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ANALYTICAL INSTRUMENTS

AMI Deltacon DG

Version 6.21 and higher

Operator's Manual

A-96.250.491 / 041119

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AMI Deltacon DG–Operator's Manual

This document describes the main steps for instrument setup, operation and maintenance.

1. Safety Instructions

General

The instructions included in this section explain the potential risks associated with instrument operation and provide important safety practices designed to minimize these risks.

If you carefully follow the information contained in this section, you can protect yourself from hazards and create a safer work environment.

More safety instructions are given throughout this manual, at the respective locations where observation is most important.

Strictly follow all safety instructions in this publication.

Target audience

Operator: Qualified person who uses the equipment for its intended purpose.

Instrument operation requires thorough knowledge of applications, instrument functions and software program as well as all applicable safety rules and regulations.

OM Location

The AMI Operator's Manual shall be kept in proximity of the instrument.

Qualification, Training

To be qualified for instrument installation and operation, you must:

- read and understand the instructions in this manual as well as the Material Safety Data Sheets.
- know the relevant safety rules and regulations.

1.1. Warning Notices

The symbols used for safety-related notices have the following significance:

DANGER

Your life or physical wellbeing are in serious danger if such warnings are ignored.

- Follow the prevention instructions carefully.

WARNING

Severe injuries or damage to the equipment can occur if such warnings are ignored.

- Follow the prevention instructions carefully.

CAUTION

Damage to the equipment, minor injury, malfunctions or incorrect process can be the consequence if such warnings are ignored.

- Follow the prevention instructions carefully.

Mandatory Signs

The importance of the mandatory signs in this manual.

Safety goggles

Safety gloves

Warning Signs The importance of the warning signs in this manual.


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

1.2. General Safety Regulations

Legal Requirements

The user is responsible for proper system operation.
All precautions must be followed to ensure safe operation of the instrument.

Spare Parts and Disposables

Use only official SWAN spare parts and disposables. If other parts are used during the normal warranty period, the manufacturer's warranty is voided.

Modifications

Modifications and instrument upgrades shall only be carried out by an authorized Service Technician. SWAN will not accept responsibility for any claim resulting from unauthorized modification or alteration.

WARNING

Electrical Shock Hazard

If proper operation is no longer possible, the instrument must be disconnected from all power lines, and measures must be taken to prevent inadvertent operation.

- To prevent from electrical shock, always make sure that the ground wire is connected.
- Service shall be performed by authorized personnel only.
- Whenever electronic service is required, disconnect instrument power and power of devices connected to.
  - relay 1,
  - relay 2,
  - alarm relay

WARNING

For safe instrument installation and operation you must read and understand the instructions in this manual.

WARNING

Only SWAN trained and authorized personnel shall perform the tasks described in this document.

1.3. Restriction for use

The AMI Deltacon DG is designed for determination of:

- specific (total) conductivity
- cation (acid) conductivity after the cation exchanger
- degassed conductivity after a sample reboiler in water-steam-cycles only.

It calculates the pH value and the concentration of the alkaline substance (NH_3, Morpholine, etc.) if an alkaline substance is present in the water.
It is not suitable for pH determination in high purity water before alkalization reagent addition.

Conditions for pH calculation:

- only 1 alkalization agent in the sample
- the contamination is mostly NaCl
- phosphate concentration is < 0.5 ppm
- pH value is > 7.5, and < 11.5

No sand. No oil.
The sample must not contain any particles, which may block the flow cell. Sufficient sample flow is coercive for the correct function of the instrument.

WARNING

For safe instrument installation and operation you must read and understand the instructions in this manual, as well as the Material Safety Data Sheets (MSDS)

- Cation Exchange Resin

Download MSDS

The current Material Safety Data Sheets (MSDS) for the below listed reagents are available for downloading at **www.swan.ch**.

Product name:	Cation Exchange Resin
Catalogue number:	A-82.841.030, A-82.841.031 and A-82.841.035

2. Product Description

2.1. Description of the System

Application Range

The AMI Deltacon DG is a complete monitoring system for the automatic, continuous measurement of the conductivity before (specific conductivity) and after a cation exchanger (cationic or acid conductivity) and the conductivity of the re-boiled sample (degassed conductivity).

Based on difference conductivity measurement, the pH of the sample can be calculated.

The application range covers water steam cycles except neutral treatment.

Special Features

- Many temperature compensation curves for specific conductivity measurement:
  - Strong acids (HCl)
  - Strong bases (NaOH)
  - Ammonia
  - Morpholine
  - Ethanolamines
- Flow monitoring
- Automatic determination of boiling point in configurable intervals and if air pressure changes by more than 5 hPa.

  NOTICE: *The boiling point determination can also be started manually in the menu <Maintenance>/<Degasser>.*

- Surveillance of resin exhaust.
- Calculation of pH according to the VGB 450L, edition 2006
- Calculates the concentration of an alkaline substance present in the water.

Signal Outputs

Two signal outputs programmable for measured values (freely scalable, linear, bilinear, log) or as continuous control output (control parameters programmable).

Current loop: 0/4–20 mA
Maximal burden: 510 Ω

Third signal output available as an option. The third signal output can be operated as a current source or as a current sink (selectable via switch).

Relays

Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function. Both contacts can be set as normally open or normally closed with a jumper.

Maximum load: 1 A/250 VAC

Alarm Relay

One potential free contact.

Alternatively:

- Open during normal operation, closed on error and loss of power.
- Closed during normal operation, open on error and loss of power.

Summary alarm indication for programmable alarm values and instrument faults.

Input

For potential-free contact to freeze the measuring value or to interrupt control in automated installations (*hold* function or *remote-off)*.

Communication interface (optional)

- USB Interface for logger download
- Third signal output (can be used in parallel to the USB interface)
- RS485 with Fieldbus protocol Modbus or Profibus DP
- HART interface

Safety Features

No data loss after power failure. All data is saved in non-volatile memory.
Over voltage protection of in- and outputs.
Galvanic separation of measuring inputs and signal outputs.

Measuring principle

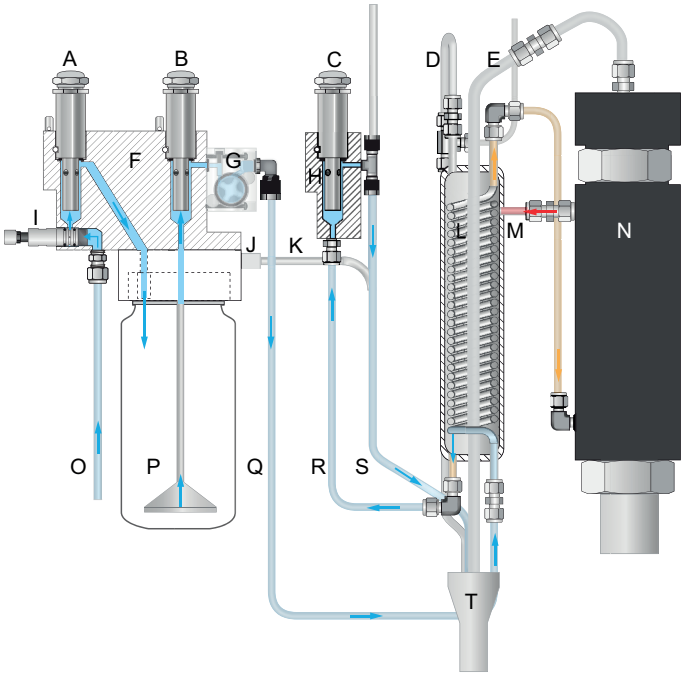
When a voltage is set between two electrodes in an electrolyte solution, the result is an electric field which exerts force on the charged ions: the positively charged cations move towards the negative electrode (cathode) and the negatively charged anions towards the positive electrode (anode). The ions, by way of capture or release of electrons at the electrodes, are discharged and so a current *I* flows through this cycle and the Ohms law $V = I \times R$ applies. From the total resistance *R* of the current loop, only the resistance of the electrolyte solution, respectively its conductivity $^1/_R$, is of interest.

The cell constant of the sensor is determined by the manufacturer and is printed on the sensor label. If the cell constant has been programmed in the transmitter, the instrument measures correctly. No calibration is required, the sensor is factory calibrated. Measuring unit is µS/cm or µS/m.

Specific Conductivity	Conductivity from all ions in the sample, mainly the alkalization agent. The contribution of impurities is masked by the alkalization agent.
Cation Conductivity (Acid Conductivity)	The alkalization agent is removed in the cation column. All cationic ions are exchanged with H+, all anionic impurities (ions with negative charge) pass through the column unchanged.
Degassed Conductivity	After the heat exchanger the sample is heated up to 0.5 °C below the boiling point. Hereby volatile components are removed from the sample, mainly carbon dioxide. Thus, the degassed cation conductivity is a measure of the impurities without a CO_2 error.
Temperature compensation	The mobility of ions in water increase with higher temperature which enlarges the conductivity. Therefore, the temperature is measured simultaneously by an integrated Pt1000 temperature sensor and the conductivity is compensated to 25 °C. Several temperature compensation curves, designed for different water compositions, can be chosen. After cation exchanger (cation conductivity), the temperature compensation curve strong acids has to be set. For more information see: **Influence of Temperature on Electrical Conductivity, PPChem (2012)**.
Standard Temperature	The displayed conductivity value is compensated to 25 °C standard temperature.
Correction or calibration	Not necessary. Auto zero is done automatically each day at 0.30 at night.
Operation	The sample enters at the sample inlet [O] and flows through the flow regulating valve [I], where the flow rate can be adjusted. With the first conductivity sensor [A] the specific conductivity (sc) of the sample is measured. Then the sample is led through the cation exchanger bottle [P] where all alkalization agent is eliminated. Afterwards the cation conductivity (cc) of the sample is measured with the second conductivity sensor [B]. The sample leaves the measuring cell through the flow meter [G] and is led through the heating element of the heat exchanger [L], where the sample is pre-heated.The pre-heated sample flows then into the heater [N] where it is heated up to its boiling point. Vapor leaves the heater via the pressure relief tube [E]. The boiled sample flows via tube [M] back to the heat exchanger where it is cooled down. Then it flows via tube [R] into flow cell [H] where the degassed conductivity is measured.

The temperature is measured with the temperature sensors integrated in the conductivity sensors.

Fluidics overview



A *Conductivity sensor (sc)*
B *Conductivity sensor (cc)*
C *Conductivity sensor (dc)*
D *Heat exchanger pressure relief tube*
E *Heater pressure relief tube*
F *Flow cell 1, (sc, cc)*
G *Flow meter*
H *Flow cell 2, (dc)*
I *Flow regulating valve*
J *Manual deaeration valve*
K *Deaeration tube cation exchanger bottle*
L *Heat exchanger*
M *Connection tube*
N *Heater*
O *Sample inlet*
P *Cation exchanger bottle*
Q *Connection tube*
R *Inlet to Flow cell (dc)*
S *Sample outlet*
T *Waste*

2.2. Instrument Specification

Power Supply

Voltage:	100–127 VAC and 200–240 VAC (±10%) 50/60 Hz (±5%)
Max. current:	
Voltage at 90 VAC:	12 A
Voltage at 140 VAC:	19 A
Voltage higher than 180 VAC:	9.5 A
Max. power consumption:	
Voltage at 90 VAC:	1.1 kW
Voltage at 140 VAC:	2.6 kW
Voltage at 265 VAC:	2.6 kW
Average power consumption:	1.2 kW

Sample requirements

Flow rate:	5–15 l/h
Temperature:	up to 50 °C
Inlet pressure:	up to 2 bar
Outlet pressure:	pressure free

On-site requirements

The analyzer site must permit connections to:

Sample inlet:	Swagelok 1/4” adapter for stainless steel tube
Sample outlet:	13/16” steel tube

Measuring range

Measuring range	Resolution
0.055 to 0.999 µS/cm	0.001 µS/cm
1.00 to 9.99 µS/cm	0.01 µS/cm
10.0 to 99.9 µS/cm	0.1 µS/cm
100 to 1000 µS/cm	1 µS/cm

Automatic range switching.

Accuracy

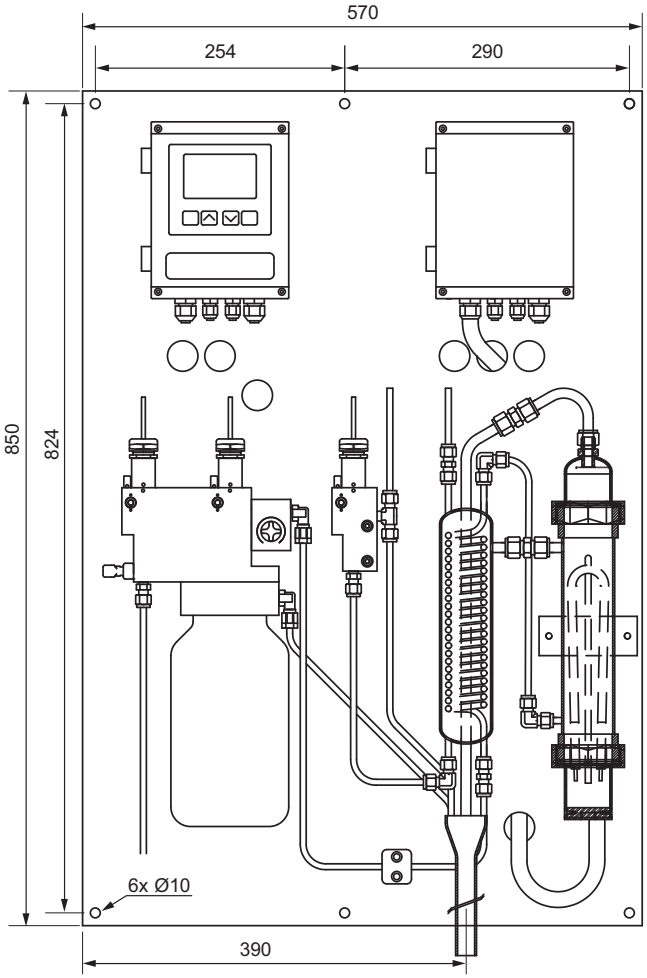
±1% of measuring value (up to 5 mS/cm)
±3% of measuring value (up to 30 mS/cm)

Electronics housing

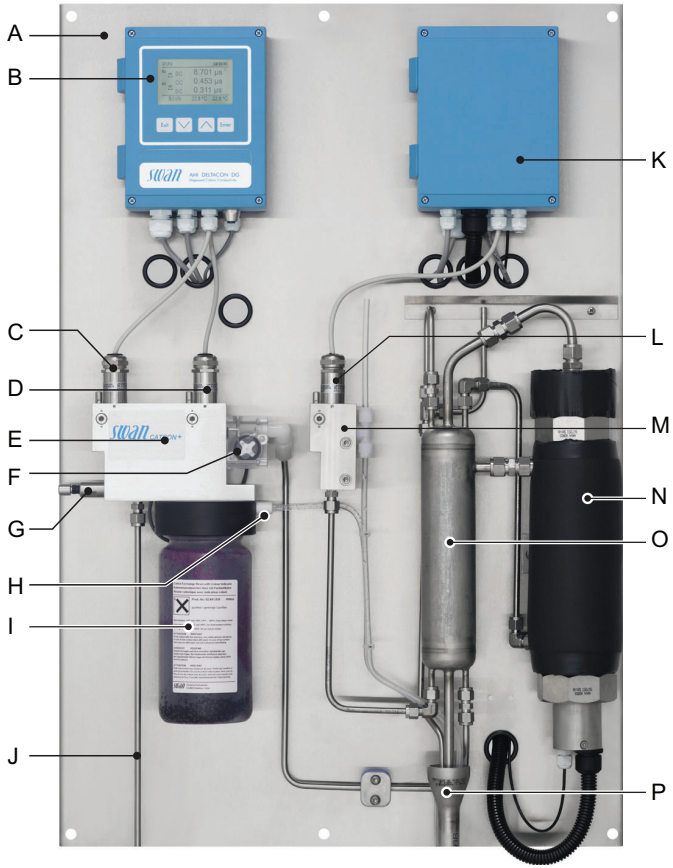
Aluminium with a protection degree of IP 66/NEMA 4X
Ambient temperature: -10 to +50 °C
Humidity: 10–90% rel., non condensing
Display:backlit LCD, 75 x 45 mm

Dimensions

Panel:	Stainless steel
Dimensions:	570 x 850 x200 mm
Screws:	8 mm
Weight:	26 kg



2.3. Instrument Overview



A *Panel*
B *Transmitter*
C *Specific conductivity sensor*
D *Cation conductivity sensor*
E *Flow cell 1, sc, cc*
F *Flow meter*
G *Flow regulating valve*
H *Manual deaeration valve*
I *Cation exchanger*
J *Sample inlet*
K *Degasser controller*
L *Degassed conductivity sensor*
M *Flow cell 2, dc*
N *Heater*
O *Heat exchanger*
P *Waste*

3. Installation

3.1. Installation Checklist Monitors

Check	Instrument's specification must conform to your AC power ratings. Do not turn on power until instructed to do so.
On-site requirements	100–127 VAC, 200–240 VAC (±10%), 50/60 Hz (±5%) isolated power outlet with ground connection and 2.6 kW Sample line with sufficient sample flow and pressure (see Instrument Specification, p. 12.
Installation	Mounting of Instrument Panel, p. 16. Connecting Sample and Waste, p. 16. Monitor: Sensors are already mounted.
Cation exchanger	Fill up cation exchanger bottle with high purity water. Remove the empty bottle and install the cation exchanger bottle.
Electrical Wiring	***NOTICE:*** *Do not switch on the Instrument until all electrical connections are made.* Connect all external devices like limit switches, current loops and pumps (see Connection Diagram, p. 21.) Connect power cord, see Power Supply, p. 22.
Power-up	Open sample flow and wait until flow cell is completely filled. Manually deaerate the cation exchanger bottle. Switch on power. Adjust sample flow.
Instrument set-up	Program all parameters for the sensors (cell constant, temperature correction, cable length, temperature compensation for specific conductivity). If required activate calculations. Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms). Program display screens.
Degasser	The instrument is delivered with the degassing unit switched off. To switch the unit on, follow the instruction in chapter 4, Programming, p. 29.
Run-in period	Let the instrument run continuously for 1 h. This is valid for rinsed cation exchanger resin (nuclear grade) delivered by Swan. If you do not use rinsed cation exchanger resin, the run-in period may be much longer.

3.2. Mounting of Instrument Panel

The first part of this chapter describes the preparing and placing of the system for use.

- The instrument must only be installed by trained personnel.
- Mount the instrument in vertical position.
- For ease of operation mount it so that the display is at eye level.
- For the installation a kit containing the following installation material is available:
  - 6 Screws 8x60 mm
  - 6 Dowels
  - 6 Washers 8.4/24 mm

Mounting requirements

The instrument is only intended for indoor installation.

3.3. Connecting Sample and Waste

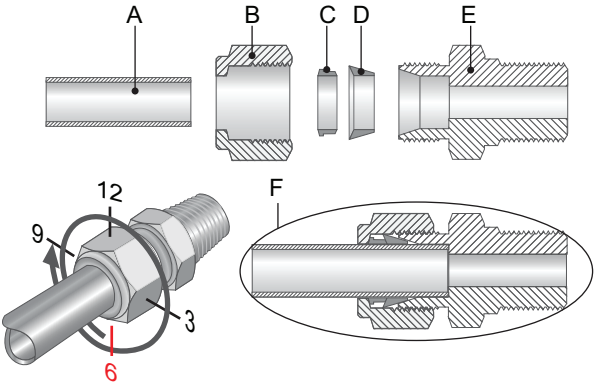
3.3.1 Swagelok Fitting Stainless Steel at Sample Inlet

Preparation

Cut the tube to length and deburr it. The tube must be straight and free from blemishes for approximately 1,5 x tube diameter from the end.
Lubrication with lubricating oil, MoS2, Teflon etc. is recommended for the assembly and reassembly of bigger sized unions (thread, compression cone).

Installation

1. Insert the compression ferrule [C] and the compression cone [D] into the union nut [B].
2. Screw on the union nut onto the body, do not tighten it.
3. Push the stainless steel pipe through the union nut as far as it reaches the stop of the body.
4. Mark the union nut at 6 o'clock position.
5. While holding the fitting body steady, tighten the nut union 1¼ rotation using an open ended spanner.



A Stainless *steel tube*
B *Union nut*
C *Compression ferrule*
D *Compression cone*
E *Body*
F *Tightened connection*

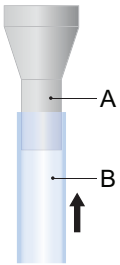
Waste Connect the waste tube to the waste funnel.

CAUTION

Hot water and steam

Hot water and steam leaves the sample outlet, PVC tubes may be damaged.

- Do not use PVC tubes but silicon tubes for the waste line

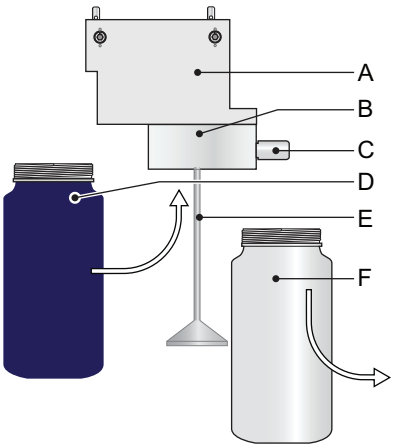


A *Steel tube 13/16”*
B *Silicone tube*

3.4. Installation of Cation Exchanger

Cation exchanger bottle

The bottle containing the cation exchanger is delivered separately. For transport, an empty bottle is installed into the bottle holder.



A *Flow cell*
B *Bottle holder*
C *Manual deaeration valve*
D *Cation exchanger bottle*
E *Inlet filter holder*
F *Empty bottle*

Install cation exchanger bottle

Install the cation exchanger bottle as follows:

1. Unscrew and remove the empty bottle [F] from the bottle holder [B].
2. Fill high purity water into the cation exchanger bottle [D], until the water level in the bottle reaches the beginning of the thread.
3. Carefully, without spilling water, push the cation exchanger bottle over the inlet filter holder [E] into the bottle holder [B].
4. Screw the cation exchanger bottle into the bottle holder.
   ⚠ *Do not tighten the bottle too firmly, this could damage the gasket.*
5. Open the manual deaeration valve [C].
6. Open the flow regulating valve.
7. After a few minutes close the manual deaeration valve.

3.5. Electrical Connections

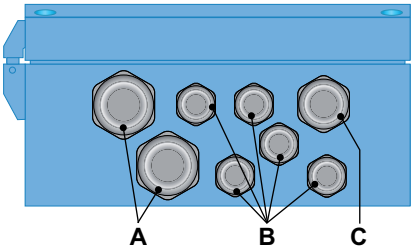
WARNING

Electrical hazard.

- Always turn off AC power before manipulating electric parts.
- Grounding requirements: Only operate the instrument from an power outlet which has a ground connection.
- Make sure the power specification of the instrument corresponds to the power on site.

Cable thicknesses

In order to comply with IP66, use the following cable thicknesses



A *PG 11 cable gland: cable $Ø_{outer}$ 5–10 mm*
B *PG 7 cable gland: cable $Ø_{outer}$ 3–6.5 mm*
C *PG 9 cable gland: cable $Ø_{outer}$ 4–8 mm*

NOTICE: *Protect unused cable glands*

Wire

- For Power and Relays: Use max. 1.5 mm^2 / AWG 14 stranded wire with end sleeves.
- For Signal Outputs and Input: Use 0.25 mm^2 / AWG 23 stranded wire with end sleeves.

WARNING

External Voltage.
External supplied devices connected to relay 1 or 2 or to the alarm relay can cause electrical shocks

- Make sure that the devices connected to the following contacts are disconnected from the power before resuming installation.
  - relay 1
  - relay 2
  - alarm relay

WARNING

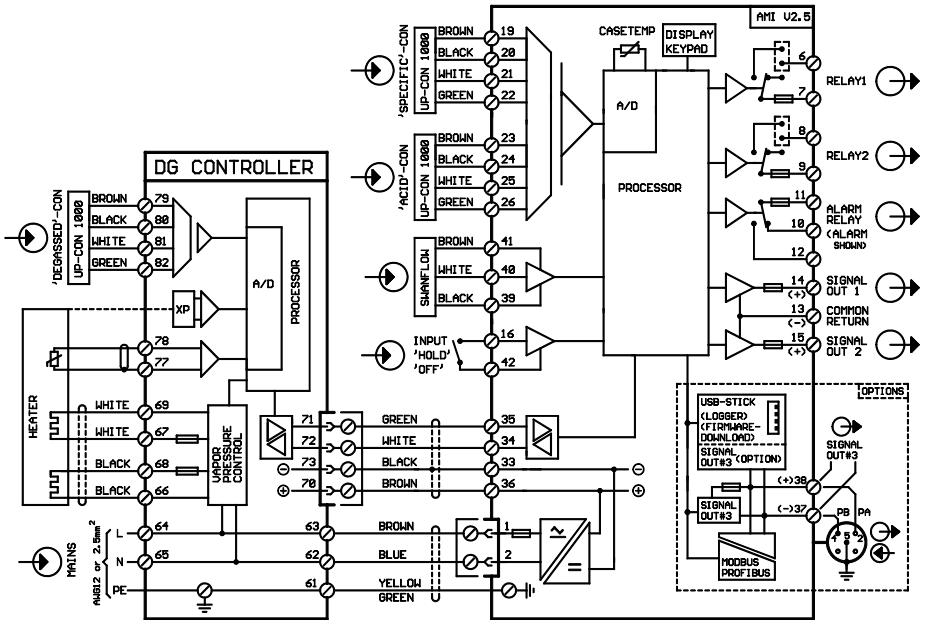
To prevent from electrical shock, do not connect the instrument to the power unless the ground wire (PE) is connected.

- Do not connect unless specifically instructed to do so.

WARNING

The mains of the AMI Transmitter must be secured by a main switch and appropriate fuse or circuit breaker.

3.5.1 Connection Diagram



CAUTION

Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.5.2 Power Supply

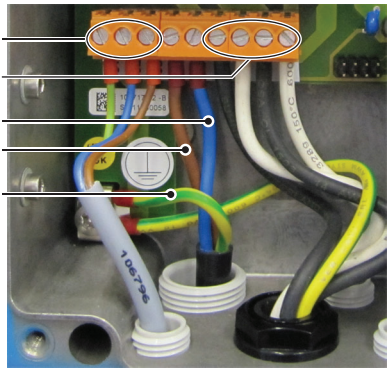
The mains supply is connected to the degasser controller. From there the AMI transmitter and the heater are supplied.

WARNING

Electrical shock hazard

Installation and maintenance of electrical parts must be performed by professionals

- Always turn off AC power before manipulating electric parts.



Already connected external devices.

D *Transmitter supply*
E *Heater supply*

Mains connection

A *Neutral conductor*
B *Phase conductor*
C *Protective earth*

NOTICE: *The protective earth wire (Ground) has to be connected to the grounding terminal.*

Installation requirements

The installation must meet the following requirements.

- Mains cable to comply with standards IEC 60227 or IEC 60245; flammable rating FV1
- Mains equipped with an external switch or circuit-breaker
  - near the instrument
  - easily accessible to the operator
  - marked as interrupter for AMI Deltacon DG

3.6. Input

NOTICE: *Use only potential-free (dry) contacts.*
The total resistance (sum of cable resistance and resistance of the relay contact) must be less than 50 Ω.

Terminals 16/42

For programming see Program List and Explanations, p. 53.

3.7. Relay Contacts

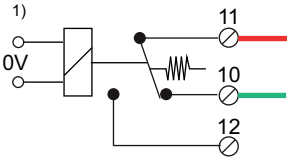
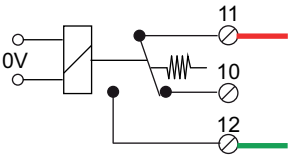
3.7.1 Alarm Relay

NOTICE: *Max. load1 A / 250 VAC*

Alarm output for system errors.

Error codes see Troubleshooting, p. 42.

NOTICE: *With certain alarms and certain settings of the AMI transmitter the alarm relay does not switch. The error, however, is shown on the display.*

	Terminals	Description	Relay connection
NC[1] Normally Closed	10/11	Active (opened) during normal operation. Inactive (closed) on error and loss of power.	
NO Normally Open	12/11	Active (closed) during normal operation. Inactive (opened) on error and loss of power.	

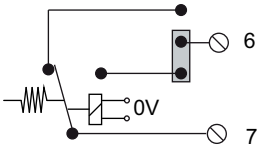
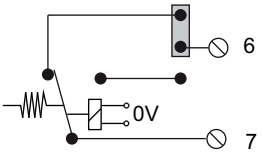
1) *usual use*

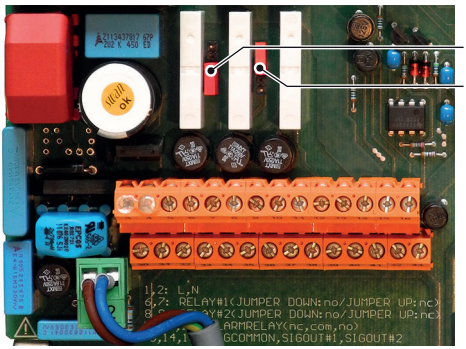
3.7.2 Relay 1 and 2

NOTICE: *Max. load 1 A / 250 VAC*

Relay 1 and 2 can be configured as normally open or as normally closed. Standard for both relays is normally open. To configure a Relay as normally closed, set the jumper in the upper position.

NOTICE: *Some error codes and the instrument status may influence the status of the relays described below.*

Relay config.	Terminals	Jumper pos.	Description	Relay configuration
Normally Open	6/7: Relay 1 8/9: Relay 2		Inactive (opened) during normal operation and loss of power. Active (closed) when a programmed function is executed.	
Normally Closed	6/7: Relay 1 8/9: Relay 2		Inactive (closed) during normal operation and loss of power. Active (opened) when a programmed function is executed.	



A *Jumper set as normally open (standard setting)*
B *Jumper set as normally closed*

For programming see Menu Installation 5.3.2 & 3, p. 68

CAUTION

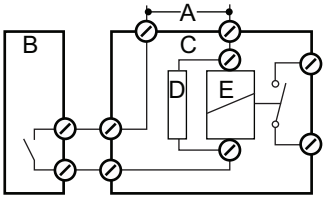
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

Heavy inductive or directly controlled loads (solenoid valves, dosing pumps) may destroy the relay contacts.

- To switch inductive loads > 0.1 A use an AMI relay box available as an option or suitable external power relays.

Inductive load

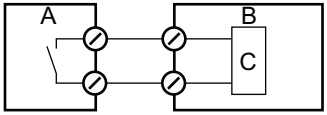
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load. A snubber is not necessary if an AMI relaybox is used.



A *AC or DC power supply*
B *AMI Transmitter*
C *External power relay*
D *Snubber*
E *Power relay coil*

Resistive load

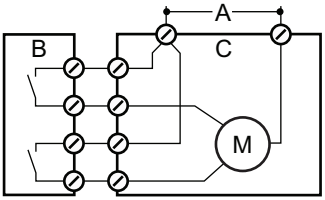
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



A *AMI Transmitter*
B *PLC or controlled pulse pump*
C *Logic*

Actuators

Actuators, like motor valves, are using both relays: One relay contact is used for opening, the other for closing the valve, i.e. with the 2 relay contacts available, only one motor valve can be controlled. Motors with loads bigger than 0.1 A must be controlled via external power relays or an AMI relay box.



A *AC or DC power supply*
B *AMI Transmitter*
C *Actuator*

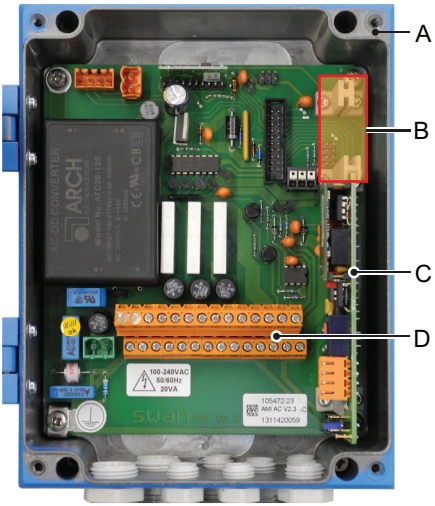
3.8. Signal Outputs

3.8.1 Signal Output 1 and 2 (current outputs)

NOTICE: *Max. burden 510 Ω.*
If signals are sent to two different receivers, use signal isolator (loop isolator).

Signal output 1: Terminals 14 (+) and 13 (-)
Signal output 2: Terminals 15 (+) and 13 (-)
For programming see Program Overview, p. 47, Menu Installation

3.9. Interface Options



A *AMI Transmitter*
B *Slot for interfaces*
C *Frontend PCB*
D *Screw terminals*

The slot for interfaces can be used to expand the functionality of the AMI instrument with either:

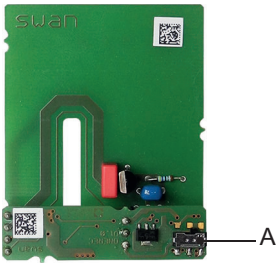
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- an USB Interface

3.9.1 Signal Output 3

Terminals 38 (+) and 37 (-).

Requires the additional board for the third signal output 0/4–20 mA. The third signal output can be operated as a current source or as a current sink (switchable via switch [A]). For detailed information see the corresponding installation instruction.

NOTICE: *Max. burden 510 Ω.*



Third signal output 0/4 - 20 mA PCB

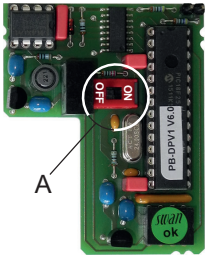
A Operating mode selector switch

3.9.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA

To connect several instruments by means of a network or to configure a PROFIBUS DP connection, consult the PROFIBUS manual. Use appropriate network cable.

NOTICE: *The switch must be ON, if only one instrument is installed, or on the last instrument in the bus.*



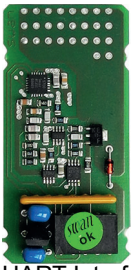
Profibus, Modbus Interface PCB (RS 485)

A On - OFF switch

3.9.3 HART Interface

Terminals 38 (+) and 37 (-).

The HART interface PCB allows for communication via the HART protocol. For detailed information, consult the HART manual.

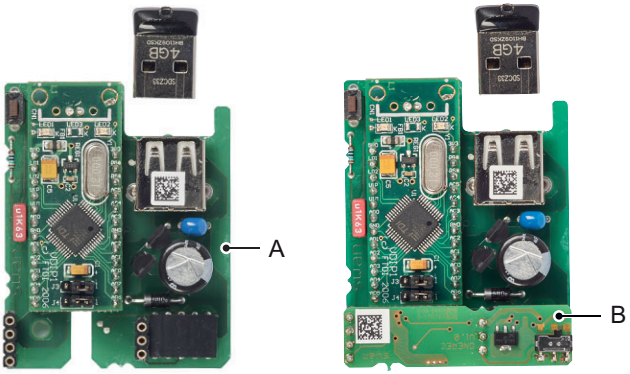


HART Interface PCB

3.9.4 USB Interface

The USB Interface is used to store Logger data and for Firmware upload. For detailed information see the corresponding installation instruction.

The optional third signal output 0/4 – 20 mA PCB [B] can be plugged onto the USB interface and used in parallel.



USB Interface

A USB interface PCB

B Third signal output 0/4 - 20 mA PCB

4. Instrument Setup

After the analyzer is installed according to the previous instructions, connect the power cord. Do not switch on power, yet!

4.1. Establish sample flow

1. Open flow regulating valve, see Fluidics overview, p. 11.
2. Wait until the flow cell has been completely filled.
3. Switch on power.
4. Adjust the sample flow to 5 - 10 l/h.
5. Let the instrument run-in for 1 h.
   ⇒ *This recommendation is valid for rinsed cation exchanger resin (nuclear grade) delivered by Swan.*

   NOTICE: *Not rinsed cation exchanger resin from other suppliers can take a run-in period of several hours to several days.*

4.2. Programming

Sensor parameters

Program all sensor parameters in Menu Installation-Sensors:
menu 5.1.2.1, sensor 1
menu 5.1.2.2, sensor 2
menu 5.1.2.3, sensor 3
The sensor characteristics are printed on the label of each sensor.

87-344.203	UP-Con1000SL	Sensor type
SW-xx-xx-xx	ZK = 0.0417	Cell constant
SWAN AG	DT = 0.06 °C	Temperature correction

Enter for each sensor separately the:
- Cell constant [cm^{-1}]
- Temperature correction [°C]

NOTICE: *Cable length [m] Set the cable length to 0.0 m if the sensors are installed in the flow cell of the AMI monitor.*

- Temperature compensation: The default setting for sensor 1 (specific conductivity) is ammonia.

Calculations

Menu 5.1.1.1

Set <Calculations> to “Yes” if you want to have pH and alkalization agent calculated and displayed.

Measuring unit

Menu 5.1.1.2

Set the <Measuring unit> according to your requirements:

- µS/cm
- µS/m

Monitoring of cation exchange resin

Menu 5.1.1.3

Set <Monitoring of resin> to “Yes” if you want to monitor the capacity of the cation exchanger resin.

Display

Menu 4.4.1, Screen 1

Menu 4.4.2, Screen 2

Program display screens according to your requirements, see program list and explanations 4.4 Display, p. 57.

External devices

Program all parameters for external devices (interface, recorders, etc.) See program list and explanations 5.2 Signal Outputs, p. 59 and 4.2 Relay Contacts, p. 56.

Limits Alarms

Program all parameters for instrument operation (limits, alarms). See program list and explanations 4.2 Relay Contacts, p. 56.

Degasser

CAUTION

Possible damage of the degasser

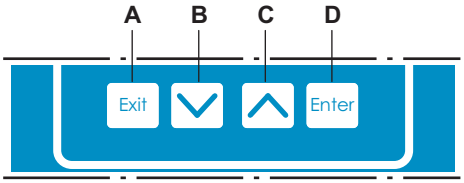
When the instrument is completely empty at initial start-up, the degasser is heating-up for a short time at full power without sample. This can damage the degasser.

- Open the flow regulating valve and wait until the sample flows into the waste funnel before switching on the degasser.

To switch the degasser on navigate to menu 5.1.2.4, <Installation/Sensors/Sensor parameters/Degasser/Mode> and set Mode to “on”.

5. Operation

5.1. Keys



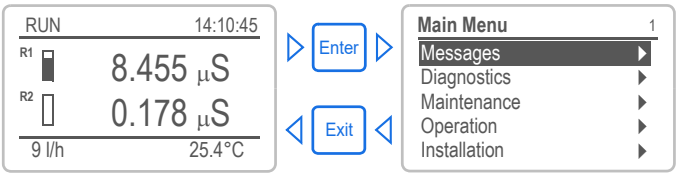
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

B to move DOWN in a menu list and to decrease digits

C to move UP in a menu list and to increase digits
to switch between display1 and 2

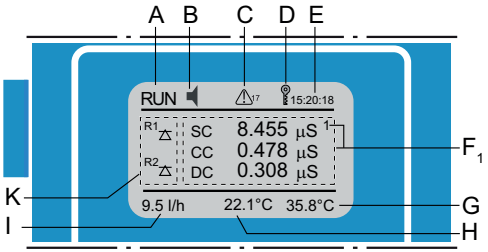
D to open a selected sub-menu
to accept an entry

Program Access, Exit

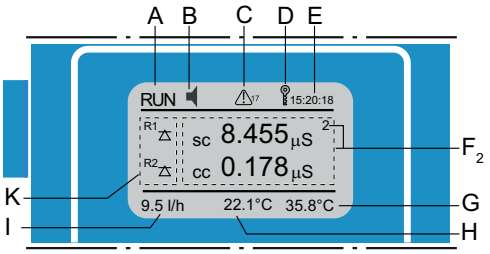


5.2. Display

Example of Display 1



Example of Display 2



A RUN — normal operation

HOLD — input closed or cal delay: Instrument on hold (shows status of signal outputs).

OFF — input closed: control/limit is interrupted (shows status of signal outputs).

B ERROR — Error — Fatal Error

C Remaining cation exchanger resin in % (if monitoring of resin = yes)

D Keys locked, transmitter control via Profibus

E Time

F F_1 Process values Display 1; F_2 Process values Display 2
SC: Specific conductivity
CC: Cation conductivity
DC: Degassed conductivity (DC^H: DC measurement is on hold)

G Sample temperature 3, degassed conductivity temperature.

H Sample temperature 1, specific conductivity temperature.

I Sample flow in l/h

K Relay status

Relay status, symbols

upper/lower limit not yet reached

upper/lower limit reached

control upw./downw. no action

control upw./downw. active, dark bar indicates control intensity

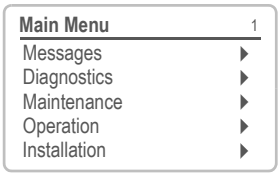
motor valve closed

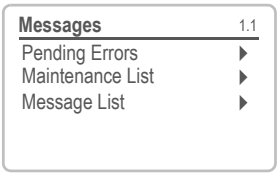
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

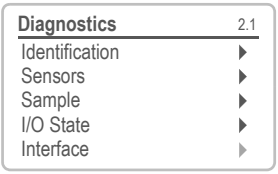
5.3. Software Structure





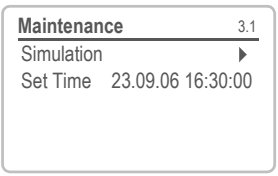
Menu **Messages 1**

Reveals pending errors as well as an event history (time and state of events that have occurred at an earlier point of time).
It contains user relevant data.



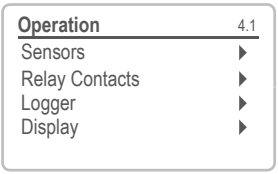
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



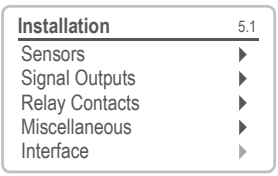
Menu **Maintenance 3**

For instrument calibration, relay and signal output simulation, and to set the instrument time.
It is used by the service personnel.



Menu **Operation 4**

User relevant parameters that might need to be modified during daily routine. Normally password protected and used by the process-operator.
Subset of menu 5 - Installation, but process-related.



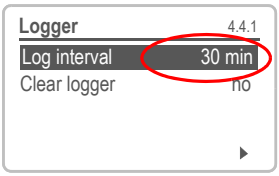
Menu **Installation 5**

For initial instrument set up by SWAN authorized person, to set all instrument parameters. Can be protected by means of password.

5.4. Changing Parameters and values

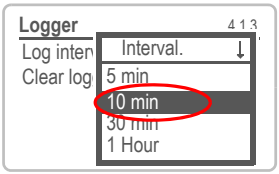
Changing parameters

The following example shows how to change the logger interval:



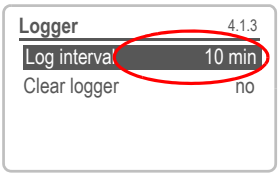
1 Select the parameter you want to change.

2 Press [Enter]



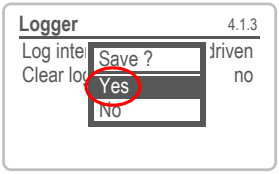
3 Press [▲] or [▼] key to highlight the required parameter.

4 Press [Enter] to confirm the selection or [Exit] to keep the previous parameter).



⇒ *The selected parameter is highlighted (but not saved yet).*

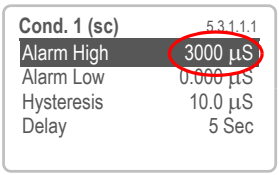
5 Press [Exit].



⇒ *Yes is highlighted.*

6 Press [Enter] to save the new parameter.
⇒ *The system reboots, the new parameter is set.*

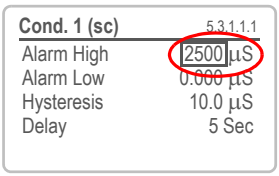
Changing values



1 Select the value you want to change.

2 Press [Enter].

3 Set required value with [▲] or [▼] key.



4 Press [Enter] to confirm the new value.

5 Press [Exit].
⇒ *Yes is highlighted.*

6 Press [Enter] to save the new value.

6. Maintenance

WARNING

Stop operation before maintenance.
- Stop sample flow.
- Shut off power of the instrument.

6.1. Maintenance Schedule

Monthly	◆ Check sample flow. ◆ If monitoring of resin has been switched off: Check cation exchanger resin. The resin color changes to red/orange if exhausted.
If required	◆ Clean conductivity sensors ◆ Replace the inlet filter

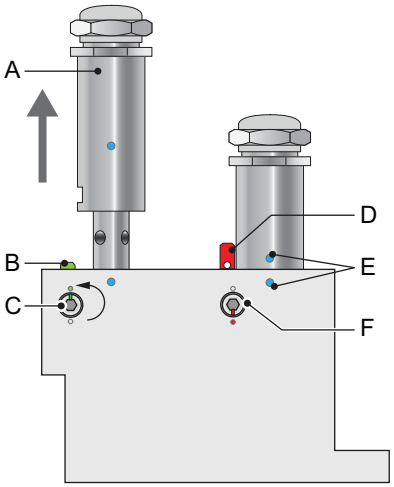
Resin consumption

A 1 l resin bottle, delivered by Swan lasts at 1 ppm alkalization agent (pH 9.4)
- for 4 months at sample flow 10 l/h,
- respectively 5 months at sample flow 5 l/h

6.2. Stop of Operation for Maintenance

1. Stop sample flow.
2. Shut off power of the instrument.

6.3. Maintenance of the Sensor



A *Conductivity sensor*
B *Security pin unlocked*
C *Locking screw open*
D *Security pin locked*
E *Alignment marks*
F *Locking screw closed*

6.3.1 Remove the Sensor from the Flow Cell

To remove the sensor form the flow cell proceed as follows:

1. Press the security pin [B] down.
2. Turn the locking screw [C] 180° counterclockwise with a 5 mm allen key.
   ⇒*The security pin remains down.*
3. Remove the sensor.

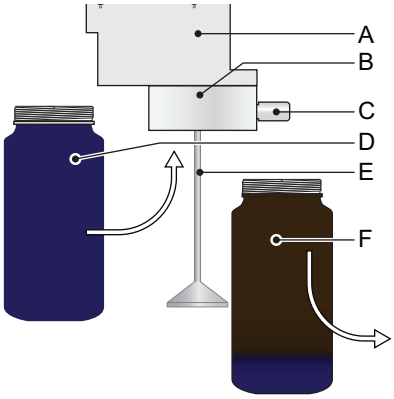
Cleaning If the sensor is slightly contaminated, clean it with soapy water and a pipe cleaner. If the sensor is strongly contaminated, dip the tip of the sensor into 5% hydrochloric acid for a short time.

6.3.2 Install the Sensor into the Flow Cell

1. Make sure that the locking mechanism is in unlocked position (locking screw in position [C] and security pin in position [B]).
2. Put the sensor into the flow cell with the alignment marks [E] in line.
3. Turn the locking screw with a 5 mm allen key clockwise 180°.
   ⇒*The security pin moves up in lock position.*

6.4. Replace the Ion Exchanger

The resin of the ion exchanger changes its color from dark violet to brown if the capacity is exhausted. The resin should be changed before no violet resin is left or the cation conductivity rises above the normal value. At a concentration of 1 ppm alkalization agent, one resin filling will last for roughly 4 months if sample flow is 10 l/h, or 5 months if sample flow is 5 l/h.



A *Flow cell*
B *Bottle holder*
C *Manual deaeration valve*
D *New cation exchanger bottle*
E *Inlet filter holder*
F *Exhausted cation exchanger bottle*

1 Stop sample flow.

2 Slightly squeeze the exhausted cation exchanger bottle [F] before removing.
⇒ *Thus no water will spill out of the flow cell when loosening the bottle.*

3 Unscrew and carefully remove the exhausted cation exchanger bottle [F].

4 Fill high purity water into the new cation exchanger bottle [D], until the water level in the bottle reaches the beginning of the thread.

5 Carefully, without spilling water, push the cation exchanger bottle over the inlet filter holder [E] into the bottle holder [B].

6 Screw the cation exchanger bottle into the bottle holder.
⚠ *Do not tighten the bottle too firmly, this could damage the gasket.*

7 In the menu <maintenance/change of resin> set change of resin to yes.

8 Open the manual deaeration valve [C].

9 Open the flow regulating valve and adjust the sample flow.

10 After a few minutes close the manual deaeration valve.

11 Pre-rinse the new cation exchanger resin until the display shows stable measuring values.

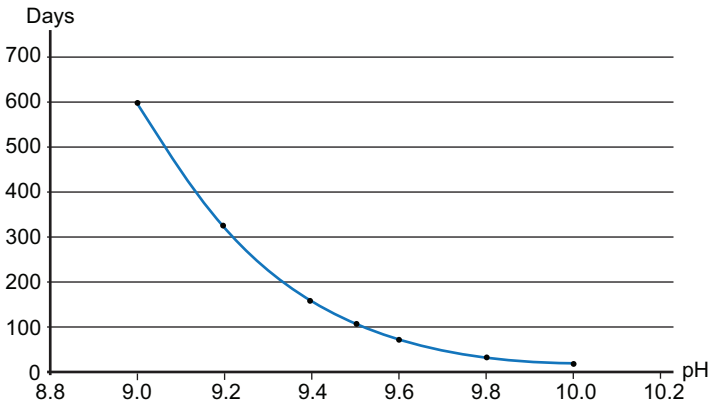
Operation time 1 liter Swan resin

This graphic shows the average exhaust time (flow 6 l/h) and must be verified by the user.

Cation Conductivity.

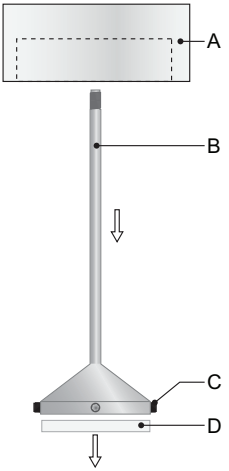
Operational days for 1 l of cation exchange resin with an exchange capacity of 1.8 eq/l.

Flow rate 6 l/h alkalization with ammonia. (safety margin of 15% subtracted).



6.5. Changing the inlet filter

The inlet filter of the cation exchanger prevents the resin from entering the flow cell. It is located in the inlet filter holder [B].



A *Bottle holder*
B *Inlet filter holder*
C *Allen screws*
D *Inlet filter*

1 Stop sample flow.

2 Slightly squeeze the cation exchanger bottle [E] before removing.
⇒ *Thus no water will spill out of the flow cell when loosening the bottle.*

3 Unscrew and carefully remove the cation exchanger bottle.

4 For better access to the allen screws [C] unscrew and remove the filter holder [B] from the bottle holder [A].

5 Loosen the 4 allen screws with a 1.5 mm allen key.

6 Carefully remove the inlet filter [D] with a screw driver no.0 from the inlet filter holder.

7 Insert a new inlet filter.

8 Tighten the 4 allen screws slightly.

9 Install the inlet filter holder.

10 Screw the cation exchanger bottle into the bottle holder.
⚠ *Do not tighten the bottle too firmly, this could damage the gasket.*

6.6. Replacing Fuses

6.6.1 Fuses in the AMI Transmitter

WARNING

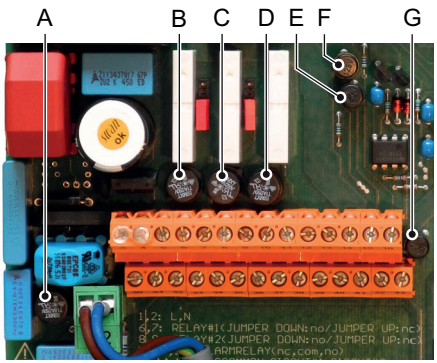
External Voltage.
External supplied devices connected to relay 1 or 2 or to the alarm relay can cause electrical shocks

- Make sure that the devices connected to the following contacts are disconnected from the power before resuming installation.
  - relay 1
  - relay 2
  - alarm relay

When a fuse has blown, find out the cause and fix it before replace it with a new one.

Use tweezers or needle-nosed pliers to remove the defective fuse.

Use original fuses provided by SWAN only.



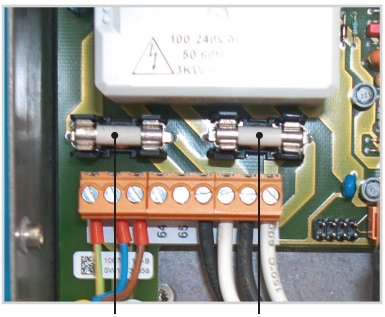
A *1.6 AT/250V Instrument power supply*
B *1.0 AT/250V Relay 1*
C *1.0 AT/250V Relay 2*
D *1.0 AT/250V Alarm relay*
E *1.0 AF/125V Signal output 2*
F *1.0 AF/125V Signal output 1*
G *1.0 AF/125V Signal output 3*

6.6.2 Fuses in the Degasser Control Unit

WARNING

Electrical hazard.

- Always turn off AC power before manipulating electric parts.



A *12.5 AT/250V Heater*
B *12.5 AT/250V Heater*

6.7. Longer Stop of Operation

1. Stop sample flow.
2. Slightly squeeze the ion exchanger bottle.
   ⇒ *Thus no water will spill out of the flow cell when loosening the bottle.*
3. Unscrew and carefully remove the ion exchanger bottle with the exhausted resin.
4. Close the ion exchanger bottle with the screw cover and store it in a frost-protected room.
5. Screw an empty bottle into the bottle holder.
6. Shut off power of the instrument.

7. Troubleshooting

This chapter provides some hints to make troubleshooting easier. For any detailed information how to replace or clean parts please see chapter Maintenance, p. 35.

For any detailed information how to program the instrument please see chapter Program List and Explanations, p. 53.

If you need help please contact your local distributor. Note serial number of instrument and all diagnostic values before.

Conditions for pH calculation

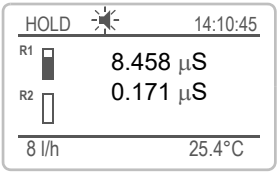
- only 1 alkalization agent in the sample (no mixture)
- the contamination is mostly NaCl
- phosphate concentration is < 0.5 ppm
- if pH value is < 8, the concentration of contaminant must be small compared to the concentration of the alkalization agent
- pH value is > 7.5, and < 11.5

Problem	Possible Reason
Cond. value <0.055 µS/cm	◆ Air bubble at sensor tip or sensor in air.
High cation cond. after start-up	◆ Cation exchanger resin not rinsed. Use Swan cation exchanger resin.
No pH/alkalization agent value available in display, relay, signal output	◆ Switch on calculations in Installation, Sensor, Miscellaneous, Calculations. ◆ Afterwards program screen 1 and 2 in Operation, Display, Screen 1, Screen 2.

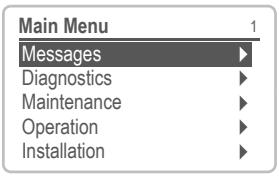
7.1. Error List

Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded.
Such Errors are marked **E0xx** (bold and black).
Fatal Error (blinking symbol)
Control of dosing devices is interrupted.
The indicated measured values are possibly incorrect.
Fatal Errors are divided in the following two categories:

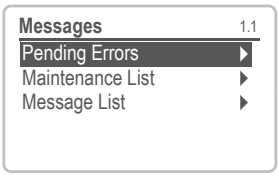
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



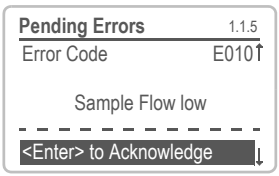
Error or fatal Error
Error not yet acknowledged.
Check **Pending Errors 1.1.5 *** and take corrective action.
Press [ENTER].



Navigate to menu Messages.
Press [ENTER].



Navigate to menu Pending Errors.
Press [ENTER].



Press [ENTER] to acknowledge the Pending Errors. The Error is reset and saved in the Message List.

Error	Description	Corrective action
E001	Cond. 1 Alarm high	– check process – check programmed value, see 5.3.1.1, p. 65
E002	Cond. 1 Alarm low	– check process – check programmed value, see 5.3.1.1, p. 65
E003	Cond. 2 Alarm high	– check process – check programmed value, see 5.3.1.1.2.1, p. 65
E004	Cond. 2 Alarm low	– check process – check programmed value, see 5.3.1.1.2.25, p. 66
E005	Cond. 3 Alarm high	– check process – check programmed value, see 5.3.1.1.2.25, p. 66
E006	Cond. 3 Alarm low	– check process – check programmed value, see 5.3.1.1.2.25, p. 66
E007	Temp. 1 high	– check process – check programmed value, see 5.3.1.1.4, p. 66
E008	Temp. 1 low	– check process – check programmed value, see 5.3.1.1.4, p. 66
E009	Sample Flow high	– check sample inlet pressure – check programmed value, see 5.3.1.3.2, p. 68
E010	Sample Flow low	– check sample inlet pressure – Check flow regulating valve – check programmed value, see 5.3.1.3.35, p. 68
E011	Temp. 1 shorted	– Check wiring of temperature sensor – Check temperature sensor

Error	Description	Corrective action
E012	Temp. 1 disconnected	– Check wiring of temperature sensor – Check temperature sensor
E013	Case Temp. high	– check case/environment temperature – check programmed value, see 5.3.1.4.1, p. 68
E014	Case Temp. low	– check case/environment temperature – check programmed value, see 5.3.1.4.2, p. 68
E015	pH Calculation undef.	– pH out of range (<7.5 or >11.5)
E017	Control time-out	– Check control device or programming in Installation, Relay contact, Relay 1/2 5.3.2 & 3, p. 68
E018	Degasser disconnected	– check wiring of degasser
E019	Temp. 2 shortened	– check wiring of temperature sensor – check temp. sensor
E020	Temp. 2 disconnected	– check wiring of temperature sensor – check temp. sensor
E021	Temp. 3 shortened	– check wiring of temperature sensor – check temp. sensor
E022	Temp. 3 disconnected	– check wiring of temperature sensor – check temp. sensor
E023	Degasser Ctl Timeout	–
E024	Input active	– See If Fault Yes is programmed in Menu see 5.3.4, p. 73
E026	IC LM75	– call service
E028	Signal output open	– check wiring on signal outputs 1 and 2
E030	EEProm Frontend	– call service
E031	Cal. Recout	– call service
E032	Wrong Frontend	– call service
E033	pH Alarm high	– check process – check programmed value, see 5.3.1.1.4.1, p. 66

Error	Description	Corrective action
E034	pH Alarm low	– check process – check programmed value, see 5.3.1.1.4.25, p. 66
E035	Alkali Alarm high	– check process – check programmed value, see
E036	Alkali Alarm low	– check process – check programmed value, see
E037	Temp. 2 high	– check process – check programmed value, see 5.3.1.2.2.1, p. 67
E038	Temp. 2 low	– check process – check programmed value, see 5.3.1.2.2.25, p. 67
E039	Temp. 3 high	– check process – check programmed value, see 5.3.1.2.2.1, p. 67
E040	Temp. 3 low	– check process – check programmed value, see 5.3.1.2.2.25, p. 67
E041	Degasser Line Voltage	–
E042	Degasser Temperature	–
E049	Power-on	– none, normal status
E050	Power-down	– none, normal status
E067	Resin depleted	– Exchange the cation resin bottle, see Replace the Ion Exchanger, p. 37

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, p. 53

- Menu 1 **Messages** informs about pending errors and maintenance tasks and shows the error history. Password protection possible. No settings can be modified.
- Menu 2 **Diagnostics** is always accessible for everybody. No password protection. No settings can be modified.
- Menu 3 **Maintenance** is for service: Calibration, simulation of outputs and set time/date. Please protect with password.
- Menu 4 **Operation** is for the user, allowing to set limits, alarm values, etc. The presetting is done in the menu Installation (only for the System engineer). Please protect with password.
- Menu 5 **Installation**: Defining assignment of all inputs and outputs, measuring parameters, interface, passwords, etc. Menu for the system engineer. Password strongly recommended.

8.1. Messages (Main Menu 1)

Pending Errors 1.1*	*Pending Errors*	1.1.5*	* Menu numbers
Maintenance List 1.2*	*Maintenance List*	1.2.5*	
Message List 1.3*	*Number*	1.3.1*	
	Date, Time		

8.2. Diagnostics (Main Menu 2)

Identification	Designation	AMI Delatacon		* Menu numbers
2.1*	Version	V6.21-04/17		
	Degasser	2.0		
	Factory Test	*Instrument*	2.1.4.1*	
	2.1.4*	*Motherboard*		
		Front End		
		Degasser 1		
		Degasser 2		
	Operating Time	*Years / Days / Hours / Minutes / Seconds*		2.1.5.1*
	2.1.5*			
Sensors	**Conductivity**	Sensor 1	*Current value*	2.2.1.1.1*
2.2*	2.2.1*	2.2.1.1*	*Raw value*	
			Cell constant	
		Sensor 2	*Current value*	2.2.1.1.2.1*
		2.2.1.2*	*Raw value*	
			Cell constant	
		Sensor 3	*Current value*	2.2.1.1.3.1*
		2.2.1.3*	*Raw value*	
			Cell constant	
	Miscellaneous	Case Temp.	*2.2.2.1**	
	2.2.2*			
	Degasser	*Heater*	2.2.4.1*	
	2.2.4*	*Boiling Point*	2.2.4.2*	
		PWM	2.2.4.3*	
		Line Voltage	2.2.4.4*	
		Sample Flow	2.2.4.5*	
		Air Pressure	2.2.4.6*	
	Boiling point	*Number*	2.2.5.1*	
	2.2.5	*Date, Time*	2.2.5.2*	
		Boiling point	2.2.5.3*	
		Air Pressure	2.2.5.4*	
		Sample Flow	2.2.5.5*	

Sample	*Sample ID*	2.3.1*		
2.3*	**Sample Flow**	*Sample Flow*	2.3.2.1*	
	2.3.2*	*Raw value*		
	Sample Temp.	*Temp.1*	2.3.3.1*	
	2.3.3*	*(Pt1000)*		
		Temp.2		
		(Pt1000)		
		Temp.3		
		(Pt1000)		
	Resin capacity (%)			
	Change of resin (date)			
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1/2*	2.4.2*		
	Input			
	Signal Output 1/2			
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Simulation	*Alarm Relay*	3.1.1*	*Menu numbers
3.1*	*Relay 1*	3.1.2*	
	Relay 2	3.1.3*	
	Signal Output 1	3.1.4*	
	Signal Output 2	3.1.5*	
Set Time	*(Date), (Time)*		
3.2*			
Change of Resin			
3.3*			
Degasser	Define Boiling Point	3.5.1*	
3.5*			

8.4. Operation (Main Menu 4)

Sensors	*Filter Time Const.*	4.1.1*		
4.10*	*Hold after Cal*	4.1.2*		
Relay Contacts	**Alarm Relay**	**Cond. 1 (sc)**	*Alarm High*	4.2.1.1.1*
4.2*	4.2.1*	4.2.1.1*	*Alarm Low*	4.2.1.1.25*
			Hysteresis	4.2.1.1.35*
			Delay	4.2.1.1.45*
		Cond. 2 (cc)	*Alarm High*	4.2.1.2.1*
		4.2.1.2*	*Alarm Low*	4.2.1.2.25*
			Hysteresis	4.2.1.2.35*
			Delay	4.2.1.2.45*
		Cond. 3 (dc)	*Alarm High*	4.2.1.3.1*
		4.2.1.3*	*Alarm Low*	4.2.1.3.25*
			Hysteresis	4.2.1.3.35*
			Delay	4.2.1.3.45*
		pH	*Alarm High*	4.2.1.4.1*
		4.2.1.4*	*Alarm Low*	4.2.1.4.25*
			Hysteresis	4.2.1.4.35*
			Delay	4.2.1.4.45*
		Neutral salts	*Alarm High*	4.2.1.5.1*
		4.2.1.5*	*Alarm Low*	4.2.1.5.25*
			Hysteresis	4.2.1.5.35*
			Delay	4.2.1.5.45*
	Relay 1/2	*Parameter*		
	4.2.2*/4.2.3*	*Setpoint*	4.2.x.200*	
		Hysteresis	4.2.x.300*	
		Delay	4.2.x.40*	
	Input	*Active*	4.2.4.1*	
	4.2.4*	*Signal Outputs*	4.2.4.2*	
		Output / Control	4.2.4.3*	
		Fault	4.2.4.4*	
		Delay	4.2.4.5*	
Logger	*Log Interval*	4.3.1*		
4.3*	*Clear Logger*	4.3.2*		* Menu numbers
Display	**Screen 1**	Row 1	4.4.1.1*	
4.4*	4.4.1*	Row 2	4.4.1.2*	
		Row 3	4.4.1.3*	
	Screen 2	Row 1	4.4.2.1*	
	4.4.2*	Row 2	4.4.2.2*	
		Row 3	4.4.2.3*	

8.5. Installation (Main Menu 5)

Sensors	**Miscellaneous**	*Calculations*	5.1.1.1*		
5.1*	*5.1.1**	*Maes. unit*	5.1.1.2*		
		Monitoring of resin	5.1.1.3*		
		Resin Capacity	5.1.1.4*		
		Volume of resin	5.1.1.5*		
	Sensor parameters	**Sensor 1**	Cell Constant	5.1.2.1.1*	
	5.1.2*	5.1.2.1*	Temp. Corr.	5.1.2.1.2*	
			Cable length	5.1.2.1.3*	
			Temp. comp.	*Comp.*	
			5.1.2.1.5*	5.1.2.1.5.1*	
		Sensor 2	*Cell Constant*	5.1.2.2.1*	
		5.1.2.2*	*Temp. Corr.*	5.1.2.2.2*	
			Cable length	5.1.2.2.3*	
			Temp. comp.	*Comp.*	
			5.1.2.2.5*	**5.1.2.2.5.1***	
		Sensor 3	*Cell Constant*	**5.1.2.3.1***	
		5.1.2.3*	*Temp. Corr.*	**5.1.2.3.2***	
			Cable length	**5.1.2.3.3***	
			Temp. comp.	*Comp.*	
			5.1.2.3.5*	5.1.2.3.5.1*	
		Degasser	Mode	5.1.2.4.1*	
		5.1.2.4*	Boiling point interval	5.1.2.4.2*	
	Flow	Sensor	5.1.3.1*		
	5.1.3*				
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1/5.2.2.1*		
5.2*	5.2.1/5.2.2*	*Current Loop*	5.2.1.2/5.2.2.2*		
		Function	5.2.1.3/5.2.2.3*		
		Scaling	*Range Low*	5.2.x.40.10/11*	
		5.2.x.40	*Range High*	5.2.x.40.20/21*	
Relay Contacts	**Alarm Relay**	**Conductivity**	**Cond. 1 (sc)**	*Alarm High*	5.3.1.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*5.3.1.1.1**	*Alarm Low*	5.3.1.1.1.25*
				*Hysteresis**	5.3.1.1.1.35
				Delay	5.3.1.1.1.45*
			Cond. 2 (cc)	*Alarm High*	5.3.1.1.2.1*
			*5.3.1.1.2**	*Alarm Low*	5.3.1.1.2.25*
				*Hysteresis**	5.3.1.1.2.35
				Delay	5.3.1.1.2.45*

			Cond. 3 (cc)	*Alarm High*	5.3.1.1.3.1*
			*5.3.1.1.2**	*Alarm Low*	5.3.1.1.3.25*
				*Hysteresis *	5.3.1.1.3.35
				Delay	5.3.1.1.3.45*
		Sample Temp.	**Temp. 1**	*Alarm High*	5.3.1.2.1.1*
		5.3.1.2*	5.3.1.2.1*	*Alarm Low*	5.3.1.2.1.25*
			Temp. 2	*Alarm High*	5.3.1.2.2.1*
			5.3.1.2.2*	*Alarm Low*	5.3.1.2.2.25*
			Temp. 3	*Alarm High*	5.3.1.2.3.1*
			5.3.1.2.3*	*Alarm Low*	5.3.1.2.3.25*
		Sample Flow	*Flow Alarm*	5.3.1.3.1*	
		5.3.1.3*	*Alarm High*	5.3.1.3.2	
			Alarm Low	5.3.1.3.35	
		Case Temp.	Alarm High	5.3.1.4.1*	
		5.3.1.4*	*Alarm low*	5.3.1.4.2*	
	Relay 1/2	*Function*	5.3.2.1/ 5.3.3.1*		
	5.3.2/5.3.3*	*Parameter*	5.3.2.20/ 5.3.3.20*		
		Setpoint	5.3.2.300 / 5.3.3.301*		
		Hysteresis	5.3.2.400/ 5.3.3.401*		
		Delay	5.3.2.50/ 5.3.3.50*		
	Input	*Active*	5.3.4.1*		
	5.3.4*	*Signal Outputs*	5.3.4.2*		
		Output/Control	5.3.4.3*		
		Fault	5.3.4.4*		
		Delay	5.3.4.5*		
Miscellaneous	*Language*	5.4.1*			
5.4*	*Set defaults*	5.4.2*			
	Load Firmware	5.4.3*			
	Password	*Messages*	5.4.4.1*		
	5.4.4*	*Maintenance*	5.4.4.2*		
		Operation	5.4.4.3*		
		Installation	5.4.4.4*		
	Sample ID	5.4.5*			
	Line break detection	5.4.6			
Interface	*Protocol*	5.5.1*		(only with RS485	
5.5*	*Device Address*	5.5.21*		interface)	
	Baud Rate	5.5.31*			
	Parity	5.5.41*			

9. Program List and Explanations

1 Messages

1.1 Pending Errors

1.1.5 Provides the list of active errors with their status (active, acknowledged). If an active error is acknowledged, the alarm relay is active again. Cleared errors are moved to the Message list.

1.2 Maintenance List

1.2.5 Provides the list of necessary maintenance. Cleared maintenance messages are moved to the Message list.

1.3 Message List

1.3.1 Shows the error history: Error code, date / time of issue and status (active, acknowledged, cleared). 65 errors are memorized. Then the oldest error is cleared to save the newest error (circular buffer).

2 Diagnostics

In diagnostics mode, the values can only be viewed, not modified.

2.1 Identification

Desig.: Designation of the instrument.
Version: Firmware of the instrument (e.g. V6.21-04/17)
Degasser: Firmware of the degasser (e.g. 2.00)

2.1.4 **Factory Test**: Test date of the Instrument, Motherboard, Frontend, Degasser

2.1.5 **Operating Time:** Years / Days / Hours / Minutes / Seconds

2.2 Sensors

2.2.1 **Conductivity**:

2.2.1.1 **Sensor 1**: Shows the
Current value in µS
Raw value in µS
Cell Constant

2.2.1.2 **Sensor 2**: Shows the
Current value in µS
Raw value in µS
Cell Constant

2.2.1.3 **Sensor 3**: Shows the
Current value in µS
Raw value in µS
Cell Constant

2.2.2 **Miscellaneous**:

2.2.2.1 *Case Temp:* Shows the current temperature in [°C] inside the transmitter.

2.2.4 **Degasser**

2.2.4.1 *Heater:* Current sample temperature in °C.
Boiling point: Value of the last calculated boiling point in °C.
PWM: Heating power in %.
Line Voltage: Current degasser voltage in V
Air pressure: Current local air pressure in hPa.
Case Temp.: Current temperature in the transmitter housing.

2.2.5 **Boiling Point**

The boiling point depends on the air pressure and is therefore automatically recalculated in configurable intervals (default: 6 hours). Each calculation is stored and numbered and can be viewed in the history with date, time, boiling point, air pressure and sample flow.

2.2.5.1 *Number: Counter of the boiling point calculations.*
Date, Time: Date and time for each boiling point calculation.
Boiling point: Boiling point at this date.
Air pressure: Air pressure at this date.
Sample flow: Sample flow at this date.

2.3 Sample

2.3.1 *Sample ID*: Shows the identification assigned to a sample. This identification is defined by the user to identify the location of the sample.

2.3.2 **Sample Flow**: Shows the current sample flow in l/h and the raw value in Hz.

The sample flow must be above 5 l/h.

2.3.3 Sample Temp:

2.3.3.1 *Temp 1:* Shows the current sample temperature at sensor 1 in °C.
(Pt 1000): Shows the current temperature at sensor 1 in Ohm.

Temp 2: Shows the current sample temperature at sensor 2 in °C.
(Pt 1000): Shows the current temperature at sensor 2 in Ohm.

Temp 3: Shows the current sample temperature at sensor 3 in °C.
(Pt 1000): Shows the current temperature at sensor 3 in Ohm.

Resin capacity: Shows the remaining resin capacity in %.
Change of Resin: Shows the date of the last resin changing.

2.4 I/O State

Shows current status of all in- and outputs.

2.4.1

Alarm Relay:	Active or inactive
Relay 1/2:	Active or inactive
Input:	Open or closed
Signal Output 1/2:	Actual current in mA
Signal Output 3:	Actual current in mA (if option is installed)

2.5 Interface

Only available if optional interface is installed.
Review programmed communication settings.

3 Maintenance

3.1 Simulation

To simulate a value or a relay state, select the

- alarm relay,
- relay 1/2
- signal output 1/2

with the [▲] or [▼] key.
Press the [Enter] key.
Change the value or state of the selected item with the [▲] or [▼] key.
Press the [Enter] key.

⇒ *The value is simulated by the relay/signal output.*

Alarm Relay:	Active or inactive
Relay 1/2:	Active or inactive
Signal Output 1/2:	Actual current in mA
Signal Output 3:	Actual current in mA (if option is installed)

At the absence of any key activities, the instrument will switch back to normal mode after 20 min. If you quit the menu, all simulated values will be reset.

3.2 Set Time

Adjust date and time.

3.3 Change of Resin

Yes or No: After exchanging the resin bottle navigate to this menu, press [Enter], select <Yes>, press [Exit] and confirm with <Yes>. With this action the resin capacity is set to 100 % and the current date is saved. Date and resin capacity are displayed in the menu <Diagnostics/Sample>

3.5 Degasser

3.5.1 *Define Boiling point*
In this menu you can start a manual determination of the boiling point at any time.

4 Operation

4.1 Sensors

4.1.1 *Filter Time Constant:* Used to damp noisy signals. The higher the filter time constant, the slower the system reacts to changes of the measured value.
Range: 5–300 Sec

4.1.2 *Hold after Cal.:* Delay permitting the instrument to stabilize again after calibration. During calibration plus hold-time, the signal outputs are frozen (held on last valid value), alarm values, limits are not active.
Range: 0–6‘000 Sec

4.2 Relay Contacts

See Relay Contacts, p. 23

4.3 Logger

The instrument is equipped with an internal logger. The logger data can be copied to a PC with an USB stick if option USB interface is installed.

The logger can save approx. 1500 data records. The Records consists of: Date, time, alarms, measured values, measured value uncompensated.
Range: 1 Second to 1 hour

4.3.1 *Log Interval:* Select a convenient log interval. Consult the table below to estimate the max logging time. When the logging buffer is full, the oldest data record is erased to make room for the newest one (circular buffer).

Interval	1 s	5 s	1 min	5 min	10 min	30 min	1 h
Time	25 min	2 h	25 h	5 d	10 d	31 d	62 d

4.3.2 *Clear Logger:* If confirmed with <yes>, the complete logger data is deleted. A new data series is started.

4.3.3 *Eject USB Stick*: With this function all logger data are copied to the USB stick before the USB stick is deactivated.
Only visible it the optional USB interface is installed.

4.4 Display

Process values are displayed on two screens. Toggle screens with the [▲] key. Each screen displays max. 3 process values.

4.4.1 Screen 1

4.4.1.1 Row 1

4.4.1.2 Row 2

4.4.1.3 Row 3

Possible settings for all rows are:

- None
- Cond 1 (cc)
- Cond 2 (sc)
- Cond 3 (dc)
- Difference
- pH (if <Calculations> = yes)
- Ammonia (depends on the settings in <Sensor parameters>/ <Temp. comp.>)

4.4.2 Screen 2

Same as screen 1.

5 Installation

5.1 Sensors

5.1.1 **Miscellaneous**:

5.1.1.1 *Calculations:* Select “yes” if pH and ammonia concentrations should be calculated. pH and ammonia are now available on screen 1 or 2, on the signal outputs and as alarm or limit values.

5.1.1.2 *Meas. unit:* Choose the measuring unit as µS/cm or µS/m.

5.1.1.3 *Monitoring of resin:* Select “yes” if consumption of cation resin should be calculated and displayed. Replacement of exhausted resin must now be confirmed in menu <Maintenance>.

5.1.1.4 *Resin Capacity:* Enter the resin capacity in eq/l.
Range: 0.5–4.0

5.1.1.5 *Volume of resin:* Enter the volume of the resin bottle.
Range: 0.5–30.0 l

5.1.2 Sensor parameters:

5.1.2.1 Sensor 1

5.1.2.1.1 *Cell Constant*: Enter the cell constant printed on the sensor label.

5.1.2.1.2 *Temp. Corr*: Enter the temperature correction printed on the sensor label.

5.1.2.1.3 *Cable length*: Enter the cable length. Set the cable length to 0.0 m if the sensors are installed in the flow cell on the AMI monitor.

5.1.2.1.5 Temp. comp:

5.1.2.1.5.1 *Comp.*: Available compensation models:

- Strong acids (Never select strong acids for sensor 1!)
- Strong bases
- Ammonia
- Morpholine
- Ethanolamines

5.1.2.2 Sensor 2

5.1.2.2.1 *Cell Constant*: Enter the cell constant printed on the sensor label.

5.1.2.2.2 *Temp. Corr*: Enter the temperature correction printed on the sensor label.

5.1.2.2.3 *Cable length*: Enter the cable length. Set the cable length to 0.0 m if the sensors are installed in the flow cell on the AMI monitor.

5.1.2.2.5 Temp. comp:

5.1.2.2.5.1 *Comp.*: Available compensation models:

- Strong acids

5.1.2.3 Sensor 3

5.1.2.3.1 *Cell Constant*: Enter the cell constant printed on the sensor label.

5.1.2.3.2 *Temp. Corr*: Enter the temperature correction printed on the sensor label.

5.1.2.3.3 *Cable length*: Enter the cable length. Set the cable length to 0.0 m if the sensors are installed in the flow cell of the AMI monitor.

5.1.2.3.5 **Temp. comp**:

5.1.2.3.1 *Comp.*: Available compensation models:

- Strong acids

5.1.2.4 **Degasser**

5.1.2.4.1 Mode: on, off, input

On: The degasser is switched on.

Off: The degasser is switched off.

Input: The degasser can be switched on or off via signal input.

NOTICE: *When the sample flow falls below 5 l/h, the degasser will be switched off automatically.*

5.1.2.4.2 *Boiling point interval:* Defines the time interval of the boiling point determination. In most applications, the preset interval of six hours is short enough to keep the carbon dioxide removal rate constant. In water with an elevated carbon dioxide content (CC> 1 µS/cm) a shorter boiling point interval is recommended.

Range: 1 h, 2 h, 4 h, 6 h

5.2 Signal Outputs

NOTICE: *The navigation in the menu <Signal Output 1> and <Signal Output 2> is equal. For reason of simplicity only the menu numbers of Signal Output 1 are used in the following.*

5.2.1 **Signal Output 1:** Assign process value, the current loop range and a function to each signal output.

5.2.1.1 *Parameter:* Assign one of the process values to the signal output. Available values:

- Cond 1 (cc)
- Cond 2 (sc)
- Cond 3 (dc)
- Temp. 1
- Temp. 2
- Temp. 3
- Difference
- Sample flow
- pH
- Ammonia

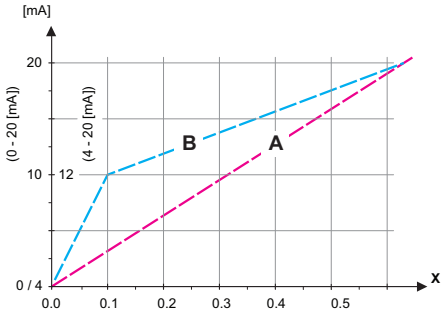
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

5.2.1.3 *Function:* Define if the signal output is used to transmit a process value or to drive a control unit. Available functions are:

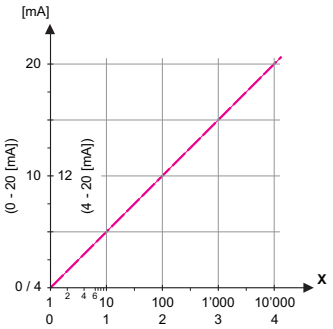
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 60
- Control upwards or control downwards for controllers.
  See As control output, p. 62

As process values

The process value can be represented in 3 ways: linear, bilinear or logarithmic. See graphs below.



A linear
B bilinear
X Measured value



X Measured value (logarithmic)

5.2.1.40 **Scaling:** Enter beginning and end point (Range low & high) of the linear or logarithmic scale. In addition, the midpoint for the bilinear scale.

Parameter Cond. 1 (sc):

5.2.1.40.10 Range low: 0 –3000 µS

5.2.1.40.20 Range high: 0 –3000 µS

Parameter Cond. 2 (cc):

5.2.1.40.11 Range low: 0 –3000 µS

5.2.1.40.21 Range high: 0 –3000 µS

Parameter Cond. 3 (dc):

5.2.1.40.12 Range low: 0 –3000 µS

5.2.1.40.22 Range high: 0 –3000 µS

Parameter Temp. 1

5.2.1.40.13 Range low: -25 to +270 °C

5.2.1.40.23 Range high: -25 to +270 °C

Parameter Temp. 2

5.2.1.40.14 Range low: -25 to +270 °C

5.2.1.40.24 Range high: -25 to +270 °C

Parameter Temp. 3

5.2.1.40.15 Range low: -25 to +270 °C

5.2.1.40.25 Range high: -25 to +270 °C

Parameter Difference

5.2.1.40.16 Range low: 0 –3000 µS

5.2.1.40.26 Range high: 0 –3000 µS

Parameter Sample flow

5.2.1.40.17 Range low: 0 –20 l/h

5.2.1.40.27 Range high: 0 –20 l/h

Parameter pH

5.2.1.40.18 Range low: 0 –14 pH

5.2.1.40.28 Range high: 0 –14 pH

Parameter Ammonia

5.2.1.40.19 Range low: 0–500 ppm

5.2.1.40.29 Range high: 0–500 ppm

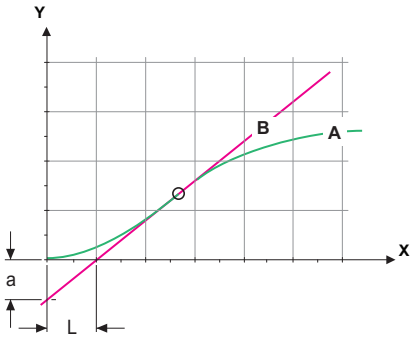
As control output

Signal outputs can be used for driving control units. We distinguish different kinds of controls:

- *P-controller:* The controller action is proportional to the deviation from the setpoint. The controller is characterized by the P-Band. In the steady-state, the setpoint will never be reached. The deviation is called steady-state error.
  Parameters: setpoint, P-Band
- *PI-controller:* The combination of a P-controller with an I-controller will minimize the steady-state error. If the reset time is set to zero, the I-controller is switched off.
  Parameters: setpoint, P-Band, reset time.
- *PD-controller:* The combination of a P-controller with a D-controller will minimize the response time to a fast change of the process value. If the derivative time is set to zero, the D-controller is switched off.
  Parameters: setpoint, P-Band, derivative time.
- *PID-controller:* The combination of a P-, an I - and a D-controller allows a proper control of the process.
  Parameters: setpoint, P-Band, reset time, derivative time.

Ziegler-Nichols method for the optimization of a PID controller:

Parameters: Setpoint, P-Band, Reset time, Derivative time



A	Response to maximum control output	Xp = 1.2/a
B	Tangent on the inflection point	Tn = 2L
X	Time	Tv = L/2

The point of intersection of the tangent with the respective axis will result in the parameters a and L.

Consult the manual of the control unit for connecting and programming details. Choose control upwards or downwards.

Control upwards or downwards

Setpoint: User-defined process value for the selected parameter.

P-Band: Range below (upwards control) or above (downwards control) the set-point, within the dosing intensity is reduced from 100% to 0% to reach the setpoint without overshooting.

5.2.1.43 **Control Parameters:** if Parameters = Cond. 1(sc)

5.2.1.43.10 Setpoint
Range: 0 –3000 µS

5.2.1.43.20 P-Band:
Range: 0 –3000 µS

5.2.1.43 **Control Parameters:** if Parameters = Cond. 2(cc)

5.2.1.43.11 Setpoint
Range: 0 –3000 µS

5.2.1.43.21 P-Band:
Range: 0 –3000 µS

5.2.1.43 **Control Parameters:** if Parameters = Cond. 3(dc)

5.2.1.43.12 Setpoint
Range: 0 –3000 µS

5.2.1.43.22 P-Band:
Range: 0 –3000 µS

5.2.1.43 **Control Parameters:** if Parameters = Temp. 1

5.2.1.43.13 Setpoint
Range: -25 to +270 °C

5.2.1.43.23 P-Band:
Range: -25 to +270 °C

5.2.1.43 **Control Parameters:** if Parameters = Temp. 2

5.2.1.43.14 Setpoint
Range: -25 to +270 °C

5.2.1.43.24 P-Band:
Range: -25 to +270 °C

5.2.1.43 **Control Parameters:** if Parameters = Temp. 3

5.2.1.43.15 Setpoint
Range: -25 to +270 °C

5.2.1.43.25 P-Band:
Range: -25 to +270 °C

5.2.1.43 **Control Parameters:** if Parameters = Difference

5.2.1.43.16 Setpoint
Range: 0 –3000 µS

5.2.1.43.26 P-Band:
Range: 0 –3000 µS

5.2.1.43 **Control Parameters:** if Parameters = Sample flow

5.2.1.43.17 Setpoint
Range: 0 –20 l/h

5.2.1.43.27 P-Band:
Range: 0 –20 l/h

5.2.1.43 **Control Parameters:** if Parameters = pH

5.2.1.43.18 Setpoint
Range: 0 –14 pH

5.2.1.43.28 P-Band:
Range: 0 –14 pH

5.2.1.43 **Control Parameters:** if Parameters = Ammonia

5.2.1.43.19 Setpoint
Range: 0 –500 ppm

5.2.1.43.29 P-Band:
Range: 0 –500 ppm

5.2.1.43.3 *Reset time:* The reset time is the time till the step response of a single I-controller will reach the same value as it will be suddenly reached by a P-controller.
Range: 0–9'000 sec

5.2.1.43.4 *Derivative time:* The derivative time is the time till the ramp response of a single P-controller will reach the same value as it will be suddenly reached by a D-controller.
Range: 0–9'000 sec

5.2.1.43.5 *Control timeout:* If a controller action (dosing intensity) is constantly over 90% during a defined period of time and the process value does not come closer to the setpoint, the dosing process will be stopped for safety reasons.
Range: 0–720 min

5.3 Relay Contacts

5.3.1 **Alarm Relay:** The alarm relay is used as cumulative error indicator. Under normal operating conditions the contact is active.

The contact is inactive at:

- Power loss

- Detection of system faults like defective sensors or electronic parts
- High case temperature
- Process values out of programmed ranges.

Program alarm levels, hysteresis values and delay times for the following parameters:

- Cond.1 (sc)
- Cond. 2 (cc)
- Cond. 3 (dc)
- pH
- Ammonia
- Sample Temp. 1
- Sample Temp. 2
- Sample Temp. 3
- Sample Flow
- Case Temperature low and high

5.3.1.1 Conductivity

5.3.1.1.1 Cond. 1 (sc)

5.3.1.1.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E001, is displayed in the message list.
Range: 0 –3000 µS

5.3.1.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E002 is displayed in the message list.
Range: 0 –3000 µS

5.3.1.1.1.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0 –3000 µS

5.3.1.1.1.45 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range: 0–28‘800 Sec

5.3.1.1.2 Cond. 2 (cc)

5.3.1.1.2.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E003, is displayed in the message list.
Range: 0–3000 µS

5.3.1.1.2.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E004 is displayed in the message list.
Range: 0–3000 µS

5.3.1.1.2.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0–3000 µS

5.3.1.1.2.45 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range: 0–28‘800 Sec

5.3.1.1.3 Cond. 3 (dc)

5.3.1.1.3.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E005, is displayed in the message list.
Range: 0–3000 µS

5.3.1.1.3.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E006 is displayed in the message list.
Range: 0–3000 µS

5.3.1.1.3.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0–3000 µS

5.3.1.1.3.45 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range: 0–28‘800 Sec

5.3.1.1.4 pH (if Calculations = yes)

5.3.1.1.4.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E033, is displayed in the message list.
Range: 0–14 pH

5.3.1.1.4.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E034 is displayed in the message list.
Range: 0–14 pH

5.3.1.1.4.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range: 0–14 pH

5.3.1.1.4.45 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range: 0–28'800 Sec

5.3.1.1.5 Ammonia (if Calculations = yes)

5.3.1.1.5.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E035, is displayed in the message list.
Range: 0–500 ppm

5.3.1.1.5.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E036 is displayed in the message list.
Range: 0–500 ppm

5.3.1.1.5.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range: 0–500 ppm

5.3.1.1.5.45 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range: 0–28'800 Sec

5.3.1.2 Sample Temp.

5.3.1.2.1 Temp. 1

5.3.1.2.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E007, is displayed in the message list.
Range: 30–200 °C

5.3.1.2.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E008 is displayed in the message list.
Range: -10 to + 20 °C

5.3.1.2.2 Temp. 2

5.3.1.2.2.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E037, is displayed in the message list.
Range: 30–200 °C

5.3.1.2.2.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E038 is displayed in the message list.
Range: -10 to + 20 °C

5.3.1.2.3 Temp. 3

5.3.1.2.3.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E037, is displayed in the message list.
Range: 30–200 °C

5.3.1.2.3.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E038 is displayed in the message list.
Range: -10 to + 20 °C

5.3.1.3 Sample Flow: Define at which sample flow an alarm should be issued.

5.3.1.3.1 *Flow Alarm:* Program if the alarm relay should be activated if there is a flow alarm. Choose between yes or no. The flow alarm will always be indicated in the display, pending error list, saved in the message list and the logger.
Available values: Yes or no

> ***NOTICE:*** *Sufficient flow is essential for a correct measurement. We recommend to program yes.*

5.3.1.3.2 *Alarm High:* If the measuring values rises above the programmed value E009 will be issued.
Range: 9–20 l/h

5.3.1.3.35 *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 5–8 l/h

5.3.1.4 Case Temp.

5.3.1.4.1 *Alarm high:* Set the alarm high value for temperature of electronics housing. If the value rises above the programmed value E013 is issued.
Range: 30–75 °C

5.3.1.4.2 *Alarm low:* Set the alarm low value for temperature of electronics housing. If the value falls below the programmed value E014 is issued.
Range: -10 to +20 °C

5.3.2 & 3 Relay 1 and 2: The contacts can be set as normally open or normally closed with a jumper. See Relay 1 and 2, p. 24. The function of relay contacts 1 or 2 is defined by the user.

> ***NOTICE:*** *The navigation in the menu <Relay 1> and <Relay 2> is equal. For reason of simplicity only the menu numbers of Relay 1 are used in the following.*

1 First select the functions as:
- Limit upper/lower,
- Control upwards/downwards,
- Timer
- Fieldbus

2 Then enter the necessary data depending on the selected function. The same values may also be entered in menu 4.2 Relay Contacts, p. 56

5.3.2.1 Function = Limit upper/lower:

When the relays are used as upper or lower limit switches, program the following:

5.3.2.20 *Parameter:* select a process value

5.3.2.300 *Setpoint*: If the measured value rises above respectively falls below the set-point, the relay is activated.

Parameter	Range
Cond. 1 (sc)	0.000–3000 µS
Cond.2 (cc)	0.000–3000 µS
Cond.3 (dc)	0.000–3000 µS
Temp. 1	-25 to +270 °C
Temp. 2	-25 to +270 °C
Temp. 3	-25 to +270 °C
Difference	0.000–3000 µS
Sample flow	0–20 l/h
pH	0 –14 pH
Ammonia	0 –500 ppm

5.3.2.400 *Hysteresis:* within the hysteresis range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.

Parameter	Range
Cond. 1 (sc)	0.000–3000 µS
Cond. 2 (cc)	0.000–3000 µS
Cond. 3 (dc)	0.000–3000 µS
Temp. 1	0–100 °C
Temp. 2	0–100 °C
Temp. 3	0–100 °C
Difference	0–3000 µS

Parameter	Range
Sample flow	0–20 l/h
pH	0 –14 pH
Ammonia	0 –500 ppm

5.3.2.50 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range. 0–600 Sec

5.3.2.1 Function = Control upwards/downwards:

The relays may be used to drive control units such as solenoid valves, membrane dosing pumps or motor valves. When driving a motor valve both relays are needed, relay 1 to open and relay 2 to close the valve.

5.3.2.22 *Parameter:* Choose on of the following process values.

- Cond.1 (sc)
- Cond.2 (cc)
- Cond.3 (dc)
- Temp. 1
- Temp. 2
- Temp. 3
- Difference
- Sample Flow
- pH
- Ammonia

5.3.2.32 **Settings***:* Choose the respective actuator:

- Time proportional
- Frequency
- Motor valve

5.3.2.32.1 Actuator = Time proportional

Examples of metering devices that are driven time proportional are solenoid valves, peristaltic pumps.

Dosing is controlled by the operating time.

5.3.2.32.20 *Cycle time:* duration of one control cycle (on/off change).
Range: 0–600 sec.

5.3.2.32.30 *Response time:* Minimal time the metering device needs to react.
Range: 0–240 sec.

5.3.2.32.4 **Control Parameters**
Range for each Parameter same as 5.2.1.43, p. 63

5.3.2.32.1 Actuator = Frequency

Examples of metering devices that are pulse frequency driven are the classic membrane pumps with a potential free triggering input. Dosing is controlled by the repetition speed of dosing shots.

5.3.2.32.21 *Pulse frequency:* Max. pulses per minute the device is able to respond to. Range: 20–300/min.

5.3.2.32.31 **Control Parameters**
Range for each Parameter same as 5.2.1.43, p. 63

5.3.2.32.1 Actuator = Motor valve

Dosing is controlled by the position of a motor driven mixing valve.

5.3.2.32.22 *Run time:* Time needed to open a completely closed valve
Range: 5–300 Sec.

5.3.2.32.32 *Neutral zone:* Minimal response time in % of the runtime. If the requested dosing output is smaller than the response time, no change will take place.
Range: 1–20 %

5.3.2.32.4 **Control Parameters**
Range for each Parameter same as 5.2.1.43, p. 63

5.3.2.1 Function = Timer:

The relay will be activated repetitively depending on the programmed time scheme.

5.3.2.24 *Mode:* Operating mode (interval, daily, weekly)

5.3.2.24 *Interval*

5.3.2.340 *Interval:* The interval can be programmed within a range of 1–1'440 min.

5.3.2.44 *Run Time*: Enter the time the relay stays active.
Range: 5–32'400 sec.

5.3.2.54 *Delay*: during run time plus the delay time the signal and control outputs are held in the operating mode programmed below.
Range: 0–6'000 Sec.

5.3.2.6 *Signal Outputs*: Select operating mode of the signal output:

Cont.: Signal outputs continue to issue the measured value.

Hold: Signal outputs hold the last valid measured value. Measurement is interrupted. Errors, except fatal errors, are not issued.

Off: Signal outputs are switched off (set to 0 or 4 mA). Errors, except fatal errors, are not issued.

5.3.2.7 *Output/Control*: Select operating mode of the controller output:

Cont.: Controller continues normally.

Hold: Controller continues based on the last valid value.

Off: Controller is switched off.

5.3.2.24 *daily*

The relay contact can be activated daily, at any time of a day.

5.3.2.341 *Start time*: to set the start time proceed as follows:

1 Press [Enter], to set the hours.

2 Set the hour with the [▲] or [▼] keys.

3 Press [Enter], to set the minutes.

4 Set the minutes with the [▲] or [▼] keys.

5 Press [Enter], to set the seconds.

6 Set the seconds with the [▲] or [▼] keys.

Range: 00:00:00–23:59:59

5.3.2.44 *Run Time*: see Interval

5.3.2.54 *Delay*: see Interval

5.3.2.6 *Signal Outputs*: see Interval

5.3.2.7 *Output/Control*: see Interval

5.3.2.24 *weekly*

The relay contact can be activated at one or several days, of a week. The daily starting time is valid for all days.

5.3.2.342 Calendar:

5.3.2.342.1 *Start time*: The programmed start time is valid for each of the programmed days. To set the start time see 5.3.2.341, p. 72.

Range: 00:00:00–23:59:59

5.3.2.342.2 *Monday*: Possible settings, on or off
to
5.3.2.342.8 *Sunday*: Possible settings, on or off

5.3.2.44 *Run Time*: see Interval

5.3.2.54 *Delay*: see Interval

5.3.2.6 *Signal Outputs*: see Interval

5.3.2.7 *Output/Control*: see Interval

5.3.2.1 Function = Fieldbus:

The relay will be switched via the Profibus input. No further parameters are needed.

5.3.4 **Input:** The functions of the relays and signal outputs can be defined depending on the position of the input contact, i.e. no function, closed or open.

5.3.4.1 *Active:* Define when the input should be active:

No:	Input is never active.
When closed	Input is active if the input relay is closed
When open:	Input is active if the input relay is open

5.3.4.2 *Signal Outputs:* Select the operation mode of the signal outputs when the relay is active:

Continuous:	Signal outputs continue to issue the measured value.
Hold:	Signal outputs hold the last valid measured value. Measurement is interrupted. Errors, except fatal errors, are not issued.
Off:	Sets the signal outputs to 0 or 4 mA. Errors, except fatal errors, are not issued.

5.3.4.3 *Output/Control:* (relay or signal output):

Continuous:	Controller continues normally.
Hold:	Controller continues based on the last valid value.
Off:	Controller is switched off.

5.3.4.4 *Fault:*

No:	No message is issued in pending error list and the alarm relay does not close when input is active. Message E024 is stored in the message list.
Yes:	Message E024 is issued and stored in the message list. The Alarm relay closes when input is active.

5.3.4.5 *Delay:* Time which the instrument waits, after the input is deactivated, before returning to normal operation.
Range: 0–6'000 Sec

5.4 Miscellaneous

5.4.1 *Language:* Set the desired language.
Available settings: German / English / French / Spanish / Italian

5.4.2 *Set defaults:* Reset the instrument to factory default values in three different ways:

- **Calibration:** Sets calibration values back to default. All other values are kept in memory.
- **In parts:** Communication parameters are kept in memory. All other values are set back to default values.
- **Completely:** Sets back all values including communication parameters.

5.4.3 *Load Firmware:* Firmware updates should be done by instructed service personnel only.

5.4.4 **Password:** Select a password different from 0000 to prevent unauthorized access to the menus "Messages", "Maintenance", "Operation" and "Installation".

Each menu may be protected by a *different* password.

If you forgot the passwords, contact the closest SWAN representative.

5.4.5 *Sample ID:* Identify the process value with any meaning full text, such as KKS number.

5.4.6 *Line Break Detection:* If activated, error message E028 is shown in case of line break on signal outputs 1 and 2.

5.5 Interface

Select one of the following communication protocols. Depending on your selection, different parameters must be defined.

5.5.1 *Protocol:* **Profibus**

5.5.20	Device address:	Range: 0–126
5.5.30	ID-Nr.:	Range: Analyzer; Manufacturer; Multivariable
5.5.40	Local operation:	Range: Enabled, Disabled

5.5.1 *Protocol:* **Modbus RTU**

5.5.21	Device address:	Range: 0–126
5.5.31	Baud Rate:	Range: 1 200–115 200 Baud
5.5.41	Parity:	Range: none, even, odd

5.5.1 *Protocol:* **USB-Stick:**

Only visible if an USB interface is installed. No further settings are possible.

5.5.1 *Protocol:* **HART**

Device address: Range: 0–63

10. Material Safety Data sheets

10.1. Cation Exchanger Resin SWAN

Product name:	Cation Exchange Resin
Catalogue number:	A-82.841.030 and A-82.841.031

Download MSDS

The current Material Safety Data Sheets (MSDS) for the above listed Reagents are available for downloading at **www.swan.ch**.

11. Default Values

Operation:

Sensors:	Filter Time Const.:	20 s
	Hold after Cal.:	0 s
Relay Contacts	Alarm Relay	same as in Installation
	Relay 1/2	same as in Installation
	Input	same as in Installation
Logger:	Logger Interval:	30 min
	Clear Logger:	no
Display:	Screen 1 and 2; Row 1:	Cond 1(sc)
	Screen 1 and 2; Row 2:	Cond 2(cc)
	Screen 1 and 2; Row 3:	None

Installation:

Sensors	Miscellaneous; Calculations:	no
	Miscellaneous; Meas. unit	µS/cm
	Miscellaneous; Monitoring of resin	no
	Miscellaneous; Resin Capacity:	1.8
	Miscellaneous; Volume of resin:	1.0 l
	Sensor Parameters; Sensor 1, 2 and 3;Cell Constant	0.0415 cm^{-1}
	Sensor Parameters; Sensor 1, 2 and 3; Temp. corr.	0.00 °C
	Sensor Parameters; Sensor 1, 2 and 3; Cable length	0.0 m
	Sensor Parameters; Sensor 1; Temp. comp.; Comp:	Ammonia
	Sensor Parameters; Sensor 2; Temp. comp.; Comp:	Strong Acids
	Sensor Parameters; Sensor 3; Temp. comp.; Comp:	Strong Acids
	Flow:	yes
	Degasser; Mode	on
	Degasser; Boiling point interval	6 h
Signal Output 1	Parameter:	Cond 1(sc)
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0.000 µS
	Scaling: Range high:	1000.00 µS
Signal Output 2	Parameter:	Cond 2(cc)
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0.000 µS
	Scaling: Range high:	1000.00 µS
Alarm Relay:	Conductivity; Cond. 1 (sc), Cond. 2 (cc) and Cond. 3 (dc):	
	Alarm high:	3000.00 µS
	Alarm low:	0.000 µS

Hysteresis: ..... 10.0 µS
Delay: ..... 5 s

Sample Temp: (Temp. 1, Temp. 2 and Temp. 3)

Alarm High: ..... 160 °C
Alarm Low: ..... 0 °C

Sample Flow:
Flow Alarm ..... yes
Alarm high: ..... 16 l/h
Alarm low: ..... 5 l/h
Case temp. high: ..... 65 °C
Case temp. low: ..... 0 °C

Relay 1/2

Function: ..... limit upper
Parameter: ..... Cond 1(sc)
Setpoint: ..... 1000 µS
Hysteresis: ..... 10 µS
Delay: ..... 30 s

If Function = Control upw. or dnw:

Parameter: ..... Cond 1(sc)
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 1000 µS
Settings: Control Parameters: P-band: ..... 10 µS
Settings: Control Parameters: Reset time: ..... 0 s
Settings: Control Parameters: Derivative Time: ..... 0 s
Settings: Control Parameters: Control Timeout: ..... 0 min

Settings: Actuator: ..... Time proportional
Cycle time: ..... 60 s
Response time: ..... 10 s

Settings: Actuator ..... Motor valve
Run time: ..... 60 s
Neutral zone: 5%

If Function = Timer:

Mode: ..... Interval
Interval: ..... 1 min

Mode: ..... daily
Start time: 00.00.00

Mode: ..... weekly
Calendar; Start time: 00.00.00
Calendar; Monday to Sunday: ..... Off

Run time: ..... 10 s
Delay: ..... 5 s

	Signal output:	cont
	Output/Control:	cont
Input:	Active	when closed
	Signal Outputs	hold
	Output/Control	off
	Fault	no
	Delay	10 s
Miscellaneous	Language:	English
	Set default:	no
	Load firmware:	no
	Password:	for all modes 0000
	Sample ID:	- - - - - - - -
	Line break detection	no
Interface	Protocol:	depending on interface

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13. Notes

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