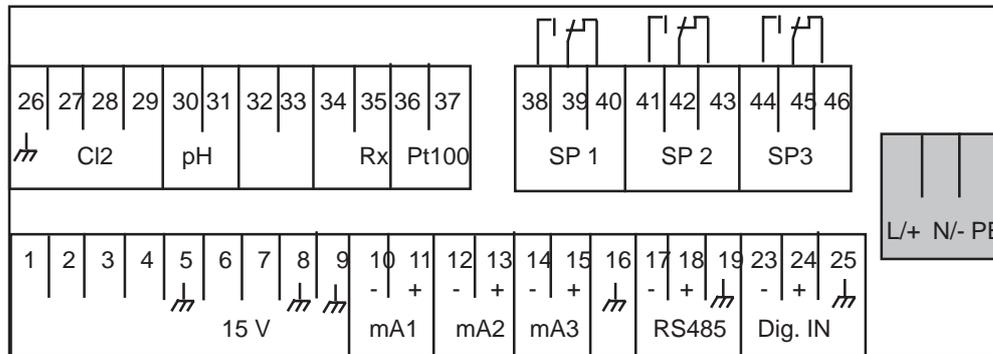
Flow monitor PT-55-W with integrated Pt100

pH sensor AH-300-K-2-2-PG

Chlorine sensor AuAu-600-OO-2-1-PG

ATTENTION The sensors are delivered with protective caps. Remove these prior to installation!

2.2 Connection diagram



Connection	terminals	notes
Chlorine sensor	26 - 29	26 = screen 27 = measuring electrode, white* 28 = reference electrode, black* 29 = counter electrode, brown*
pH sensor	30 – 31	30 = RD / screen reference electrode 31 = BU / core measuring electrode
ORP sensor (option)	35	35 = BU/ core measuring electrode Do not connect screen!
Flow monitor / Pt100	36 - 37	Temperature measurement, yellow + green
	23 + 24	Flow monitor, white + brown
Analog output 1	10 – 11	10 = -, 11 = + max. load 500 Ohm
Analog output 2	12 - 13	12 = -, 13 = + max. load 500 Ohm
Analog output 3	14 - 15	14 = -, 15 = + max. load 500 Ohm
Relay 1	38 - 40	39 + 40: normally closed; 38 + 39: normally open contact
Relay 2	41 - 43	42 + 43: NC; 41 + 42: NO
Relay 3	44 - 46	45 + 46: NC; 44 + 45: NO
Power supply	L/+ N/- PE	See details on instrument label
RS485	17 + 18	17 = -, 18 = +
Digital input	23 - 24	potential-free contact (NC or NO); external controller stop

***NOTE** The colors refer to the cable of the ASR.

2.3 Installation procedure

ATTENTION The sensors are delivered with protective caps to keep them wet. Remove these prior to installation!

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 properly 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 and connect the cables according to their labels.

NOTE To help you find the right places for the sensors: You can recognise pH sensors by the glass bulb, ORP sensors by their single metal ring, and Chlorine sensors by the twin metal rings. The flow monitor with the integrated Pt100 is much shorter than the other sensors.

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.

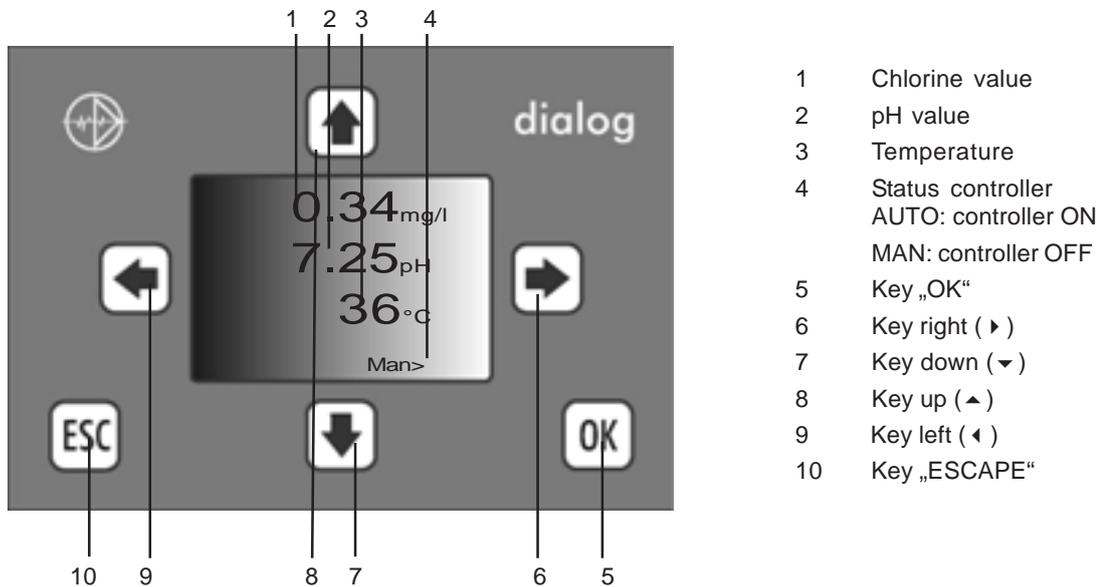
Switch on the power supply for the instrument..

Wait a few minutes until all readings are stable.

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

NOTE The pH sensor has to be taken out of the flow cell for calibration. Mind to close the inlet valve (and the outlet valve if you redirect the outlet water into a basin) before you take out the sensor.

3. Operation



When turned on the instrument shows the measured values and the status of the controllers (Auto / Man). Flow measurement is displayed only if the digital input is set to flow measurement in the basic settings of the controllers.

With the membrane keys you can move within the menu:

With key ▼ you enter the main menu.

With keys ▲ and ▼ you move up and down.

A black cursor line indicates your position in the menu.

With key ▶ you select a menu or parameter.

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

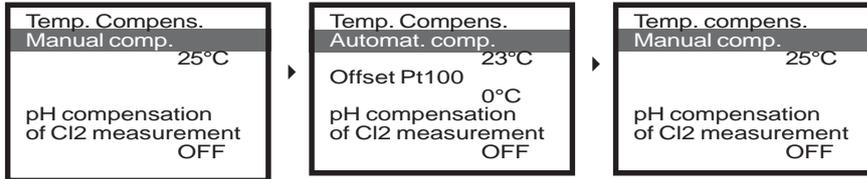
With key „ESCAPE“ you get back to the display of the measured values from any point of the menu.

Changes that have not been stored will be lost.

Key „OK“ is used for those operations which, as a safety measure, require that two keys are pressed simultaneously, i. e. calibration and reset.

3.1 How to adjust parameters

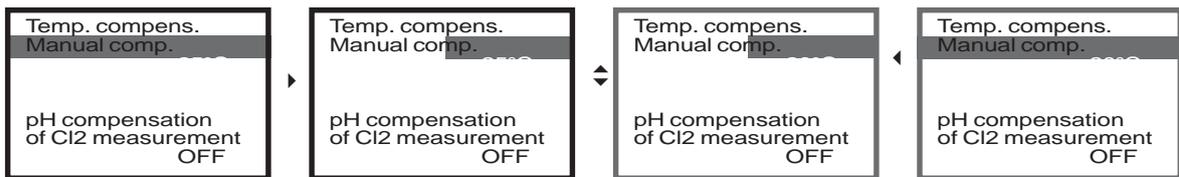
Choosing between alternatives



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

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

Adjustment of numerical values



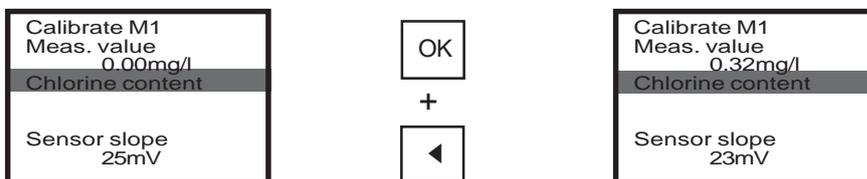
Numerical values can be altered only when they are highlighted by a half-line cursor bar. To achieve that set the cursor to the desired line and then press key **▶**.

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

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

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

Two-key operation



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

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

3.2 Menu overview

Main menu

0.44mg/l
7.24pH
27°C
Man>

Calibrate
Compensation
Controller
Manual operation
Date time
Archive
Basic settings

Select
Calibrate Cl2
Calibrate pH

Calibrate Cl2
meas. value
0.00mg/l
Chlorine content
DPD 0.00mg/l
Sensor slope
25mV/0,1mg/l

Calibrate pH
meas. val. 4.01pH
Recog. buffer
4.00pH
Sensor slope
58mV/pH
Sensor zero
0mV

Temp. compens.
Manual comp.
20°C
pH compensation
of Chlorine value
OFF

Temp. Compens.
Automat. Comp.
23°C
Pt100 correction
0°C
pH compensation
of Chlorine value
OFF

Controller
Cl2 set points

Cl2 alarm values
pH set points
pH alarm values

Cl2 set points
P controller
SP1 0.30mg/l
P range 0.20mg/l

Cl2 alarm values
high 1.00mg/l
low 0.00mg/l
Alarm delay 0s

Manual operation
Cl2 SP1 H-OFF
Cl2 SP2 H-OFF
pH SP1 _____
pH SP2 _____
Auto. switch-off
after 0min

Time Date
07:15 03.11.06
Hours 7
Minutes 15
Days 3
Months 11
Years 6

Archive
Trend Cl2
Trend pH
Trend °C
Log book



Cl2 Trend mg/l
Start 0.00mg/l
End 1.00mg/l

Log book
Time Date
11:16 10.08.06
Controller ON
*****END*****

Basic settings are described on the next page.

Basic settings

Controller	Basic settings Contr. activation Start delay	Contr. activation Ext. contr. stop by logic low	Start delay period 0s period = 0s delay OFF	
	Controller Cl2 Dosage check Controller pH Dosage check	PI controller Pulse frequency SP1 lower SP2 raise Alarm high Alarm low pulses/h 0 setting *100	Dosage check Cl2 period 0s period = 0s check is OFF select alarm relay	
	Analog outputs mA output 1 mA output 2 mA output 3	mA output 1 output for Cl2 Output 0-20mA Start 0.00mg End 1.00mg		
	Buffers used Buffer 1 7.00pH Buffer 2 4.00pH Internal buffer of pHsensor 7.00pH			
	Language Select language German English Swedish Dutch			
	Cleaning Cleaning/day 0			
	Bus address Bus address for RS485 interface 0			
	Test functions	Test functions Product info Analog inputs Digital input Analog outputs Interface Erase settings	Product info Serial number 115 Software version 6.06 Production date 8.06	Test of Analog inputs input1 52mV input2 -12mV input3 736mV input4 27°C
				Test of Digital input Input1 OFF Test of
			Analog outputs Test function On Output1 4.00mA Output2 6.20mA Output3 7.05mA	Test of digital interface >>>>>><<<<<<
			Erase settings !Attention! All settings will be erased. Press key „OK“ and „left“.	

4. General settings

4.1 Date and time

Time	date
07:15	10.08.06
Hours	7
Minutes	15
Days	10
Months	8
Years	6

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

4.2 Language

Select language:
German
English
Dutch

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

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

4.3 Code

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

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

Code 86 gives access to all parameters and menus.

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

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

Press key „ESC“ to leave the menu. Press the key again to enter the menu „enter Code“.

Enter a code, and leave the menu with key „ESC“.

5. Adjustments for measurement

Chlorine measurement

The Chlorine measurement is influenced by pH and flow. pH influence can be compensated. Whenever you activate a compensation, you have to recalibrate the Chlorine measurement. Therefore we advise to fix flow and pH value prior to calibration of the Chlorine measurement, and to activate the pH controller before activating the Chlorine controller.

Chlorine measurement requires calibration to determine the characteristics of the sensor.

For calibration, the Chlorine concentration is determined with a different method, for example photometrically with DPD, and the measured value adjusted to this value. During calibration the sensor should not be removed from the flow cell, and the flow should not be changed.

Zero-calibration is not necessary, but possible.

pH compensation can be activated and deactivated manually in the compensation menu.

pH measurement

pH measurement also requires a calibration. Here the sensor is taken out of the test water to measure two buffer solutions of known pH value. Those values can be stored and changed in the basic settings. If you use pH sensors with special filling, i. e. with an internal buffer unequal to 7, this you can also set in the basic settings.

Temperature compensation can be done manually, by entering a fix temperature value, or automatically with temperature sensor Pt100.

Temperature measurement

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

Archive and log book

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

5.1 Calibration of the pH measurement

```

Calibrate pH
Meas. value 4.01pH
Recognised buffer
  4.00 pH
Sensor slope
  58 mV/pH
Sensor zero
  0mV

```

Procedure

- 1) Switch off the controller and select manual temperature compensation. Enter the temperature of the calibration solutions. Enter the calibration menu. Select „calibrate pH“.
- 2) Immerse the pH sensor in one of the calibration solutions. The dialog recognises automatically which of the stored buffers the electrode is immersed in, and displays its pH value as „recognised buffer“. Wait until the measured value is stable, then calibrate by pressing key „OK“ and then - while still applying pressure - additionally key ◀ . The pH of the calibration solution is now displayed as measured value.
- 3) Rinse the electrode and repeat step 2 with the second calibration solution.
- 4) Check slope and sensor zero, then put the electrode back into the flow cell. Don't forget to select automatic temperature compensation and to switch on the controller.

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

Calibration values pH

Calibration values pH
Buffer 1

```

  7.00 pH
Buffer 2
  4.00 pH
Internal buffer
of the pH sensor
  7.00 pH
At works the

```

following buffers are stored:

calibration solutions: buffers pH 4 and pH 7

internal buffer of the sensor: pH 7

If you want to use other calibration solutions, correct the values. It does not matter whether you start with the higher or the lower pH.

If you are using electrodes with a special internal buffer, adjust the pH value of the sensor buffer since

5.2 Calibration of the Chlorine measurement

Calibrate Cl2 Meas. value 0.32mg/l Chlorine content 0.35mg/l Sensor slope 25mV
--

NOTE: Make sure that pH and flow are stable during calibration and that pH is between 7.0 and 7.5.

Procedure

- 1) Switch off the controller. Enter the calibration menu. Select „calibrate Cl2“.
- 2) Determine the Chlorine content, for e. g. photometrically with DPD. Enter the determined concentration and calibrate by pressing key „OK“ and then - while still applying pressure - key ◀ . The dialog adjusts the measured value to match the determined concentration.
- 3) Check the slope before switching the controller back on again.

NOTE If the slope is lower than 20% of its ideal value, an error message appears, indicating that the sensor has to be cleaned or replaced.

5.3 Temperature compensation

Compensation Automat. Comp. 21°C Pt100 correction 0°C pH compensation of Cl ₂ measurement OFF

You can choose between two alternatives:

1) Automatic compensation with temperature sensor Pt100

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

2) Manual compensation

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

Calibration of the temperature measurement

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

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

5.4 pH compensation

In the menu „compensation“ you can activate pH compensation of the Chlorine measurement. Mind that you have to recalibrate.

5.5 Automatic Sensor Cleaning ASR



Krypton D is equipped with Automatic Sensor Ceinigung ASR which is a patent-pending procedure for automatic electrochemical cleaning of the metal surfaces of the Chlorine sensor. Lime, rust, manganese oxides, and even grease are removed, and the surfaces are reactivated.

The procedure takes approx. 30 seconds. During that time measurement is not possible, and after cleaning the sensor polarises again. Therefor the Chlorine values of display and current output are held fix for five minutes. DURING that time the message „cleaning“ is shown in the display, and the calibration function is disabled.

Select the number of cleaning cycles per day. Cleaning starts always at midnight, and then again every 24, 12, or 8 hours.

Select „cleaning“ in the basic settings. Choose the number of cleaning cycles per day.

NOTE If you choose „0“, the function is deactivated.

CAUTION If the salt content (Chloride) is too high, Chlorine gas is produced during cleaning. Therefor ASR must not be used in salt solutions or sea water applications!

6. Adjustment of the controllers

Controller 1 is assigned to the Chlorine measurement, controller 2 to the pH measurement. Both controllers can be configured as ON/OFF, P, PI, or PID controllers with one or two set points each. The acting direction for each set point can be inverted for bidirectional control. Three relays and two or three analog outputs can be used as controller outputs.

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

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

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

Choose between the following controller versions:

ON/OFF controller

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

P controller

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

PI controller

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

PID controller

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

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

6.1 At works configuration

At works the dialog is configured as follows:

Controller	Controlled variable	direction	relay
Controller 1	free Chlorine	raise	1
Controller 2	pH value	lower	2

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

The third relay is configured as alarm relay for the limit surveillance of both pH and Chlorine measurement.

The current outputs are not used for control purposes.

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

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

6.2 How to change the configuration

ON/OFF controller		
SP1 raise	Rel.1	—
SP2 lower	—	—
Alarm high	Rel.3	—
Alarm low	Rel.3	—
Hysteresis	0.00mg	—

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

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

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

Select „Controller“ in the basic settings.

Select the controller you want to configure.

First line - controller version

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

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

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

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

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

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

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

NOTE If you don't want to use a set point, assign no output (—).

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

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

Lines 5 and 6 - limit surveillance

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

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

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

Lines 7 and 8 - parameters

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

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

6.3 Set points, P range, I and D action

P controller	
SP1	0.00mg
P range	0.00mg
I action	0s

Since these parameters are adjusted from time to time, they are part of the main menu. Select „set points“ in the main menu. Select „set points Cl2“ or „set points pH“. Set the cursor on set point 1 „SP1“ and enter the desired value. Repeat for set point 2 if necessary.

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

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

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

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

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

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

Adjustments for PI controllers:

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

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

Adjustments for PID controllers:

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

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

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

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

6.4 Activation and deactivation of the controllers

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

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

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

6.5 Turn-on delay

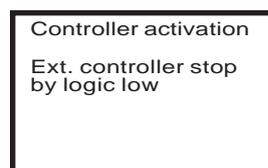
Set a delay time that has to pass before the controller is activated after start-up or power-interrupt. This gives the measurements time to settle and prevents inappropriate dosage of chemicals.

6.6 External controller stop

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

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

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



If you get the message „external controller stop“ under good flow or level conditions, select „controller“ in the basic settings and there „controller activation“. Switch the digital input from logical 1 to logical 0 or vice versa with key ▶ .

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

6.7 Manual operation of the relays

Manual operation		
Cl2	SP1	H-OFF
Cl2	SP2	—
pH	SP1	H-OFF
pH	SP2	—
Auto. switch-off		
after 0min.		

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

Manual operation is possible only if the controllers are set to Manual Mode.

Use key ▶ to switch from Automatic Mode to Manual Mode in the main display.

Select „Manual operation“ in the main menu. The display shows all set points with their assigned relays/ current outputs or with „—“, if no relays or outputs have been assigned.

Select a set point and switch the relay ON with key ▶. „H-OFF“ is replaced by „H-ON“.

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

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

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

6.8 Limits

Alarm values	
High	0.00mg/l
Low	0.00mg/l
Delay	0s

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

If the measured value exceeds a limit, the message „limit max Cl₂ (or min, or pH, respectively)“ is displayed. If a relay has been assigned, this will switch to activate an external horn or similar signal.

Alarm delay

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

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

6.9 Dosage check

Dosage check M1 Period =0s Period = 0s means Check is OFF select alarm relay Rel.3
--

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

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

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

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

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

7. Alarm

Additional to the limit function the dialog provides various check functions that raise alarm.

In case of alarm, the relay chosen as 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 connected sensors are checked. If an analog input does not receive a correct signal, for e.g. if a cable is broken or a sensor damaged, 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 is deactivated.

Dosage control

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

CAUTION Dosage control only checks the time during which the controller output is 100%. If your controller settings are such that the value of 100% cannot occur, for e.g. because you have a set point of 0.3mg/l Chlorine and a P range of 0.6mg/l, so that the maximum controller output is 50%, this condition is never met, even if the water contains no Chlorine due to a damaged feeding line! 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 Cl ₂	no	no
Slope error pH	no	no
Sensor zero pH	no	no
Error input 1 (Cl ₂)	no	yes
Error input 2 (pH)	no	yes
Error input 3 (Rx)	no	no
Error input 4 (T)	no	yes
Limit min/max Cl ₂ /pH	yes	no
Dosage check	yes	yes
Low water	no	yes

7.1 Error messages

Error message	Cause	Measures
Slope Cl ₂ / pH	The slope determined during calibration was less than 20% or higher than 200% 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 internal buffer stored in the basic settings corresponds to the value printed on the sensor. If this has been the case, try to regenerate the sensor (exchange the KCl filling solution, store the sensor in 3M KCl for a few hours, mechanically clean the junction).
Error input 1 / 2 / 3 / 4 (1: Cl ₂ , 2: pH, 3: Rx, 4: T)	The specified input does not receive a correct signal.	This message always indicates a defective part. This can be the sensor, the cable or a wrongful connection. „Error input 4“ is also displayed if automatic temperature compensation was selected although no temperature sensor Pt100 was connected.
Limit min/max Cl ₂ / 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 tips. Caution! Carefully check for leaking chemicals!
Ext. controller stop	The digital input has been short-circuited.	Open the input as soon as you want to continue the dosing. If the error message was issued by the flow sensor, check the water supply.
No water	The digital input has been short-circuited (in the „flow“ mode).	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.

8. Data output

8.1 Analog outputs

Analog output 1 Assigned to M1 Output 0-20mA Start 0.00mg/l End 0.00mg/l	Bus adress for RS485 interface 0
--	---

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

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

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

NOTE The measurements are numbered M1, M2 etc. in the order of connection. In case of doubt, look at the unit of the values to identify the measurement. „mg/l“ is the unit of the Chlorine measurement, „mV“ that of the ORP measurement, and so on.

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

NOTE If an analog output is used as controller output, the output is 0-100%, and you don't need to define start and end values.

8.2 Data output via serial interface RS485

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

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

9. Operation and maintenance

Maintenance of the instrument:

The instrument does not require any maintenance. There is no need for readjustment. If you want to have the instrument checked regularly, however, you are welcome to send it to Dr. A. Kuntze GmbH. You will get it back within two weeks time together with a report. Alternatively the instrument can be checked on site by one of our engineers.

Exchange fuse

Instruments in wall-mounting housings have an internal fuse which has to be replaced at need. You will find a spare fuse fixed inside the terminal cover. Information on the fuse can be found in the chapter „technical data“.

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

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

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

Cleaning

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

Maintenance of the measurements

The metal surfaces of the sensors must be cleaned regularly. In case of the Chlorine sensor this is done automatically by ASR. The ORP sensor has to be cleaned manually.

Clean the flow cell whenever necessary. Mind that sediments inside the flow cell can alter the flow, impede the function of the flow monitor, and lead to unwanted Chlorine consumption.

pH and Chlorine measurement have to be recalibrated regularly. How often, depends on the application and the required accuracy of the measured values.

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

NOTE **We recommend to replace sensors used for control purposes once per year.**

Maintenance of safety measures

Check the function of the alarm relay regularly to ensure that in case of a failure both the alarm from the instrument and the recognition by the SPS work reliably.

You can issue an alarm manually for e.g. by setting limit 1 to a value smaller than the measured value.

NOTE **Mind that an alarm delay time might have been set. And don't forget to reset the limit to its original value after the test!**

Also check the function of the flow monitor regularly to ensure that the controller is properly stopped in a low water situation.

Disposal

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

The ORP and Chlorine sensors contains rings of high-purity gold or platinum that can easily be removed prior to disposal.

10. Test functions



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

Product info

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

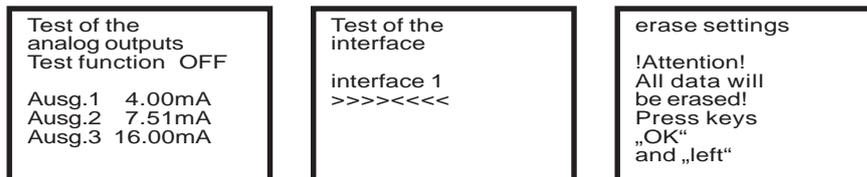
Test of the analog inputs

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

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

Test of the digital inputs

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



Test of the analog outputs

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

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

Test of the digital interface(s)

Here you can see whether the interface(s) send and receive data.

Erase settings (reset)

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

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

Controller 1:

For: Disinfection pH value
 ON/OFF Hysteresis

P PI PID
 Pulse-Pause P-Pauses P-mins
 Pulse-frequency Pulses/h *100
 Servo motor Run times P-mins

SP1: Raise Lower
 Rel. 1 Rel. 2 Rel. 3 AA1 AA2 AA3

SP2: Raise Lower
 Rel. 1 Rel. 2 Rel. 3 AA1 AA2 AA3

Alarm max: Rel. 1 Rel. 2 Rel. 3
Alarm min: Rel. 1 Rel. 2 Rel. 3

Set point:

P-range I actions D actions

Dosage checks

Limit values: max min

Alarm delay:s

Controller 2:

For: Disinfection pH value
 ON/OFF Hysteresis

P PI PID
 Pulse-Pause P-Pauses P-mins
 Pulse-Frequency Pulses/h *100
 Servo motor run times P-mins

SP1: raise lower
 Rel. 1 Rel. 2 Rel. 3 AA1 AA2 AA3

SP2: raise lower
 Rel. 1 Rel. 2 Rel. 3 AA1 AA2 AA3

Alarm min: Rel. 1 Rel. 2 Rel. 3
Alarm max: Rel. 1 Rel. 2 Rel. 3

Set point:

P-range I actions D actions

Dosage check s

Limit values: max min

Alarm delay:s

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