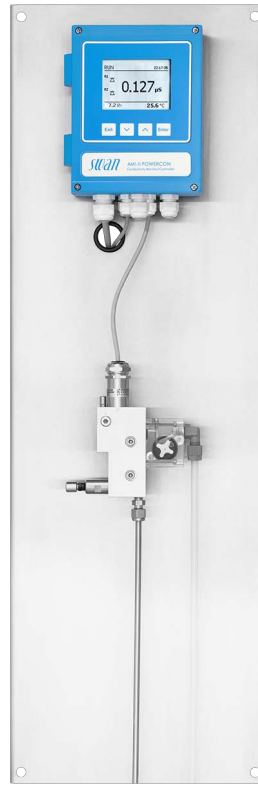
ANALYTICAL INSTRUMENTS

A-96.210.341 / 2026-06-02

AMI-II Powercon

Operator's Manual



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Document Information

Title: AMI-II Powercon Operator's Manual
ID: A-96.210.341
Revision: 00.00, 2026-06-02

History of Major Document Revisions

Revision	Issue	Description
00.xx	June 2026	First edition

Table of Content

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

Keep the Operator's Manual 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 meaning:

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 values can be the consequence if such warnings are ignored.

- Follow the prevention instructions carefully.

Mandatory signs

The mandatory signs in this manual have the following meaning:

Safety goggles

Safety gloves

Warning signs The warning signs in this manual have the following meaning:


Electrical shock hazard


Corrosive


Harmful to health


Flammable


General warning


Attention

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.

2. Product Description

2.1. Description of the System

Application range

The AMI-II Powercon is a complete monitoring system for the automatic, continuous measurement of the conductivity in ultrapure water.

Available models

The instrument is available in three variants:

- Monitor AMI-II Powercon Specific for measurement of specific conductivity.
- Monitor AMI-II Powercon Acid with integrated cation exchanger for measurement of acid conductivity.
- Single components.

Special features

- Temperature compensation curves for specific conductivity measurement:
  - Strong acids (HCl)
  - Strong bases (NaOH)
  - Ammonia
  - Morpholine
  - Ethanolamines (ETA)
  - Cyclohexylamine (CHA)
  - 2-Amino-2-methylpropanol (AMP)
  - 2-Diethylaminoethanol (DEAE)
  - Hydrofluoric acid
- Flow monitoring

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

Two additional signal outputs with the same specifications available as an option.

Alarm relay

Two potential-free contacts (one normally open and one normally closed contact). Summary alarm indication for programmable alarm values and instrument faults.

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

Maximum load: 1 A/250 VAC

Relays

Two potential-free contacts programmable as limit switches for measured values, controllers or timers with automatic hold function. Maximum load: 1 A/250 VAC

Input

One input for potential-free contact to freeze the measured value or to interrupt control in automated installations. Programmable as HOLD or OFF function.

Communication interface (optional)

- Two additional signal outputs
- RS485 with fieldbus protocol Modbus RTU or Profibus DP
- HART

Safety features

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

Correction or calibration

Not necessary, auto zero is performed automatically and continuously with each measurement.

Measuring principle

When a voltage U is applied between two electrodes in an electrolyte solution, an electric field is generated. This field moves the ions in the solution: Cations move to the cathode; Anions move to the anode. At the electrodes, the ions gain or lose electrons which generates an electric current I. Using Ohm's law the resistance R of the solution in the measuring cell can be calculated from the applied voltage and the measured current: $R = U/I$.
The resistance obtained in this way depends on the specific conductivity κ of the solution and the geometry of the measuring cell. The influence of the measuring cell's geometry is taken into account by the cell constant ZK, which is used to calculate the specific conductivity from the resistance: $\kappa = ZK \cdot 1/R$. The unit of specific conductivity is µS/cm or µS/m.
The cell constant ZK of a Swan conductivity sensor is determined during factory calibration and printed on the sensor label and certificate. Swan's UP-CON1000 sensors are designed so that the cell constant depends only on the sensor's geometry and not on that of the measuring cell. Hence, no additional calibration is required.

Specific conductivity

Specific conductivity represents the sum of the conductivity of all ions in the sample. In water-steam cycles that contain an alkalizing agent, conductivity is primarily determined by the alkalizing agent. The contribution of impurities is largely masked by the alkalizing agent.

Cation (acid) conductivity

The alkalizing agent is completely removed by the cation exchanger, and all cations (positively charged ions) are exchanged for H^+ ions. Anions (negatively charged ions) pass through the column unchanged. Together with the H^+ ions and the ions resulting from the autoprotolysis of water, they determine the conductivity after cation exchange.

Temperature compensation

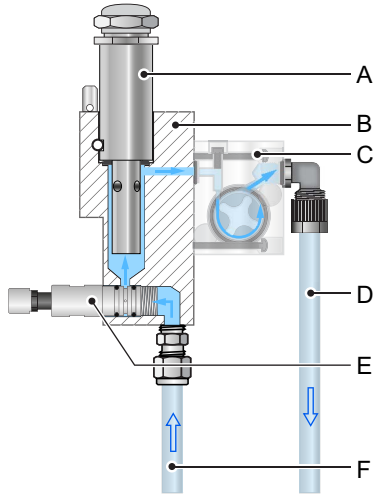
The mobility of ions increases with temperature. As a result, the conductivity of the sample also increases. To ensure accurate measurement, the temperature of the sample is measured simultaneously using an integrated Pt1000 sensor. The conductivity is automatically compensated to a reference temperature of 25 °C.
Different temperature compensation models are available for various water compositions.
The appropriate model according to the application must be selected. For cation conductivity, select the temperature compensation model for strong acids.
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.

Fluidics AMI-II Powercon Specific

The flow cell (QV-Flow) consists of the flow cell block [B], the flow meter [C] and the flow regulating valve [E].
The conductivity sensor [A] with integrated temperature sensor is screwed into the flow cell block [B].
The sample flows via the sample inlet [F] through the flow regulating valve [E], where the flow rate can be adjusted, into the flow cell block [B], were the specific conductivity of the sample is measured.
The sample leaves the flow cell block via flow meter [C] through the sample outlet [D].



A *Conductivity sensor*
B *Flow cell block*
C *Flow meter*
D *Sample outlet*
E *Flow regulating valve*
F *Sample inlet*

Fluidics AMI-II Powercon Acid

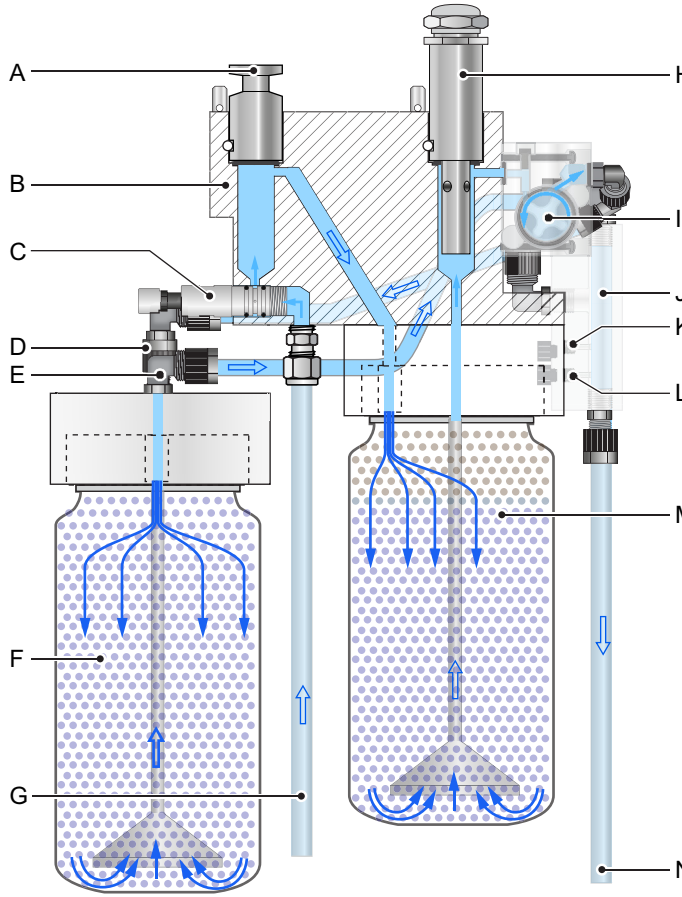
The sample enters the flow cell block [B] through the sample inlet [G] and the flow regulating valve [C]. It passes afterwards through the cation exchanger bottle [M], where the alkalization reagent is removed. Downstream the cation exchanger, cation conductivity is measured by the conductivity sensor [H]. The sample leaves the measuring cell via the flow meter [I] and the sample collector [J] and flows to the pressure-free sample outlet [N]. The sample temperature is measured by the temperature sensor integrated in the conductivity sensor.

Pre-rinse option

AMI-II Powercon Acid with pre-rinse option allows for an immediate resin change without additional rinse time, as the resin is pre-rinsed in a separate bottle. Pre-rinsing removes impurities from the resin that otherwise interfere with the measurement.

If the pre rinse option is installed, the sample flows from the flow meter through the pre rinse inlet [D] into the second cation exchanger bottle [F]. From there, the sample flows via the pre rinse outlet [E] through the sample collector [J] into the waste funnel.

The cation exchanger bottles are automatically vented via two small tubes connected to the sample collector at [K] and [L].



A *Blind plug*
B *Flow cell block*
C *Flow regulating valve*
D *Pre-rinse inlet*
E *Pre-rinse outlet*
F *Pre-rinsed cation exchanger bottle*
G *Sample inlet*
H *Conductivity sensor*
I *Flow meter*
J *Sample collector*
K *Venting tube of cation exchanger bottle*
L *Venting tube pre-rinse bottle*
M *Cation exchanger bottle*
N *Sample outlet*

2.2. Instrument Specification

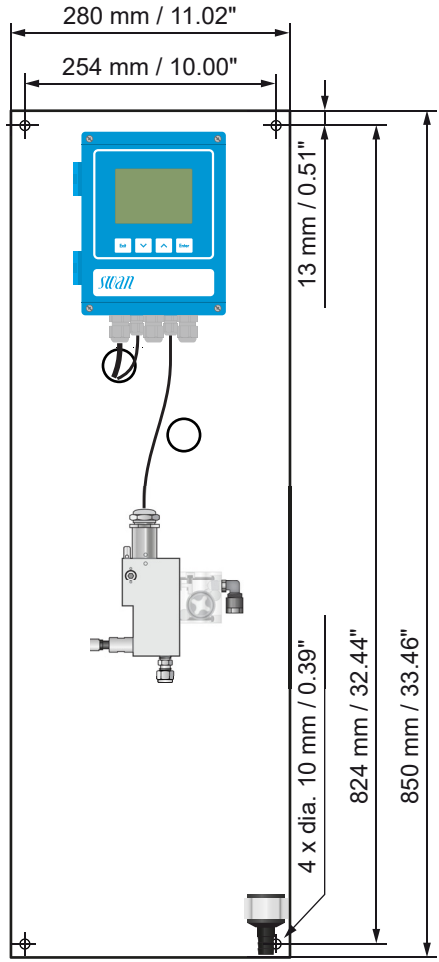
Power supply	AC variant:	100–240 VAC (±10%) 50/60 Hz (±5%)
	DC variant:	10–36 VDC
	Power consumption	max. 35 VA
Sample requirements	Flow rate:	3–20 l/h
	Temperature:	up to 50 °C
	Inlet pressure:	up to 2 bar
	Outlet pressure:	pressure free
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Swagelok fitting with R ⅛" (ISO 7-1) thread for ¼" tube OD
	Sample outlet:	
	AMI-II Powercon Specific:	8 mm Serto tube adapter (PA)
	AMI-II Powercon Acid:	for flexible tube, 15 mm inner Ø

Measuring range	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 999 µS/cm	1 µS/cm
	1.00 to 2.99 mS/cm	0.01 mS/cm
	3.0 to 9.9 mS/cm	0.1 mS/cm
	10 to 30 mS/cm	1 mS/cm

Accuracy: ±1% of measured value or ±1 digit (whichever is greater)
Ranges and accuracy valid for a cell constant of 0.0415 cm^{-1} (Swansensor UP-CON1000).

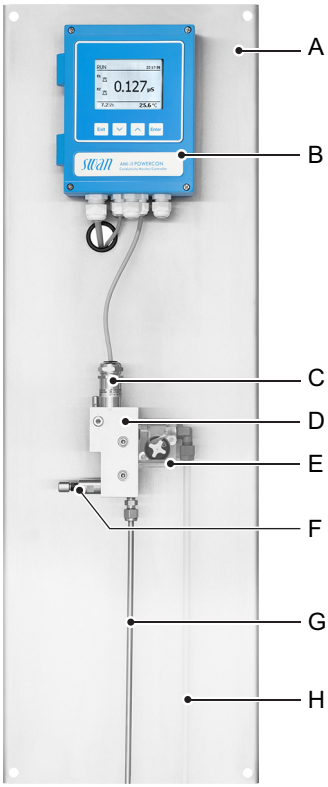
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	-10 to +50 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 74 × 53 mm

Dimensions	Panel:	stainless steel
	Dimensions:	280×850×200 mm
	Screws:	8 mm
	Weight:	7 kg (AMI-II Powercon Specific) 10 kg (AMI-II Powercon Acid)



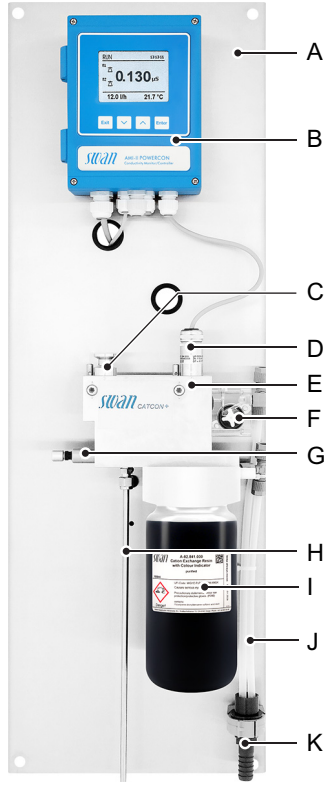
2.3. Instrument Overview

2.3.1 Monitor AMI-II Powercon Specific



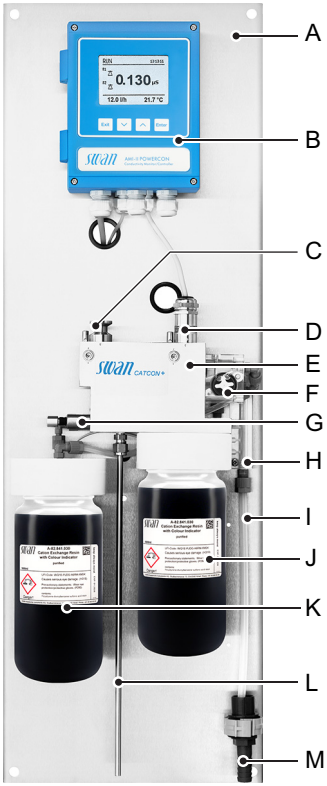
A *Panel*
B *Transmitter*
C *Slot-lock conductivity sensor*
D *Flow cell*
E *Flow meter*
F *Flow regulating valve*
G *Sample inlet*
H *Sample outlet*

2.3.2 Monitor AMI-II Powercon Acid



A *Panel*
B *Transmitter*
C *Blind plug*
D *Cation conductivity sensor*
E *Flow cell*
F *Flow meter*
G *Flow regulating valve*
H *Sample inlet*
I *Cation exchanger*
J *Sample outlet*
K *Waste funnel*

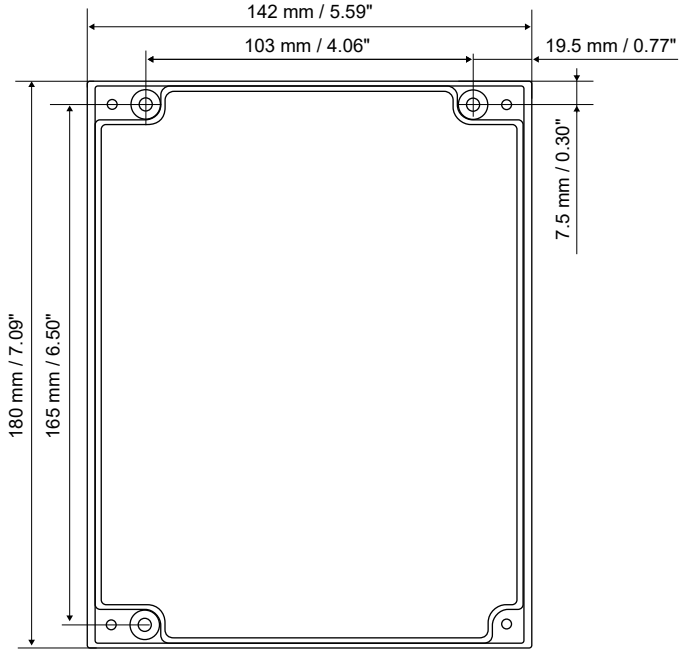
2.3.3 Monitor AMI-II Powercon Acid Prerinse



A *Panel*
B *Transmitter*
C *Blind plug*
D *Cation conductivity sensor*
E *Flow cell*
F *Flow meter*
G *Flow regulating valve*
H *Sample collector*
I *Sample outlet*
J *Cation exchanger*
K *Pre-rinsed cation exchanger*
L *Sample inlet*
M *Waste funnel*

2.4. Single Components

2.4.1 AMI-II Transmitter

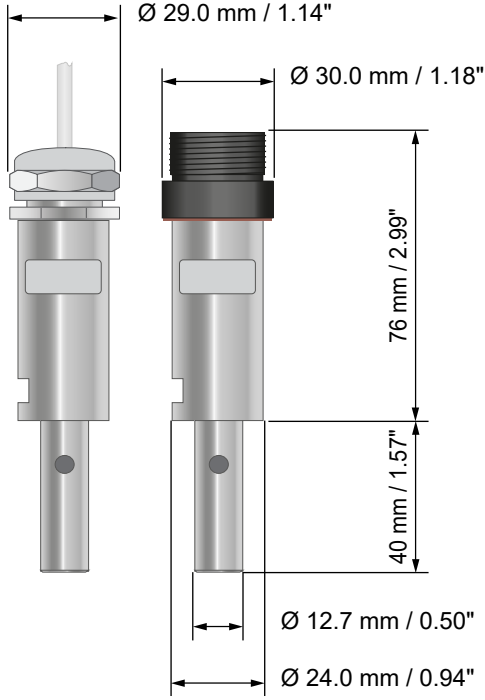


Specifications

Electronics case:	Cast aluminum
Protection degree:	IP 66 / NEMA 4X
Display:	backlit LCD, 74 x 53 mm
Electrical connectors:	screw clamps

2.4.2 Swansensor UP-CON1000 SL

Two-electrode conductivity sensor for online measurement of ultra-pure water.



Measurement

Measuring range:	0.055 µS/cm to 30 mS/cm
Accuracy at 25 °C:	±1% of measured value
Cell constant:	0.04 cm^{-1}
Temperature sensor:	Pt1000 (Class A, DIN EN 60751)

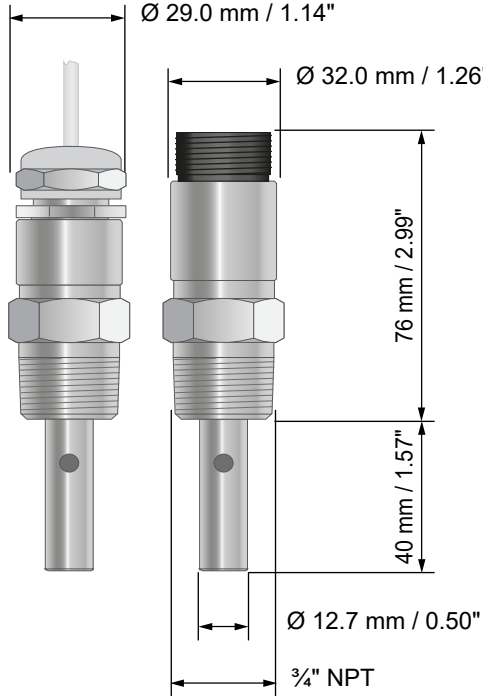
Measuring range and accuracy apply to the combination of Swansensor UP-CON1000 SL and AMI-II Powercon.

Operation and installation

Operating temperature:	-10 to 100 °C
Operating pressure:	10 bar
Process connection:	Slot-Lock for quick release of sensor
Electrical connection:	fixed cable with end sleeves or M16 male plug (IP67)

2.4.3 Swansensor UP-CON1000 NPT

Two-electrode conductivity sensor for inline measurement of ultra-pure water at high pressure.



Measurement

Measuring range:	0.055 µS/cm to 30 mS/cm
Accuracy (at 25 °C):	±1% of measured value
Cell constant:	0.04 cm^{-1}
Temperature sensor:	Pt1000 (Class A, DIN EN 60751)

Measuring range and accuracy apply to the combination of Swansensor UP-CON1000 NPT and AMI-II Powercon.

Operation and installation

Operating temperature:	-10 to 100 °C
Operating pressure:	50 bar
Process connection:	NPT ¾"
Electrical connection:	fixed cable with end sleeves or M16 male plug (IP67)

2.4.4 Flow Cells

The following flow cells can be used:

For a slot-lock sensor:
- B-Flow UP-CON SL
- Q-Flow UP-CON SL
- QV-Flow UP-CON SL
- CATCON+ SL

For a 3/4” NPT thread sensor:
- B-Flow L70
- Q-flow L70
- QV-flow L70

3. Installation

3.1. Installation Checklist

On site requirements	AC variant: 100 – 240 VAC (±10 %), 50/60 Hz (±5 %). DC variant: 10 – 36 VDC. Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see p. 14).
Installation	Mount the instrument in vertical position. Display should be at eye level. Connect sample inlet and outlet. Single components: Mount the sensor and connect the cable.
Electrical wiring	Connect all external devices like limit switches and current loops according to the connection diagram (see p. 29). Connect power cord.
Cation exchanger	Only for AMI-II Powercon Acid: Fill up cation exchanger bottle with high purity water. Remove the empty bottle and install the cation exchanger bottle. With pre-rinse set-up, install a cation exchanger bottle to the second flange.
Power-up	Start sample flow and wait until flow cell is completely filled. Switch on power. Adjust sample flow.
Instrument setup	Program all sensor parameters, the required temperature compensation, all parameters for external devices (interface, recorders, etc.) and all parameters for instrument operation (limits, alarms).
Run-in period	If the conductivity value of the sample is very low, the sensor might need some time until the correct reading is displayed.

3.2. Mounting the Instrument

Mounting requirements

Mount the instrument in vertical position. The display should be at eye level to simplify operation and maintenance.
The instrument is intended for indoor installation.

Dimensions

For panel dimensions, see p. 15.
For dimensions of single components, see p. 19.

3.3. Connecting Sample Inlet and Outlet

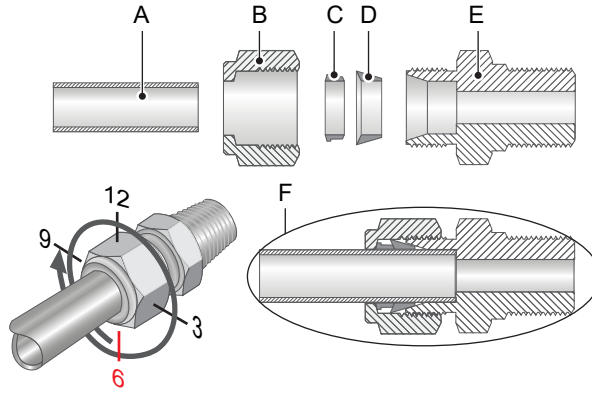
3.3.1 Stainless Steel Swagelok Fitting at Sample Inlet

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

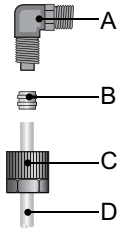
1. Insert the compression ferrule [C] and the compression cone [D] into the union nut [B].
2. Screw on the union nut onto the body, do not tighten it.
3. Push the stainless steel pipe through the union nut as far as it reaches the stop of the body.
4. Mark the union nut at 6 o'clock position.
5. While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

3.3.2 FEP Tube at Sample Outlet

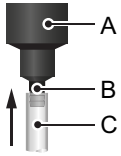
FEP flexible tube 8 mm for AMI-II Powercon Specific



A *Ellbow union*
B *Compression ferrule*
C *Knurled nut*
D *Flexible tube*

Connect the tube to the Serto elbow union and Insert it into an atmospheric drain of sufficient capacity. The maximum allowable tube length is 1.5 m. Do not connect longer tubes.

15 mm tube at waste funnel for AMI-II Powercon Acid

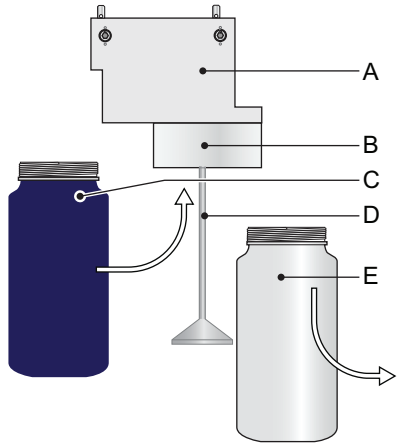


A *Waste funnel*
B *Hose nozzle*
C *15 mm tube*

Connect the 15 mm tube [C] to the hose nozzle [B] and place it into the atmospheric drain.

3.4. Installation of Cation Exchanger

Install cation exchanger bottle



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

Install the resin bottle as follows:

1 Unscrew and remove the empty bottle [E] from the bottle holder [B].

2 Fill high purity water into the cation exchanger bottle [C], 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 [D] 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 If you have a pre-rinse setup, proceed in the same way with the second cation exchanger bottle.

3.5. Electrical Connections

WARNING

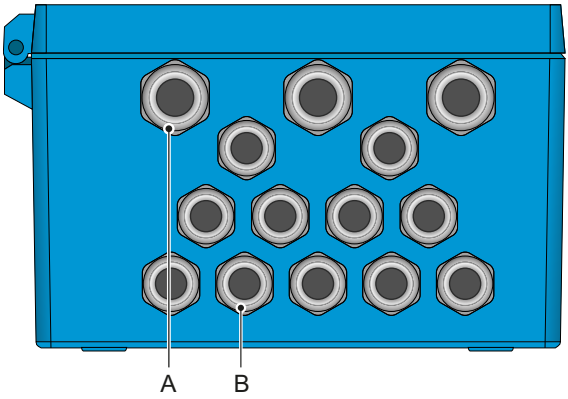
Risk of electrical shock

Failure to follow safety instructions can result in serious injury or death.

- Before working on electrical components, turn off power to the instrument. External power sources connected to relay 1 or 2 or to the alarm relay must also be turned off.
- Do not connect the instrument to power unless the ground wire (PE) is connected.
- 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. Protect unused cable glands.

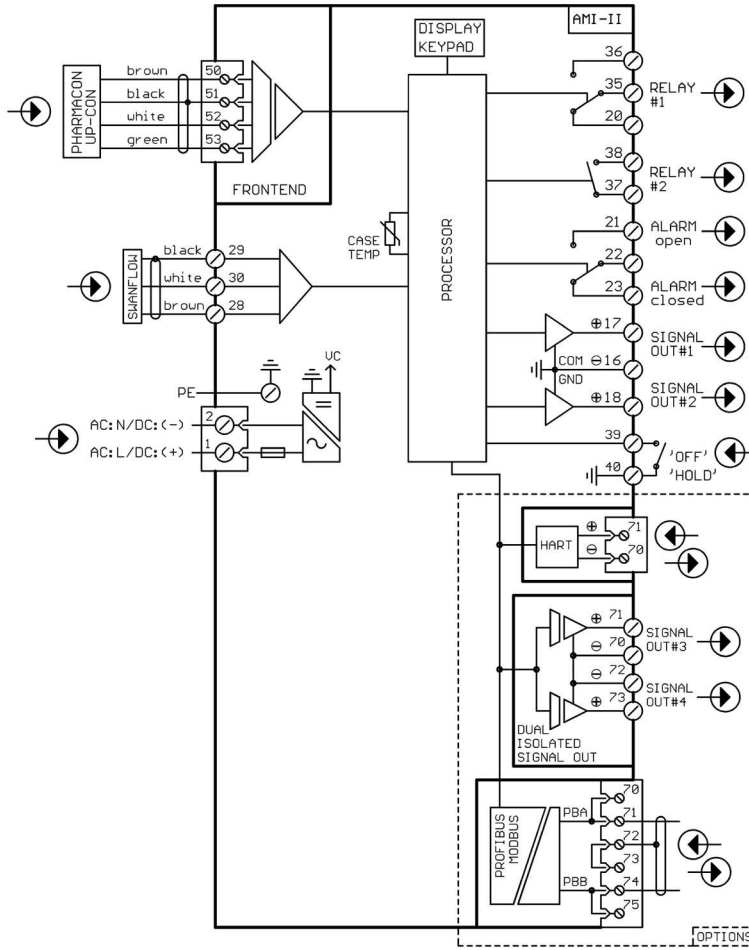


A *M16 cable glands (3x): cable $Ø_{outer}$ 5–10 mm*
B *M12 cable glands (11x): cable $Ø_{outer}$ 3–6 mm*

Wires

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.

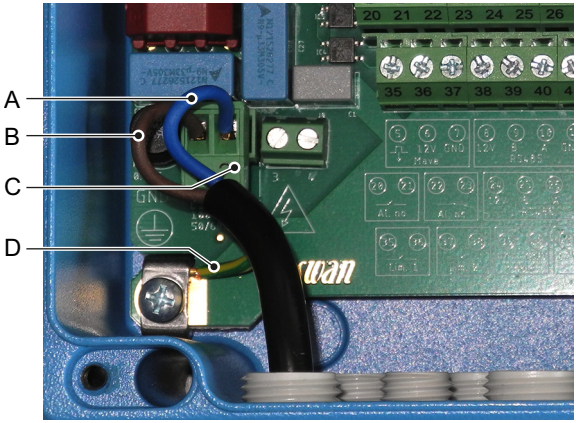
3.5.1 Connection Diagram



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



A *Neutral conductor, terminal 2*
B *Phase conductor, terminal 1*
C *Power supply connector*
D *Protective earth PE*

Installation requirements

The installation must meet the following requirements.

- Mains cable according to standards IEC 60227 or IEC 60245; flammability rating FV1.
- Mains equipped with an external switch or circuit-breaker
  - near the instrument
  - easily accessible to the operator
  - marked as interrupter for AMI-II Powercon

3.6. Relay Contacts

3.6.1 Input

Use only potential-free (dry) contacts.
Terminals: 39/40

3.6.2 Alarm Relay

One alarm output for system errors.

- Normally open contact (terminals: 21/22):
  Active (closed) when no error is present. Inactive (opened) on error and loss of power.
- Normally closed contact (terminals: 22/23):
  Active (opened) when no error is present. Inactive (closed) on error and loss of power.

Max. load: 1 A/250 VAC.
For switching inductive loads, please observe the information in section Types of Loads, p. 32.

3.6.3 Relay 1 and 2

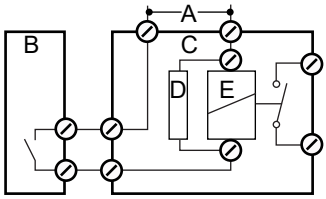
- Relay 1:
  - terminals 35/36 (normally open) or
  - terminals 35/20 (normally closed).
- Relay 2: terminals 37/38 (normally open).

Max. load 1 A/250 VAC.
For switching inductive loads, please observe the information in section Types of Loads, p. 32.

3.6.4 Types of Loads

Inductive loads

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-II transmitter it is mandatory to connect a snubber circuit in parallel to the load.

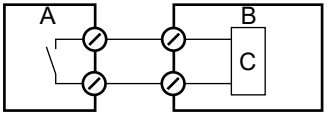


A *AC or DC power supply*
B *AMI-II transmitter*
C *External power relay*
D *Snubber*
E *Power relay coil*

To switch inductive loads higher than 0.1 A, use suitable power relays.

Resistive loads

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



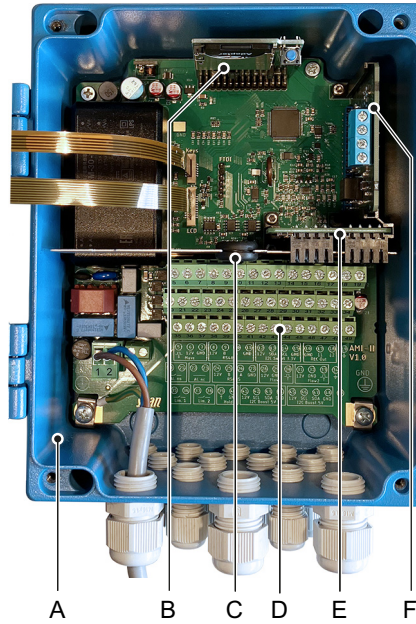
A *AMI-II transmitter*
B *PLC or controlled pulse pump*
C *Logic*

3.7. Signal Outputs

3.7.1 Signal Output 1 and 2 (Current Outputs)

Max. burden 510 Ω.
If signals are sent to two different receivers, use signal isolator (loop isolator).
Signal output 1: Terminals 17 (+) and 16 (-)
Signal output 2: Terminals 18 (+) and 16 (-)

3.8. Interface Options



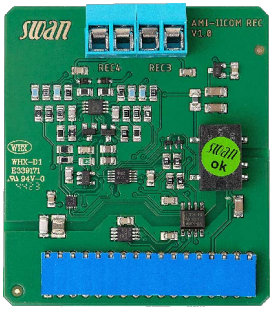
A *AMI-II transmitter*
B *SD card slot*
C *Cable grommet*
D *Screw terminals*
E *Frontend*
F *Communication option*

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

- Two additional signal outputs
- Profibus or Modbus
- HART

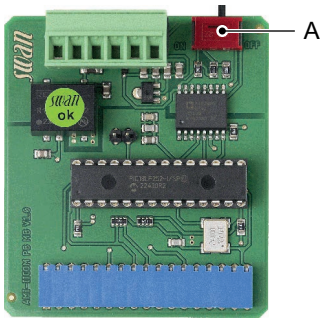
3.8.1 Signal Outputs 3 and 4

Max. burden 510 Ω.
If signals are sent to two different receivers, use signal isolator (loop isolator).
Signal output 3: terminals 71 (+) and 70 (-).
Signal output 4: terminals 73 (+) and 72 (-).



3.8.2 RS485 (Profibus or Modbus Protocol)

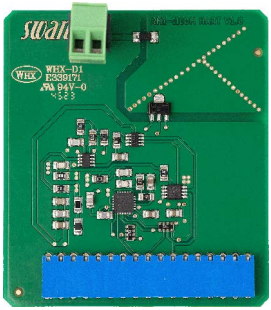
Terminal 74/75 PB, terminal 70/71 PA, terminal 72/73 shield
The switch [A] must be set to “ON” if only one instrument is installed or on the last instrument in the bus.



A *On/off switch*

3.8.3 HART

Terminals 71 (+) and 70 (-).



4. Instrument Setup

4.1. Establish Sample Flow

1. Open flow regulating valve.
2. Wait until the flow cell has been completely filled.
3. Switch on power.
4. Adjust the sample flow to 3–20 l/h (5–10 l/h recommended).
5. Let the instrument run in for 1 h.
   ⇒ *This recommendation is valid for high purity, strong acid cation exchange resin delivered by Swan.*
   Lower quality resin from other suppliers may require a longer run-in period of up to several days.

4.2. Programming

Sensor parameters

Menu 5.1.2.1
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 the:
- Cell constant [cm^{-1}]
- Temperature correction [°C]
- Cable length: If the transmitter and the flow cell are mounted together on one panel, set the cable length to 0.0 m.
- Temperature compensation.

Measuring unit

Menu 5.1.1.2
Set the measuring unit:
- µS/cm
- µS/m

External devices

Menu 5.2 Signal Outputs
Menu 5.4 Interface

Limits and alarms

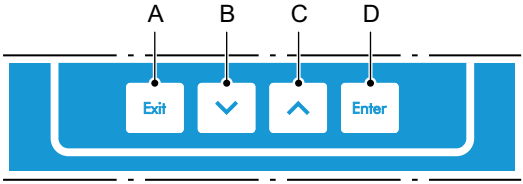
Menu 5.3 Relay Contacts
Program all parameters for instrument operation (limits, alarms).

Quality assurance

Menu 5.1.4
If necessary, activate quality assurance by selecting a level.

5. Operation

5.1. Keys



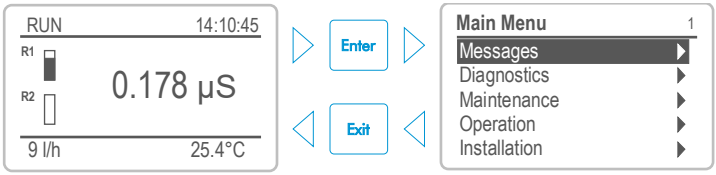
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

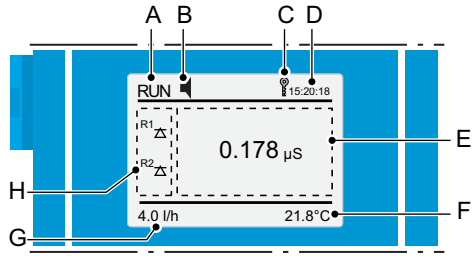
C to move up in a menu list and to increase digits

D to open a selected menu item
to accept an entry

Program access, exit



5.2. Display

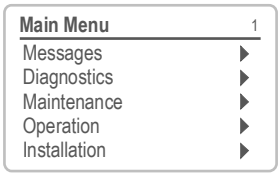


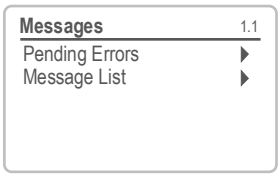
A	RUN	Normal operation
	HOLD	Input active or cal delay: Instrument on hold (shows status of signal outputs)
	OFF	Input active: Signal outputs go to 0/4 mA.
B	Error	Non-fatal error / Fatal error
C	Keys locked, transmitter control via Profibus	
D	Time	
E	Process value	
F	Sample temperature	
G	Sample flow	
H	Relay status	

Symbols used for relay status:

- Upper/lower limit not yet reached
- Upper/lower limit reached
- Control upw./downw. no action
- Control upw./downw. active, dark bar indicates control intensity
- Timer
- Timer: timing active (hand rotating)
- Relay inactive (controlled via fieldbus)
- Relay active (controlled via fieldbus)

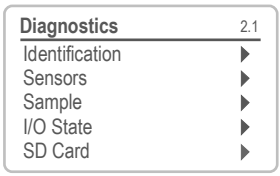
5.3. Software Structure





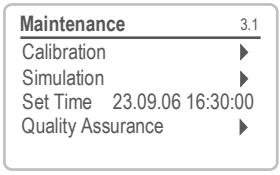
Menu 1 Messages

Shows pending errors as well as the event history (time and state of events that have occurred at an earlier point of time).
Contains user-relevant data.



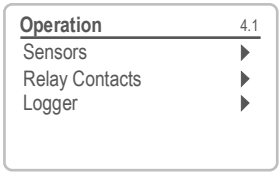
Menu 2 Diagnostics

Provides user-relevant instrument and sample data.



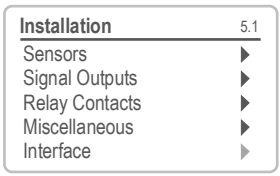
Menu 3 Maintenance

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



Menu 4 Operation

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.



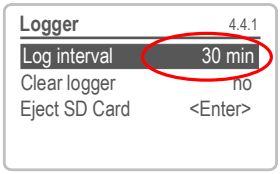
Menu 5 Installation

For initial instrument set up by Swan authorized person.
Password protection strongly recommended.

5.4. Changing Parameters and Values

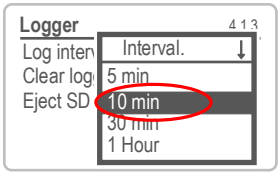
Changing parameters

The following example shows how to change the logger interval:



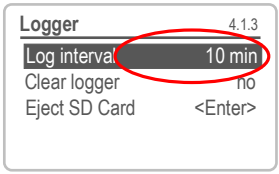
1 Select the parameter you want to change.

2 Press [Enter].



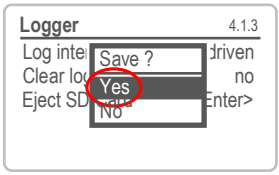
3 Press ^ or v to highlight the required parameter.

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



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

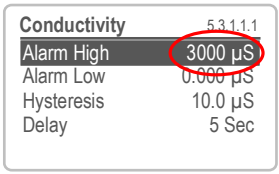
5 Press [Exit].



⇒ *Yes is highlighted.*

6 Press [Enter] to save the new parameter.

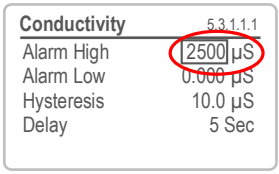
Changing values



1 Select the value you want to change.

2 Press [Enter].

3 Set required value with ^ or v.



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

6. Maintenance

6.1. Maintenance Schedule

Monthly	◆ Check sample flow.
As needed	◆ Clean conductivity sensor. ◆ Perform a verification measurement.

Instruments with cation exchanger:

Monthly	◆ Check cation exchange resin. The color changes to brown when it is depleted.
As needed	◆ Replace filter. ◆ Replace deaeration tubes.

Reagent consumption

At 1 ppm of alkalizing agent (pH 9.4 with ammonia), a one-liter bottle of cation exchange resin (exchange capacity 1.8 eq/l) lasts for:

- 3.5 months at a sample flow of 10 l/h,
- 7 months at a sample flow of 5 l/h.

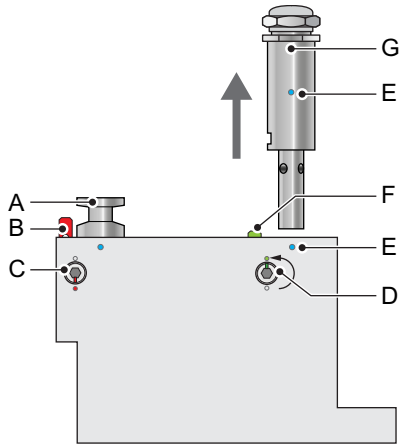
These calculations include a safety margin of 15 %.

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

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 [F] down.
2. Turn the locking screw [D] 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.

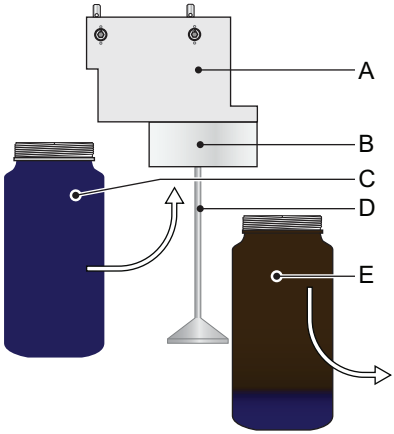
6.3.2 Install the Sensor into the Flow Cell

1. Make sure that the locking mechanism is in unlocked position (locking screw in position [D] and security pin in position [F]).
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. Changing the Cation 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.

Without pre-rinse option



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

1 Stop sample flow.

2 Slightly squeeze the exhausted 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 exhausted cation exchanger bottle [E].

4 Fill high purity water into the new cation exchanger bottle [C], 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 [D] into the bottle holder [B].

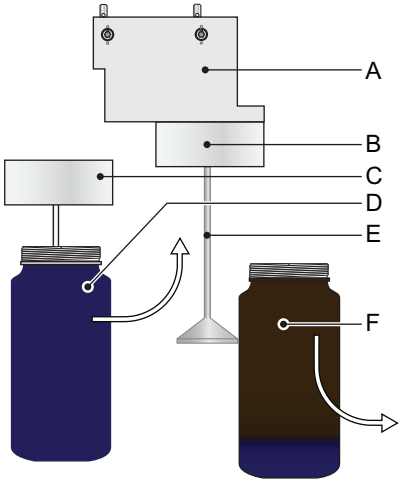
6 Screw the cation exchanger bottle into the bottle holder.

Do not tighten the bottle too firmly, this could damage the gasket.

7 Open and adjust the sample flow.

8 Rinse the new cation exchanger resin until the display shows stable measured values.

With pre-rinse option



A *Flow cell*
B *Bottle holder*
C *Pre-rinse bottle holder*
D *Pre-rinsed 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 Unscrew and carefully remove the pre-rinsed cation exchanger bottle [D] from the pre-rinse holder [C].

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

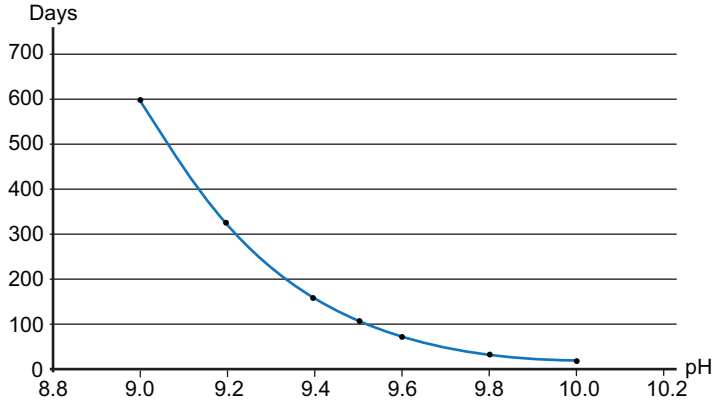
6 Screw the cation exchanger bottle into the bottle holder.

Do not tighten the bottle too firmly, this could damage the gasket.

7 Install a new bottle with fresh, unused resin into the pre-rinse bottle holder [C].
⇒ *The new cation exchanger resin will be pre-rinsed and ready for use when the next exchange is necessary.*

Operation time 1 liter Swan resin

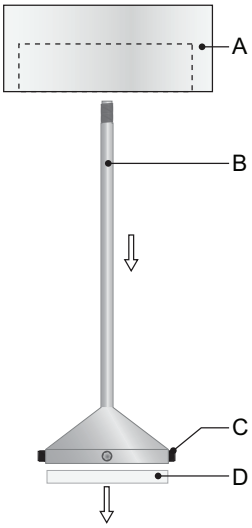
This graphic shows the average depletion time (flow 6 l/h) and must be verified by the user.



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.

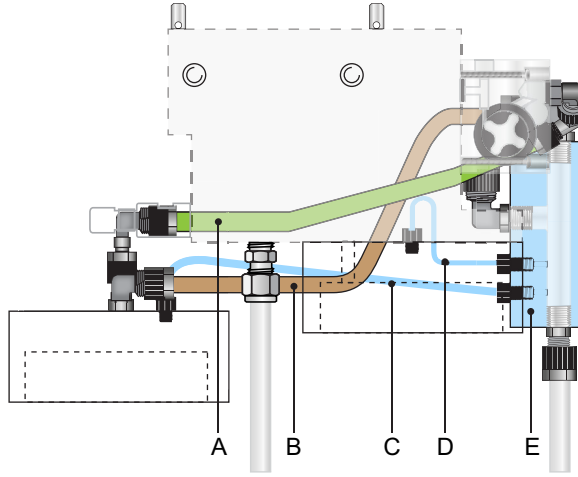
8 Tighten the 4 allen screws slightly.

9 Mount the filter holder back onto the bottle 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. Tube Connections



A *Pre-rinse inlet*
B *Per-rinse outlet*
C *Deaeration tube of pre-rinse bottle*
D *Deaeration tube of cation exchanger bottle*
E *Sample collector*

6.7. Replace the Deaeration Tubes

Depending on your application, it might be necessary to change the deaeration tube, e.g. when contaminated with iron.

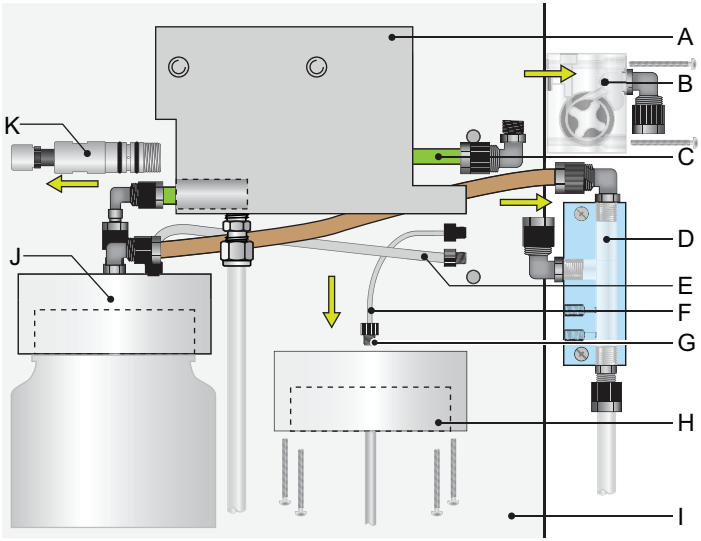
Note: *There are two different tubes:*

- The deaeration tube [F] of the cation exchanger bottle has an inner diameter of 1 mm.
- The deaeration tube [E] of the pre-rinse bottle, has an inner diameter of 2 mm.

Preparation

1 Close the main tap to stop the sample flow.

2 Remove cation exchanger bottle from the bottle holder [H].



A *Flow cell*
B *Flow meter*
C *Pre-rinse inlet*
D *Sample collector*
E *Deaeration tube of pre-rinse bottle*
F *Deaeration tube of cation exchanger bottle*
G *Tube fitting*
H *Bottle holder of cation exchanger bottle*
I *Panel*
J *Bottle holder of pre-rinse bottle*
K *Flow regulating valve*

6.7.1 Exchange Deaeration Tube of Cation Exchanger Bottle

1. Remove the inlet tube [C] to the pre-rinsed cation exchanger bottle from the flowmeter [B].
2. Remove the flowmeter [B] from the flow cell [A].
3. Remove the sample collector [D] from the panel [I].
4. Unscrew and remove the tube fittings of the deaeration tubes [E] and [F] from the sample collector.
5. Unscrew and remove the bottle holder [H] from the flow cell [A].
6. Unscrew and remove the tube fitting [G] from the bottle holder [H].
7. Replace the 1 mm deaeration tube [F].
8. Screw the tube fitting into the bottle holder and tighten it.
9. Screw the bottle holder to the flow cell.
10. Screw the cation exchanger bottle into the bottle holder.

Do not tighten the bottle too firmly, this could damage the gasket.

11. Before installing the sample collector [D] and the flowmeter [B] replace the deaeration tube [E], see following chapter.

6.7.2 Exchange Deaeration Tube of Pre-Rinse Bottle

1. Unscrew and remove the flow regulating valve [K], with a 14 mm open-end wrench from the flow cell.
2. Unscrew and remove the tube Fitting from the bottle holder [J].
3. Replace the 2 mm deaeration tube [E].
4. Screw the flow regulating valve into the flow cell and tighten it well.

Assemble

1. Screw the sample collector onto the panel.
2. Screw the flow meter [B] onto the flow cell [A].
3. Connect the inlet tube [C] to the pre-rinsed cation exchanger bottle with the elbow union of the flowmeter [B].

6.8. Quality Assurance of the Instrument

Every Swan on-line instrument is equipped with integrated, autonomous quality assurance functions to survey the plausibility of each measurement. For AMI-II Powercon these are:

- continuous monitoring of sample flow
- continuous monitoring of the temperature inside the transmitter case

In addition, a manual, menu-driven test procedure can be performed using a certified reference instrument, the AMI INSPECTOR Conductivity.

Quality assurance level

A central feature of the quality assurance function is the assignment of the monitored process to a quality assurance level. There are three predefined levels and one user-defined level. By selecting a level, the test interval and the permissible deviations of temperature and conductivity between the reference instrument and the on-line instrument are defined.

- Level 1 (trend): Measurement is used as an additional information to follow the process indicating trends.
- Level 2 (standard): Monitoring of several parameters of a process. In case of instrument failure, other parameters can be used for process monitoring.
- Level 3 (crucial): Monitoring of critical processes, value is used for control of another part or subsystem.

Additional level:

- Level 4 (user): User-defined inspection interval and maximum deviations of temperature and conductivity.

Limits and intervals

Quality level	max. deviation temperature [°C] a)	max. deviation conductivity [%]	min. inspection interval
1: Trend	0.5 °C	10%	annual
2: Standard	0.4 °C	5%	quarterly
3: Crucial	0.3 °C	5%	monthly
4: User	0–2 °C	0–20%	annual, quarterly, monthly, weekly

a) sample temperature must be 25 °C ±5 °C.

6.8.1 Activate Swan Quality Assurance Procedure

Enable quality assurance procedure on the on-line instrument(s) which shall be checked by selecting the quality level in menu 5.1.4.1. The corresponding submenus are then activated. The activation is necessary the first time only.

6.8.2 Pre-Test

- Reference instrument: AMI INSPECTOR Conductivity:
  - The reference instrument certificate should not be older than one year.
  - The battery of the AMI INSPECTOR Conductivity should be completely charged. Remaining operating time on display minimum 20 hours.
  - Disable temperature compensation (set to “none”)
- On-line instrument: AMI-II Powercon:
  - Flow cell free of particles, sensor surface free of deposits.
  - Check the message list in menu 1.3 for errors and resolve them.

6.8.3 Connecting Sample Lines

Note:

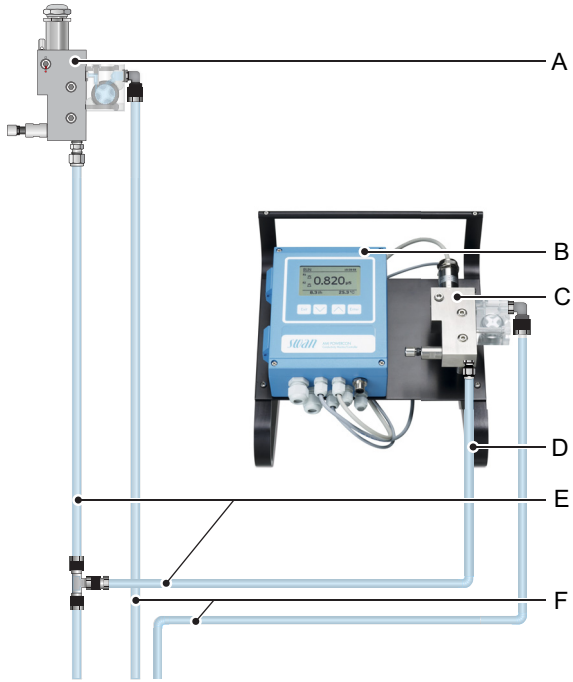
- *Avoid ingress of air, use screwed fitting.*
- *Sample as close as possible to the on-line sensor.*
- *While the measurement is in progress, wait approximately 10 minutes until the conductivity and the temperature have stabilized.*

AMI-II Powercon Specific

Depending on local conditions, the following sampling methods can be used for a comparative measurement of the specific conductivity:

- via sample point,
- via T-fitting or
- via piggyback/downstream

Example As an example, the following picture shows the connection of the AMI INSPECTOR via T-fitting to the AMI-II Powercon Specific.

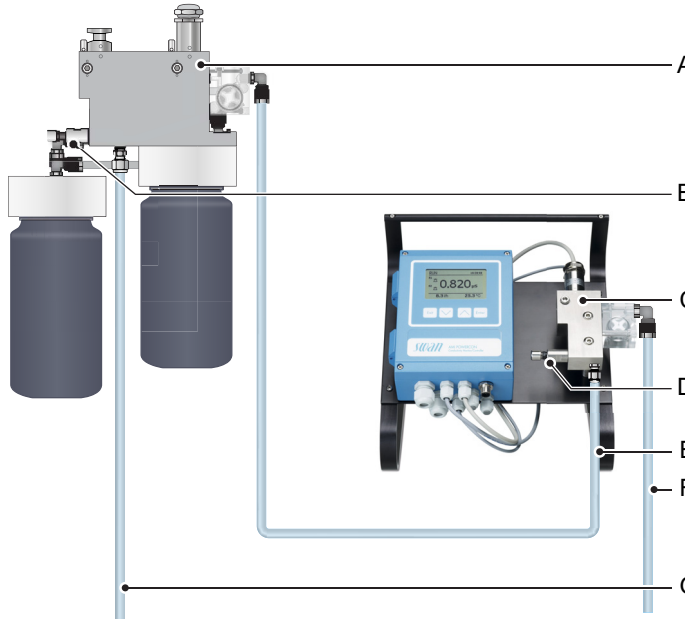


A *Flow cell of AMI-II Powercon Specific*
B *AMI INSPECTOR*
C *Flow cell of AMI INSPECTOR*
D *Supplied FEP tube*
E *Sample inlets with T-fitting*
F *Sample outlets*

1. Stop sample flow to the AMI-II Powercon Specific by closing the corresponding valve (e.g. on the Back Pressure Regulator).
2. Connect the AMI INSPECTOR as shown in the picture above.
3. Switch on the AMI INSPECTOR.
4. Start the sample flow and regulate it to 5–10 l/h using the flow regulating valve [C].

AMI-II Powercon Acid

To perform a comparative measurement of the cation conductivity, connect the AMI INSPECTOR downstream to the flow cell of the AMI-II Powercon Acid.



A *Flow cell of AMI-II Powercon Acid*
B *Flow regulating valve*
C *Flow cell of AMI INSPECTOR*
D *Flow regulating valve*
E *Supplied FEP tube*
F *Sample outlet*
G *Sample inlet*

1. Stop sample flow to the AMI-II Powercon Acid by closing the corresponding valve (e.g. on the Back Pressure Regulator).
2. Connect the AMI INSPECTOR as shown in the picture above.
3. Switch on the AMI INSPECTOR.
4. Fully open the flow regulating valve [D] of the AMI INSPECTOR.
5. Start the sample flow and regulate it to 5–10 l/h using the flow regulating valve [B] of the AMI-II Powercon Acid.

6.8.4 Carry Out Comparison Measurement

1. Navigate to menu **Maintenance** > **Quality Assurance** and follow the instructions on the screen.
2. If the QA check is not successful, it is recommended to clean the sensor. If the QA check fails again, contact your local Swan distributor for support.

6.8.5 Completion of the Mearuement

1. Stop the sample flow to the AMI-II Powercon by closing the appropriate valve, e.g. on the Back Pressure Regulator.
2. Disconnect the AMI INSPECTOR from the sample line.
3. Start and regulate sample flow to the AMI-II Powercon.
4. Shut off the AMI INSPECTOR .

6.9. Calibration

The calibration is carried out using a 0.01 mol/l (1.413 mS/cm at 25 °C) KCl solution. A calibration is only necessary if the cell constant of the sensor is not known.
To perform a calibration proceed as follows:

1. Stop sample flow.
2. Navigate to menu **Maintenance** > **Calibration**.
3. Press [Enter] and follow the dialog on the display.
4. Remove the sensor from the flow cell.
5. Clean the sensor carefully and rinse it with clean water.
6. Use a one liter beaker and fill it with one liter of calibration solution.
7. Put the sensor into the beaker filled with calibration solution.
8. Wait at least 5 minutes to permit temperature equilibration between the sensor and the calibration solution.
9. Start the calibration procedure.
10. Press [Enter], to save the values if the calibration was successful.
11. Install the sensor into the flow cell.

Note: *The temperature dependence of the above mentioned calibration solution is stored in the AMI-II Powercon transmitter. Provided that the calibration solution has a temperature between 5 °C and 50 °C and the temperature sensor has reached temperature equilibrium with the solution, a correct calibration will be performed (regardless of the programmed temperature compensation).*

6.10. Longer Stop of Operation

1 Stop sample flow.

2 Shut off power of the instrument.

If a cation exchanger bottle is present:

3 Slightly squeeze the cation exchanger bottle.
⇒ *Thus no water will spill out of the flow cell when loosening the bottle.*

4 Unscrew and carefully remove the cation exchanger bottle with the exhausted resin.

5 Close the cation exchanger bottle with the screw cover and store it in a frost-protected room.

6 Screw on an empty bottle.

7. Troubleshooting

This chapter provides some hints to make troubleshooting easier.
For information on how to handle/clean parts refer to Maintenance, p. 42.
For information on how to program the instrument refer to Program List and Explanations, p. 70.
If you need help please contact your local distributor. Note serial number of instrument and all diagnostic values before.

What to do if...

Problem	Possible reason / solution
Conductivity value <0.055 µS/cm	◆ Air bubble at sensor tip or sensor in air.
High cation conductivity after resin change	◆ Cation exchange resin not rinsed. Wait until the cation conductivity has returned to a normal level. ◆ Use Swan cation exchange resin. Lower quality resin from other suppliers may require a long run-in period of up to several days.

7.1. Error List

Two categories of messages are distinguished:

Non-fatal error

Non-fatal instrument error or exceeding of a programmed limit value. Such errors are marked **E0xx** (bold and black) in the following list.

Fatal error (flashing symbol)

Fatal instrument error. Control is interrupted and the displayed measured values may not be correct.
Fatal errors are divided into the following two subcategories:

- Errors which disappear when correct measuring conditions are recovered (i.e. sample flow low).
  Such errors are marked **E0xx** (bold and orange) in the following list.
- Errors which indicate a hardware failure of the instrument.
  Such errors are marked **E0xx** (bold and red) in the following list.

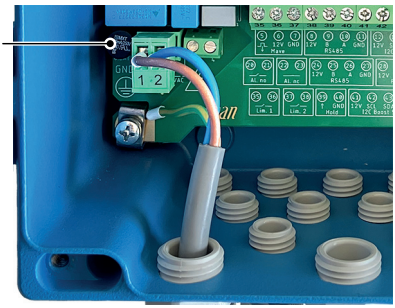
Error	Description	Corrective action
E001	Cond. Alarm high	– Check process – Check programmed value
E002	Cond. Alarm low	– Check process – Check programmed value
E007	Sample Temp. high	– Check process – Check programmed value
E008	Sample Temp. low	– Check process – Check programmed value
E009	Sample Flow high	– Check sample inlet pressure – Check programmed value
E010	Sample Flow low	– Check sample inlet pressure – Check flow regulating valve – Check programmed value
E011	Temp. shorted	– Check wiring of temperature sensor – Check temperature sensor
E012	Temp. disconnected	– Check wiring of temperature sensor – Check temperature sensor
E013	Case Temp. high	– Check case/environment temperature – Check programmed value
E014	Case Temp. low	– Check case/environment temperature – Check programmed value
E017	Control timeout	– Check control device or programming in **Installation** > **Relay contacts** > **Relay 1** and **Installation** > **Relay contacts** > **Relay 2**.
E018	Quality Assurance	– Perform QA procedure with AMI Inspector
E024	Input active	– Message informing that the relay input has been actuated. – Can be deactivated in menu **Installation** > **Relay contacts** > **Input** > **Fault**.
E025	IC MK41T56	– Call support
E026	IC LM75	– Call support
E030	I2C Frontend	– Call support

Error	Description	Corrective action
E031	Calibration Recout	– Call support
E032	Wrong Frontend	– Call support
E033	Power-on	– none, normal status
E034	Power-down	– none, normal status

7.2. Replacing Fuses

When a fuse has blown, find out the cause and fix it before replacement. Use tweezers or needle-nosed pliers to remove the defective fuse.
Use original fuses provided by Swan only.

AMI-II transmitter



A *0.8 AT/250V Instrument power supply*

8. Program Overview

Explanations for each parameter of the menus can be found in Program List and Explanations, p. 70.

- 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 accessible to anyone at any time. No password protection. No settings can be modified.
- Menu 3 **Maintenance** is intended for service technicians: Calibration, simulation of outputs and set time/date. Please protect with password.
- Menu 4 **Operation** is intended for the user and enables setting of limit values, alarm values, etc. The presetting is made in the Installation menu (for the system engineer only). 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
Message List 1.2*	*Number*	1.2.1*	
	Date, Time		

8.2. Diagnostics (Main Menu 2)

Identification 2.1*	*Designation*			* Menu numbers
	Version			
	Bootloader			
	Factory Test 2.1.3*	*Motherboard*	2.1.3.1*	
		Front End		
	Operating Time 2.1.4*	*Years / Days / Hours / Minutes / Seconds*		2.1.4.1*
Sensors 2.2*	**Cond. Sensor** 2.2.1*	*Current value*		
		Raw value		
		Cell constant		
		Cal. History 2.2.1.5*	*Number, Date, Time*	2.2.1.5.1*
		QA History 2.2.1.6*	*Number, Date, Time*	2.2.1.6.1*
	Miscellaneous 2.2.2*	Case Temp.	2.2.2.1*	
Sample 2.3*	*Sample ID*	2.3.1*		
	Temperature (Pt1000)			
	Sample Flow			
	Raw value			
I/O State 2.4*	*Alarm Relay*	2.4.1*		
	Relay 1/2	2.4.2*		
	Input			
	Signal Output 1/2			
Interface 2.5*	*Protocol*	2.5.1*		(only with RS485 interface)
	Baud rate			

8.3. Maintenance (Main Menu 3)

Calibration 3.1*	Follow instructions	3.1.5*	
Simulation 3.2*	**Relays** 3.2.1*	*Alarm Relay*	3.2.1.1*
		Relay 1	3.2.1.2*
		Relay 2	3.2.1.3*
	Signal Outputs 3.2.2*	*Signal Output 1*	3.2.2.1*
		Signal Output 2	3.2.2.2*
Set Time 3.3*	*(Date), (Time)*		
Quality Assurance 3.4*	Follow instructions	3.4.1*	

* Menu numbers

8.4. Operation (Main Menu 4)

Sensors	*Filter Time Const.*	4.1.1*		*Menu numbers
4.10*	*Hold after Cal*	4.1.2*		
Relay Contacts	**Alarm Relay**	**Alarm Conductivity**	*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*
	Relay 1/2	*Setpoint*	4.2.x.100*	
	4.2.2*/4.2.3*	*Hysteresis*	4.2.x.200*	
		Delay	4.2.x.30*	
	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*		
	Eject SD Card	4.3.3*		

8.5. Installation (Main Menu 5)

Sensors	**Flow**	*None*		* Menu numbers
5.1*	5.1.1*	*Q-Flow*		
	Sensor parameters	*Cell Constant*	5.1.2.1*	
	5.1.2*	*Temp. Corr.*	5.1.2.2*	
		Cable length	5.1.2.3*	
		Meas. unit	5.1.2.4	
	Temp.Compensation	*Comp.*	*none*	
	5.1.3*	5.1.3.1*	*Coefficient*	
			Neutral salts	
			High-purity water	
			Strong acids	
			Strong bases	
			Ammonia	
			Ethanolamines	
			Morpholine	
			Cyclohexylamine	
			2-amino-2-methylpropanol	
			2-diethylaminoethanol	
			Hydrofluoric acid	
	Quality Assurance	**Level**	*0: Off*	
	5.1.4*	5.1.4.1*	*1: Trend*	
			2: Standard	
			3: Crucial	
			4: User	
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**	**Alarm Conductivity**	*Alarm High*	5.3.1.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.1.25*
			Hysteresis *	5.3.1.1.1.35
			Delay	5.3.1.1.1.45*

		Sample Flow	*Flow Alarm*	5.3.1.2.1*
		5.3.1.2*	*Alarm High*	5.3.1.2.2
			Alarm Low	5.3.1.2.35
		Sample Temp.	*Alarm High*	5.3.1.3.1*
		5.3.1.3*	*Alarm Low*	5.3.1.3.25*
		Case Temp.high	5.3.1.4*	* Menu numbers
		Case Temp.low	5.3.1.5*	
	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*		
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). When all active errors have been acknowledged, the alarm relay is active again. Cleared errors are moved to the message list.

1.2 Message List

1.2.1 Shows the error history: Error code, date and time of issue and status (active, acknowledged, cleared). 64 errors are memorized. Then the oldest error is cleared to save the newest one (circular buffer).

2 Diagnostics

2.1 Identification

Desig.: Designation of the instrument.
Version: Version of the instrument firmware.
Bootloader: Version of the bootloader.

2.1.4 **Factory Test:** Test date of the mainboard and frontend.

2.1.5 **Operating Time:** Years, days, hours, minutes, seconds.

2.2 Sensors

2.2.1 **Cond. Sensor**

Current value in µS
Raw value in µS
Cell Constant

2.2.1.4 *QA History:* Review the QA values (number, date and time, deviation conductivity, deviation temperature) of the last quality assurance procedures. Only for diagnostic purpose.
Max. 64 data records are memorized.

2.2.1.5 *Cal. History:* Review diagnostic values of the last calibrations. Only for diagnostic purposes.
Number; Date, time
Cell constant
Max. 64 data records are memorized.

2.2.2 **Miscellaneous**

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

2.3 Sample

2.3.1 *Sample ID:* Shows the ID used to identify the location of the sample.
Temperature: Shows the current sample temperature in °C.
(Pt 1000): Shows the current temperature in Ohm.
Sample Flow: Shows the current sample flow in l/h and the raw value in Hz.

2.4 I/O State

2.4.1 Relays

2.4.1.1	*Alarm Relay:*	Active or inactive
	Relays 1 and 2:	Active or inactive
	Input:	Open or closed

2.4.2 Signal Outputs

2.4.2.1	*Signal Outputs 1 and 2:*	Current in mA
	Signal Outputs 3 and 4:	Current in mA (if option is installed)

2.5 SD Card

2.5.1 *Status:* Shows the status of the SD card.

2.6 Interface

Settings of the installed communication option (if any).

3 Maintenance

3.1 Calibration

See Calibration, p. 57.

3.2 Simulation

To simulate a value or a relay state, select

- alarm relay
- relay 1 or 2
- signal outputs 1 or 2
- signal outputs 3 or 4 (if option is installed)

Change the value or state of the selected item with the arrow keys. Press [Enter].

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

At the absence of any key activities, the instrument will switch back to normal mode after 20 min.

3.2.1	**Relays**	
3.2.1.1	*Alarm relay:*	Active or inactive
3.2.1.2	*Relay 1:*	Active or inactive
3.2.1.3	*Relay 2:*	Active or inactive
3.2.2	**Signal outputs**	
3.2.2.1	*Signal output 1:*	Current in mA
3.2.2.2	*Signal output 2:*	Current in mA
3.2.2.3	*Signal output 3:*	Current in mA
3.2.2.4	*Signal output 4:*	Current in mA

3.3 Set Time

Adjust date and time.

3.4 Quality Assurance

3.4.5 See Quality Assurance of the Instrument, p. 52.

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 s

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: 0–6000 s

4.2 Relay Contacts

See Relay Contacts, p. 80.

4.3 Logger

The instrument is equipped with an internal logger. The logger data can be copied to the SD card.

4.3.1 *Log Interval:* Select a convenient log interval.
Range: 1 s, 5 s, 1 min, 5 min, 10 min, 30 min or 1 h.

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 SD Card:* With this function all logger data are copied to the SD card and the SD card can be removed.

5 Installation

5.1 Sensors

5.1.1 *Flow:* Select “Q-Flow” if using a Swan flow cell with integrated flow meter.

5.1.2 Sensor parameters

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

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

5.1.2.3 *Cable length:* Enter the cable length. If the transmitter and the flow cell are mounted together on one panel, set the cable length to 0.0 m.

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

5.1.3 Temp. comp

5.1.3.1 *Comp.:* Available compensation models:

- none
- Coefficient
- Neutral salts
- High purity water
- Strong acids
- Strong bases
- Ammonia
- Morpholine
- Ethanolamines
- Cyclohexylamine
- 2-amino-2-methylpropanol
- 2-diethylaminoethanol
- Hydrofluoric acid

5.1.4 Quality assurance

See Quality Assurance of the Instrument, p. 52.

5.2 Signal Outputs

Note: *The navigation in the menus 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:

- Conductivity
- Temperature
- Sample flow
- Conductivity uncompensated

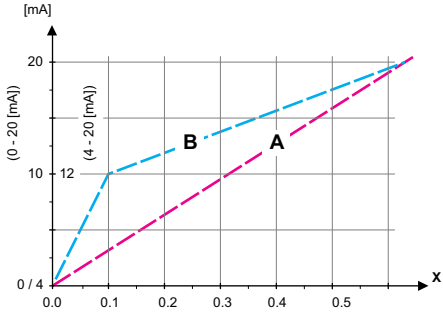
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range. Available ranges: 0–20 mA or 4–20 mA

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:

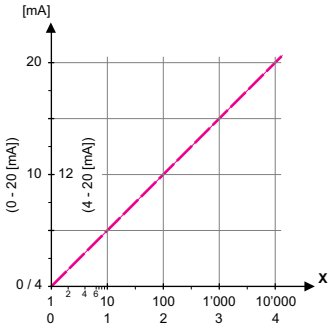
- Linear, bilinear, logarithmic or hyperbolic for process values.
- Control upwards or control downwards for controllers.

As process values

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



A *linear*
B *bilinear*
X *Measured value*



X *Measured value (logarithmic)*

* Hyperbolic scaling can be used as an alternative to logarithmic scaling in special cases. Contact Swan for details on this scaling method.

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

Parameters Conductivity:

5.2.1.40.10 Range low: 0.000 µS–300 mS

5.2.1.40.20 Range high: 0.000 µS–300 mS

Parameters Temperature:

5.2.1.40.11 Range low: -25 to +270 °C

5.2.1.40.21 Range high: -25 to +270 °C

Parameter Sample flow

5.2.1.40.12 Range low: 0–50 l/h

5.2.1.40.22 Range high: 0–50 l/h

Parameters Cond. uc:

5.2.1.40.13 Range low: 0.000 µS–300 mS

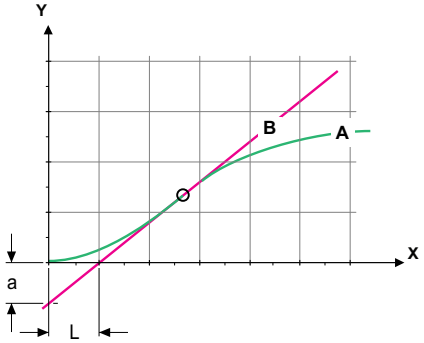
5.2.1.40.23 Range high: 0.000 µS–300 mS

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 setpoint, within the dosing intensity is reduced from 100% to 0% to reach the setpoint without overshooting.

5.2.1.40 **Control Parameters:** if Parameters = Conductivity

5.2.1.40.10 Setpoint
Range: 0.000 µS–300 mS

5.2.1.40.20 P-Band:
Range: 0.000 µS–300 mS

5.2.1.40 **Control Parameters:** if Parameters = Temperature

5.2.1.40.11 Setpoint
Range: -25 to +270 °C

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

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

5.2.1.40.12 Setpoint
Range: 0–50 l/h

5.2.1.40.22 P-Band:
Range: 0–50 l/h

5.2.1.40 **Control Parameters:** if Parameters = Cond. uc

5.2.1.40.13 Setpoint
Range: 0.000 µS–300 mS

5.2.1.40.23 P-Band:
Range: 0.000 µS–300 mS

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:

- Conductivity
- Sample Flow
- Sample Temp.
- Case Temp. high
- Case Temp. low

5.3.1.1 **Alarm Conductivity**

5.3.1.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay switches and E001 is displayed in the message list.
Range: 0.000 µS–300 mS

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay switches and E002 is displayed in the message list.
Range: 0.000 µS–300 mS

5.3.1.1.35 *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: 0.000 µS–300 mS

5.3.1.1.45 *Delay:* Waiting time before the alarm relay becomes inactive after the measured value has risen above or fallen below the programmed alarm value.
Range: 0–28‘800 s

5.3.1.2 **Sample Flow:** Define at which sample flow a flow alarm should be issued.

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

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

5.3.1.2.x *Alarm High:* If the measured value rises above the programmed value E009 will be issued.
Range: 10.0–50.0 l/h

5.3.1.2.x *Alarm Low:* If the measured value falls below the programmed value E010 will be issued.
Range: 0.0–9.0 l/h

5.3.1.3 Sample temperature

5.3.1.3.1 *Alarm High:* If the sample temperature rises above the programmed value E007 is issued.
Range: 30–200 °C

5.3.1.3.x *Alarm Low:* If the sample temperature falls below the programmed value E008 is issued.
Range: -10 to +20 °C

5.3.1.4 *Case Temp. 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

5.3.1.5 *Case Temp. 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.x Relay 1 and 2: The function of relay contacts 1 or 2 is defined by the user.

Note: *The navigation in the menus 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 can also be entered in menu 4.2.

5.3.2.1 Function = Limit upper/lower

If 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 switches.

Parameter	Range
Conductivity	0 µS–300 mS

Temperature	-25 to 270 °C
Sample flow	0–50 l/h
Cond. uc	0 µS–300 mS

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
Conductivity	0 µS–300 mS
Temperature	-25 to 270 °C
Sample flow	0–50 l/h
Cond. uc	0 µS–300 mS

5.3.2.50 *Delay:* Waiting time before the relay becomes active after the measured value has risen above or fallen below the programmed value. Range. 0–600 s

5.3.2.1 Function = Control upwards/downwards

If the relays are used to control dosing units, program the following.

5.3.2.22 *Parameter:* Choose one of the following process values.
- Conductivity
- Temperature
- Sample Flow
- Conductivity uncompensated

5.3.2.32 **Settings:** Choose the respective actuator:
- Time proportional
- Frequency

5.3.2.32.1 Actuator = Time proportional

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 s.

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

5.3.2.32.4 **Control Parameters**
Range for each parameter same as 5.2.1.43.

5.3.2.32.1 Actuator = Frequency

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.

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 1–1440 min.

5.3.2.44 *Run Time:* Enter the time the relay stays active.
Range: 5–32400 s.

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: 0–6000 s.

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. 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:* Time of day at which the relay is activated.
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 on one or several days of a week.

5.3.2.342 **Calendar**

5.3.2.342.1 *Start time:* The programmed start time is valid for each of the programmed days.
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 is switched via Profibus or Modbus.

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 when the input relay is closed.
When open:	Input is active when the input relay is open.

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

Continuous:	Signal outputs continue to issue the measured value.
Hold:	Signal outputs hold the last valid measured value. 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 switch 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 switches when input is active.

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

5.4 Miscellaneous

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

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 can 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 meaningful text, such as KKS number.

5.5 Interface

Select one of the following communication protocols.

5.5.1 *Protocol:* **Profibus**

5.5.20	Device address:	Range: 0–126
5.5.30	ID no.:	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:* **HART**

	Device address:	Range: 0–63

10. Material Safety Data sheets

10.1. Swan Cation Exchange Resin

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

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.:	10 s
	Hold after Cal.:	300 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

Installation:

Sensors	Flow:	None
	Sensor Parameters; Cell Constant	0.0415 cm^{-1}
	Sensor Parameters; Temp. corr.	0.00 °C
	Sensor Parameters; Cable length	0.0 m
	Sensor Parameters; Meas. unit	µS/cm
	Temp. Compensation; Comp.	none
	Quality Assurance; Level	0: Off
Signal Output 1	Parameter:	Conductivity
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0.000 µS
	Scaling: Range high:	1 mS
Signal Output 2	Parameter:	Temperature
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0 °C
	Scaling: Range high:	50 °C
Alarm Relay:	Alarm Conductivity:	
	Alarm high:	300 mS
	Alarm low:	0.000 µS
	Hysteresis:	1.00 µS
	Delay:	5 s
	Sample Flow:	
	Flow Alarm	yes
	Alarm high:	20 l/h
	Alarm low:	5 l/h
	Sample Temp:	
	Alarm High:	160 °C
	Alarm Low:	0 °C

Case Temp. high: ..... 65 °C
Case Temp. low: ..... 0 °C

Relay 1/2
Function: ..... limit upper
Parameter: ..... Conductivity
Setpoint: ..... 30 mS
Hysteresis: ..... 10 µS
Delay: ..... 30 s

If Function = Control upw. or dnw:

Parameter: ..... Conductivty
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: ..... 120/min.
Settings: Control Parameters: Setpoint: ..... 30 mS
Settings: Control Parameters: P-band: ..... 1 mS
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

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:	- - - - - - - -

ANALYTICAL INSTRUMENTS

A-96.210.341 / 2026-06-02

Swan Products - Analytical Instruments for:

Swan is represented worldwide by subsidiary companies and distributors and cooperates with independent representatives all over the world. For contact information, please scan the QR code.

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