ANALYTICAL INSTRUMENTS

A-96.250.321 / 270121

Operator's Manual

Firmware V6.20 and higher

SWISS MADE

AMI Solicon4

Customer Support
Swan and its representatives maintain a fully trained staff of technical specialists around the world. For any technical question, contact your nearest Swan representative, or the manufacturer:

Swan Analytische Instrumente AG
Studbachstrasse 13
8340 Hinwil
Switzerland

Internet: www.swan.ch
E-mail: support@swan.ch

Document status

Title:	AMI Solicon4 Operator's Manual	
ID:	A-96.250.321	
Revision	**Issue**	
00	April 2005	First Edition
01	April 2013	Update to FW-Release 5.30
02	October 2015	Update to FW-Release 6.00
03	February 2016	Mainboard V2.5
04	July 2020	Mainboard V2.6

Table of Contents

AMI Solicon4–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 AMI 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


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.

2. Product Description

2.1. Description of the System

This instrument is applicable for the measurement of the specific conductivity in surface water, potable water and cooling water. The complete system consists of the transmitter AMI Solicon4, the conductivity sensor Swansensor Shurecon P and the flow cell M-Flow PG.

Transmitter, flow cell and sensors are also available as single components.

Application Range

Conductivity is a parameter for the total quantity of ions present in the solution. It can be used for the monitoring of:

- the condition of waters
- water purification
- water hardness
- completeness of ion analysis

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 Ohm

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 used as normally open or normally closed.
Maximum load: 1 A/250 VAC

Alarm Relay

One potential free contact.

Alternatively:

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

Summary alarm indication for programmable alarm values and instrument faults.

Input

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

Communication interface (optional)

- USB interface to store logger data.
- 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 needs to be done, the sensor is factory-calibrated.

Temperature compensation

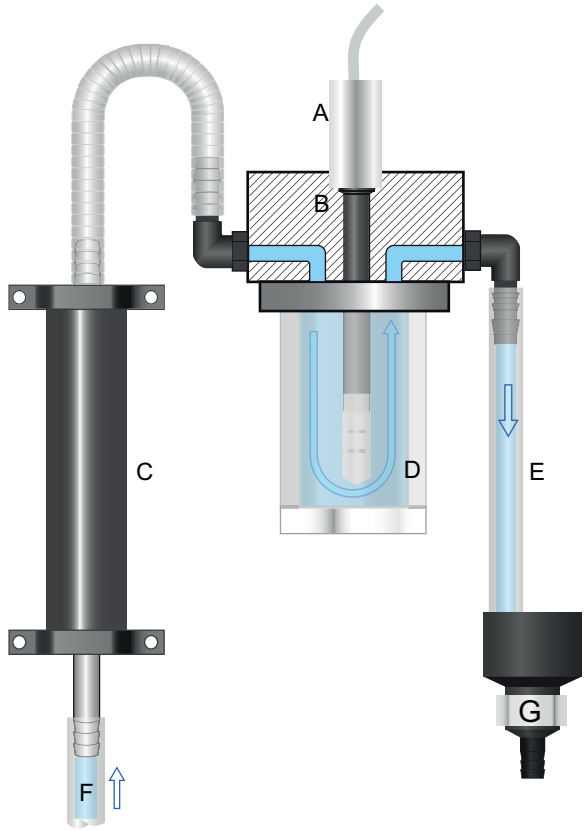
The mobility of ions in water increases with higher temperature, which enlarges the conductivity. Therefore, the temperature is measured simultaneously by an integrated Pt1000 temperature sensor and the conductivity is compensated to 25 °C.

Fluidics

The flow cell M-Flow PG consists of the flow cell block [B] and the calibration vessel [D]. The conductivity sensor [A] is fixed with a threaded sleeve.

The sample enters at the sample inlet [F], flows through the deltaT flow sensor [C] (if installed) and then through the flow cell block into the calibration vessel [D], were the conductivity is measured.

The sample leaves the calibration vessel via the flow cell block through sample outlet [E] and flows into the drain [G].



A *Conductivity sensor*
B *Flow cell block*
C *deltaT flow sensor (option)*
D *Calibration vessel*
E *Sample outlet*
F *Sample inlet*
G *Drain*

2.2. Instrument Specification

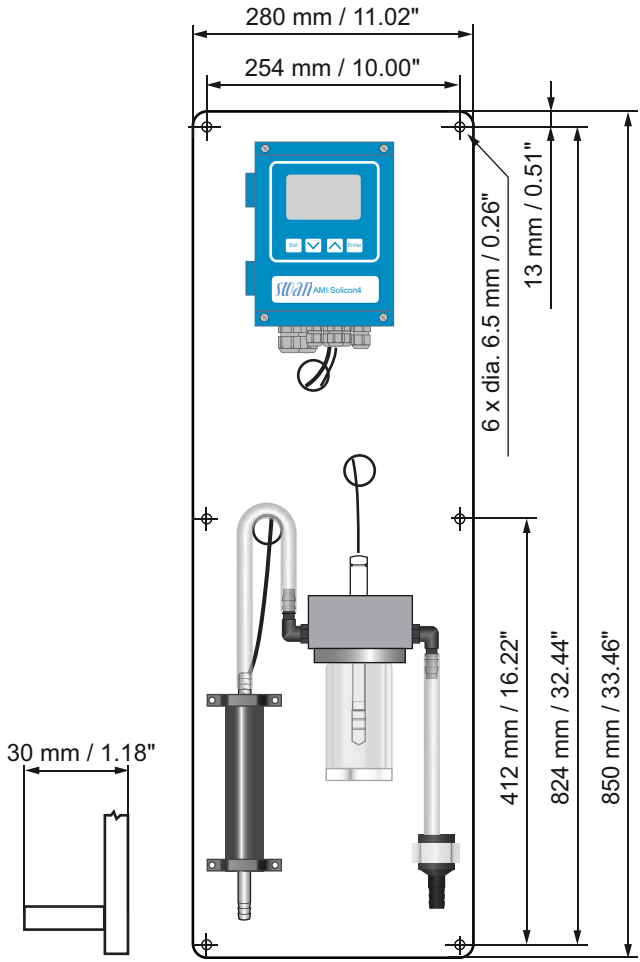
Power Supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90 % rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Sample requirements	Flow rate:	4 to 15 l/h
	Temperature:	up to 50 °C
	Inlet pressure:	up to 1 bar
	Outlet pressure:	pressure free
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Flow cell with elbow hose nozzle 1/4” diam.10 mm or deltaT sensor with hose nozzle diam. 10 mm
	Sample outlet:	1/2” hose nozzle for flexible tube diam. 20 x 15 mm

Measuring Range	Range	Resolution
	0.10 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 9.99 mS/cm	0.01 mS/cm
	10.0 to 29.9 mS/cm	0.1 mS/cm
	30 to 100 mS/cm	1 mS/cm

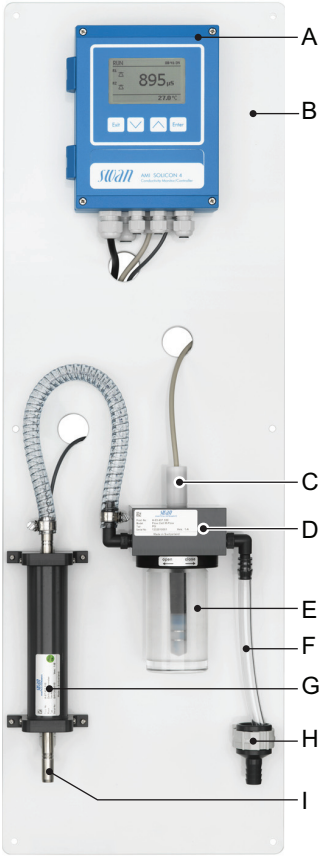
Accuracy	± 0.5% of measured value

Dimensions

Panel:	PVC
Dimensions:	280x850x150 mm
Screws:	5 mm or 6 mm diameter
Weight:	6.0 kg



2.3. Instrument Overview

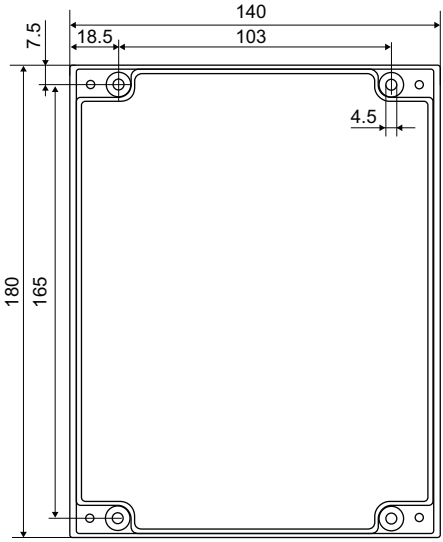


A *Transmitter*
B *Panel*
C *Conductivity sensor*
D *Flow cell block*
E *Calibration vessel*
F *Sample outlet*
G *DeltaT flow sensor (option)*
H *Drain*
I *Sample inlet*

2.4. Single Components

2.4.1 AMI Solicon4 Transmitter

Electronic transmitter and controller for conductivity measurement.



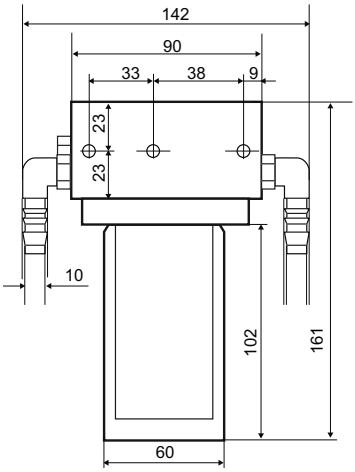
Dimensions	Width:	140 mm
	Height:	180 mm
	Depth:	70 mm
	Weight:	1.5 kg
Specifications	Electronics case:	Cast aluminum
	Protection degree:	IP 66 / NEMA 4X
	Display:	backlit LCD, 75 x 45 mm
	Electrical connectors:	screw clamps

2.4.2 Flow Cell M-Flow PG and M-Flow G1

- Flow cell M-Flow PG, made of PVC and acrylic glass with one 13.5 mm sensor opening for Swansensor Shurecon P.

or

- Flow cell M-Flow G1, made of PVC and acrylic glass with one G 1” sensor opening for Swansensor Shurecon S.



Sample connections

Inlet:	G 1/4” thread
Outlet:	G 1/4” thread

Each equipped with an elbow hose nozzle for 10 mm tube

Sample conditions

Only valid for the flow cell without sensor.

Flow rate:	4 to 15 l/h
Temperature:	up to 50 °C
Inlet pressure:	up to 1 bar @ 25 °C
Sample outlet:	Pressure-free outlet
Particle size:	below 0.5 mm

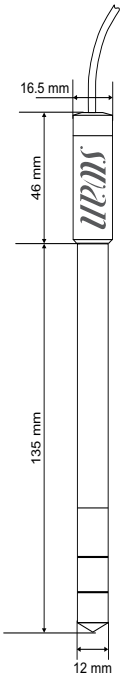
No strong acids and bases.
No organic solvents.

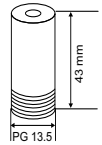
Dimensions

Width:	90 to 142 mm
Front-to-back:	105 mm
Height:	161 mm
Panel mounting:	3 screws M5

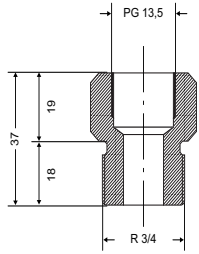
2.4.3 Swansensor Shurecon P

Sensor with integrated cable for the measurement of the specific conductivity. Four electrode design with platinum electrodes and built-in Pt1000 temperature sensor.





Sensor adapter
16 mm / PG 13.5



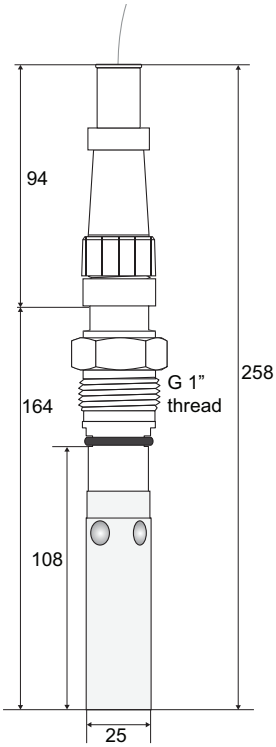
T-Fit adapter
PG 13.5 / R ¾"

Specifications

Measuring range	0.1 µS/cm to 100 mS/cm
Accuracy:	±1.5% or ± 0.2 µS/cm, whichever is greater
Temperature sensor:	Pt1000
Operating conditions:	> 50 °C Max. temperature short-time 90 °C Max.pressure 10 bar at 25 °C.
Electrical connection:	Sensor with integrated cable
Process connection:	PG 13.5 mm

2.4.4 Swansensor Shurecon S

Sensor for the measurement of the specific conductivity. Four-electrode design with integrated Pt1000 temperature sensor. Screw connector with cable must be ordered separately.

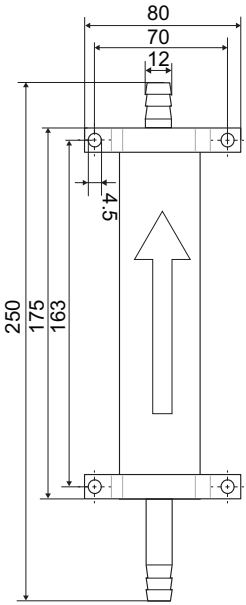


Specifications

Measuring range	0.1 µS/cm to 100 mS/cm
Accuracy:	± 1 % or ± 0.2 µS/cm whichever is greater
Temperature sensor:	Pt1000
Operating conditions:	Max. temperature: 120 °C at 6.5 bar
	Max. pressure: 12 bar at 20 °C
	Sterilizable at: 120 °C / 5 bar / 30 min
Electrical connection:	Plug M16 male (IP 67)
Process connection:	G 1" thread
Space around sensor tip:	20 mm

2.4.5 Swansensor DeltaT

Calorimetric flow meter based on heat dissipation. For applications in potable water, surface water treatment and effluent.



Specifications

Measuring range/Flow rate	0–40 l/h
Accuracy:	± 20 %
Response time t_{90}:	ca. 1 min
Sample temperature:	5–35 °C
Sample inlet and outlet:	for tubing diam. 10–11 mm
Max. cable length:	1 m

3. Installation

3.1. Installation Checklist Monitors

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 Instrument Specification, p. 12.
Installation	Mount the instrument in vertical position. Display should be at eye level. Connect sample and waste.
Electrical Wiring	Connect all external devices like limit switches, current loops and pumps. Connect power cord; do not switch on power yet!
Power-up	Turn on the sample flow and wait until the flow cell is completely filled. Switch on power.
Instrument set-up	Adjust sample flow. Program all parameters for sensor and external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms).
Run-in period	Let the instrument run continuously for 1 h.
Calibration	Perform a calibration if necessary, see Calibration, p. 44.

3.2. Mounting of Instrument Panel

To mount the instrument panel proceed according the following list:

- 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 6x60 mm
  - 6 Dowels
  - 6 Washers 6.4/12 mm

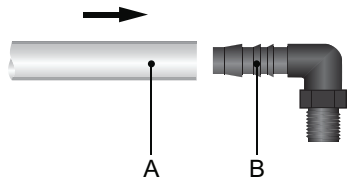
Mounting requirements

The instrument is only intended for indoor installation, dimensions see Dimensions, p. 13.

3.3. Connecting Sample Inlet and Outlet

Sample inlet

Use a plastic tube (FEP, PA, or PE 10x12 mm) to connect the sample inlet at the flow cell.

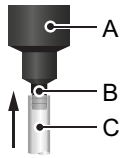


A *Plastic tube 10x12*
B *Elbow hose nozzle*

If a deltaT senor is installed, push the plastic tube over the hose nozzle of the deltaT sensor.

Sample outlet

Connect the flexible tube 20x15 mm [C] to the 1/2” hose nozzle [B] and place it into a drain with atmospheric pressure.

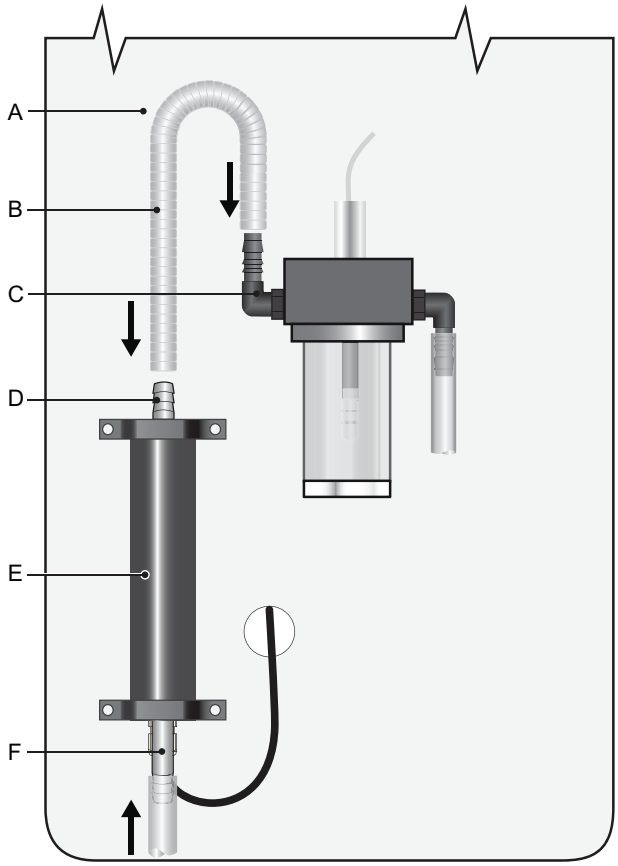


A *Waste funnel*
B *1/2” Hose nozzle*
C *Flexible tube 20x15 mm*

3.4. Install Swansensor deltaT (Option)

The following description assumes that the installation of the deltaT sensor takes place after commissioning of the monitor.

Install the deltaT sensor in vertical position with the sample inlet [F] and cable gland facing downwards. To ensure laminar flow, the sample inlet must not be restricted; e.g. by a fitting that creates turbulences.



A *Panel*
B *Tube connection*
C *Elbow hose nozzle*
D *Hose nozzle at deltaT sensor outlet*
E *deltaT sensor*
F *Hose nozzle at deltaT sensor inlet*

3.4.1 Mount the deltaT Sensor and Connect the Sample Inlet

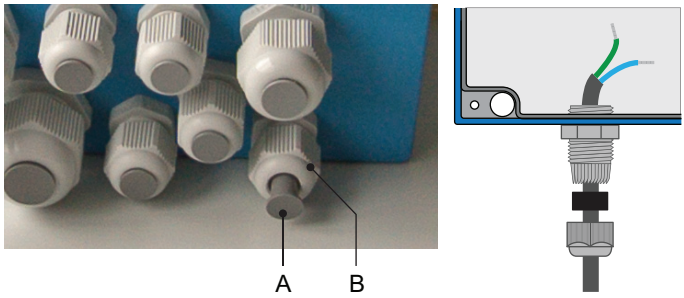
1. Stop operation according to chapter Stop of Operation for Maintenance, p. 42.
2. Mount the deltaT sensor [E] in vertical position to the panel [A].
3. Remove the plastic tube from the elbow hose nozzle at the flow cell.
4. Connect the plastic tube to the hose nozzle [F] of the deltaT sensor inlet.
5. Rotate the elbow hose nozzle of the flow cell by 180 degrees.
6. Install the hose connection [B] enclosed in the installation kit, from the hose nozzle [D] at the deltaT sensor outlet to the elbow hose nozzle [C].

3.4.2 Connect the Sensor Cable to the Transmitter

WARNING

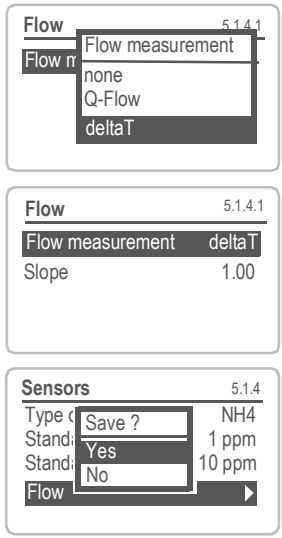
Risk of electrical shock.
Do not perform any work on electrical components if the transmitter is switched on. Failure to follow safety instructions can result in serious injury or death.

Make sure the power specification of the instrument corresponds to the power on site.



1. Remove the plug [A] from the cable gland [B]
2. Open the AMI transmitter housing.
3. Feed the sensor cable through the cable gland [B] into the transmitter housing.
4. Connect the cable to the terminals according to the connecting diagram see Connection Diagram, p. 29.
5. Close the AMI transmitter housing.
6. Switch on power.

3.4.3 Change Firmware Settings



1. Navigate to <Installation> <Sensors> <Flow> <Flow measurement>.
2. Press [Enter]
3. Select <deltaT>
4. Press [Enter]
5. Press 2 x [Exit]
6. Press [Enter] to confirm with Yes
7. Press [Exit] until the display shows the measuring values.

3.4.4 Adjust the deltaT sensor

The deltaT flow sensor is factory calibrated at 20 °C (± 20 % accuracy).
The accuracy of the flow measurement depends on the ambient temperature of the location where the deltaT sensor is installed. If the ambient temperature is higher or lower than 20 °C, the deltaT flow sensor can be adjusted. If an adjustment of the deltaT sensor is necessary proceed as follows:

Run in

After installation let the sensor run-in for at least 1h.

Determine the flow rate

1. Put the sample outlet of the instrument for 10 min. into a measuring cup with a sufficient volume.
2. To get the flow rate in l/h, multiply the amount of water contained in the measuring cup with factor 6.
   ⇒ *The flow rate in l/h results from the multiplication of the amount of water after 10 min by 6.*

Adjust slope

1. Navigate to <Installation/Sensors/Flow>, choose <Slope> and press [Enter].
2. If the calculated flow rate is higher than the displayed flow rate increase the Slope value.
3. If the calculated flow rate is lower than the displayed flow rate decrease the Slope value.
4. Press [Exit] and save with [Enter].
5. Compare the calculated flow rate with the displayed flow rate.
   ⇒ *If the flow rates are roughly equal, the adjustment is finished.*
   - Else repeat steps 1 to 5.

3.5. Electrical Connections

WARNING

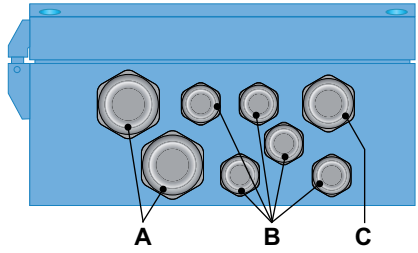
Risk of electrical shock.

Do not perform any work on electrical components if the transmitter is switched on. Failure to follow safety instructions can result in serious injury or death.

- Always turn off power before manipulating electric parts.
- Grounding requirements: Only operate the instrument from a 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*

Note: *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

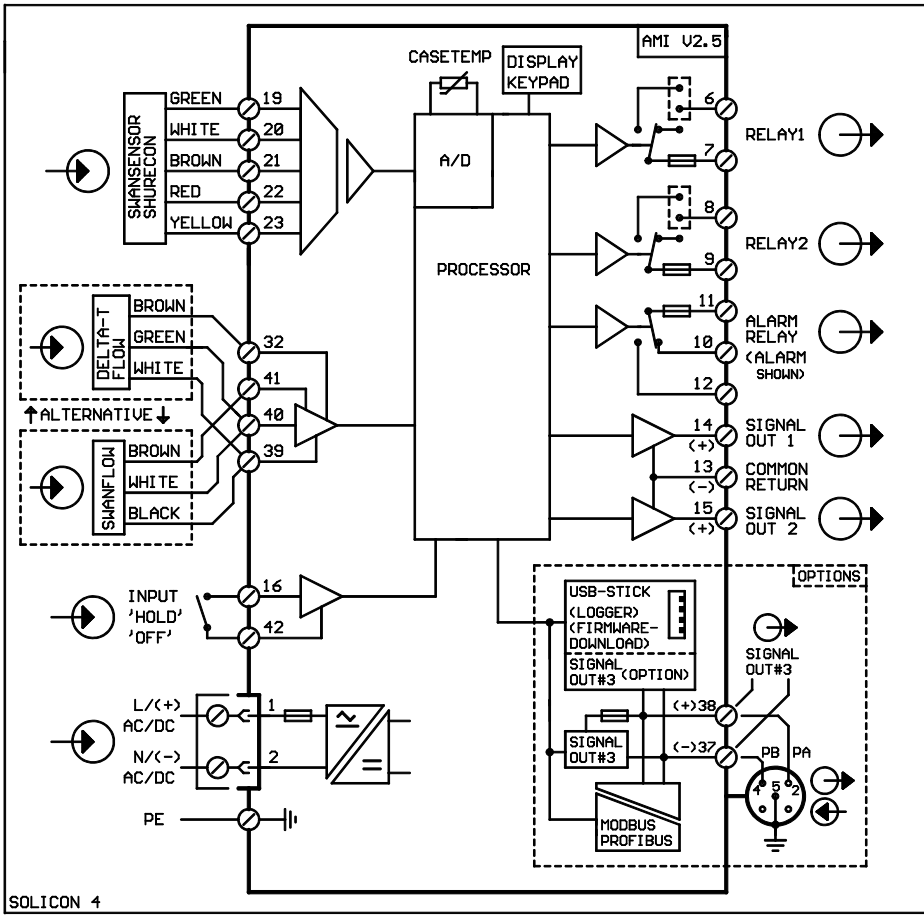
WARNING

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

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

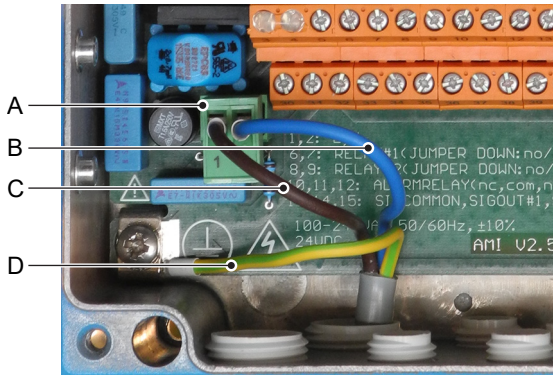
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.5.2 Power Supply

WARNING

Electrical shock hazard

Installation and maintenance of electrical parts must be performed by professionals. Always turn off power before manipulating electric parts.



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

Note: *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 Solicon4

3.6. Relay Contacts

3.6.1 Input

Note: *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. 55.

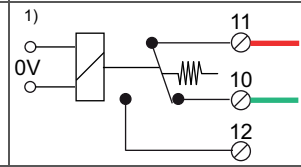
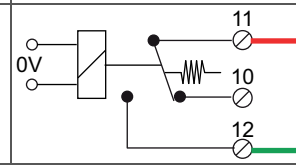
3.6.2 Alarm Relay

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

Alarm output for system errors.

Error codes see Troubleshooting, p. 46.

Note: *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.	

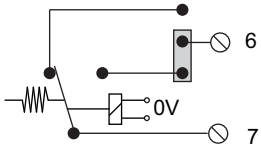
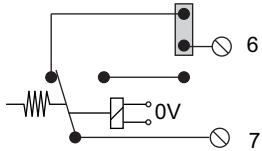
1) *usual use*

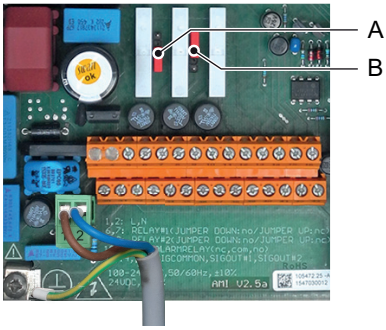
3.6.3 Relay Contacts 1 and 2

Note: *Rated load 1 AT / 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.

Note: *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 Program List and Explanations, p. 55.

CAUTION

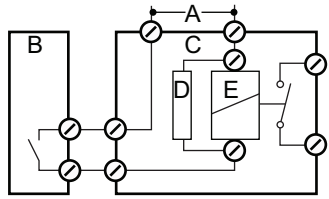
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

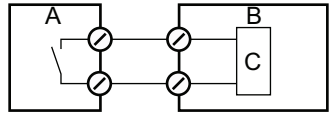
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load.



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

Resistive load

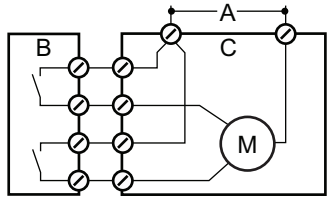
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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*

3.7. Signal Outputs

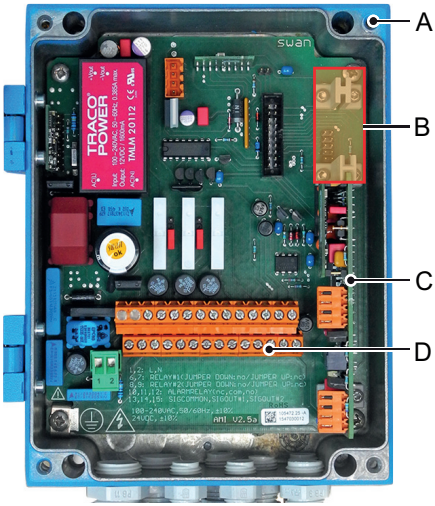
3.7.1 Signal Output 1 and 2 (current outputs)

Note: *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 List and Explanations, p. 55, Menu Installation

3.8. 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:

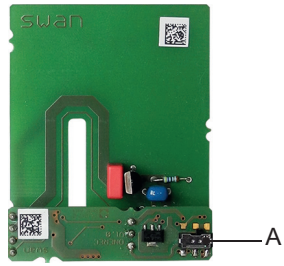
- a third signal output
- a Profibus or Modbus connection
- a HART connection
- a USB Interface

3.8.1 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.

Note: *Max. burden 510 Ω.*



Third signal output 0/4–20 mA PCB

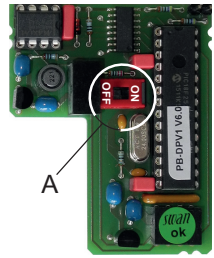
A Operating mode selector switch

3.8.2 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.

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



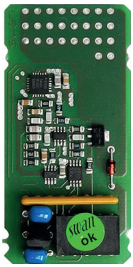
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.8.3 HART Interface

Terminals 38 (+) and 37 (-).

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

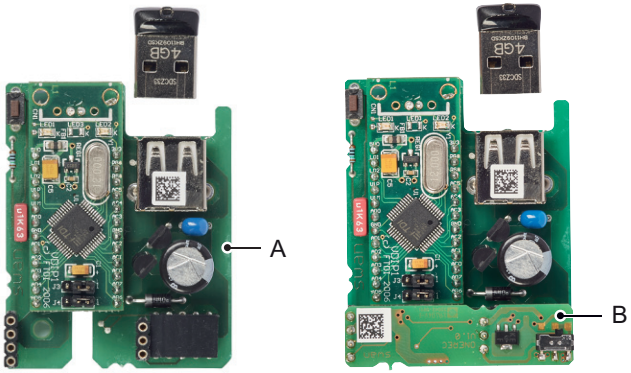


HART Interface PCB

3.8.4 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

4.1. Establish Sample Flow

1 Open sample flow tap.
2 Wait until the flow cell is completely filled.
3 Switch on power.

4.2. Programming

Programming

The sensor characteristics are printed on the label of the sensor.
Program all sensor parameters in Menu 5.1.1.1,
<Installation> <Sensors> <Sensor parameters>:

SW-xx-xx-xx	ZK = 0.0417	Cell constant
SWAN AG		Temperature correction

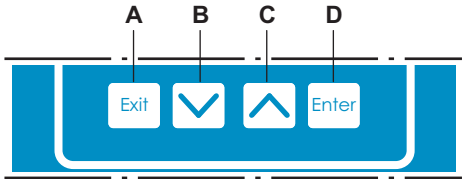
Enter the:
- Cell constant [cm^{-1}]
- Temperature correction [°C]
- Cable length

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

Program all parameters for external devices (interface, recorders, etc.) and for instrument operation (limits, alarms). See Program List and Explanations, S. 55.

5. Operation

5.1. Keys



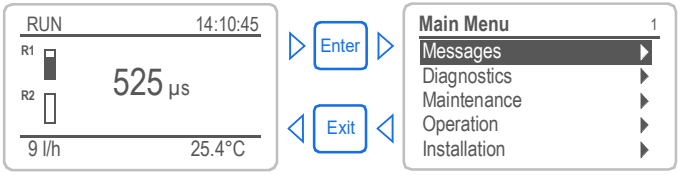
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

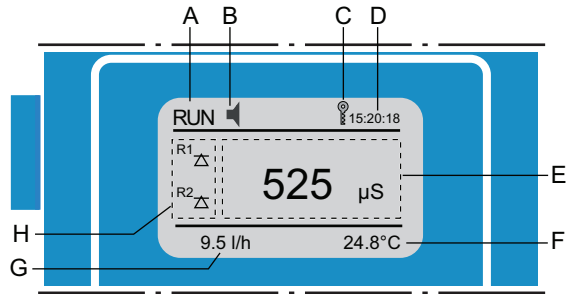
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Display



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 Keys locked, transmitter control via Profibus

D Time

E Process values

F Sample temperature

G Sample flow

H 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

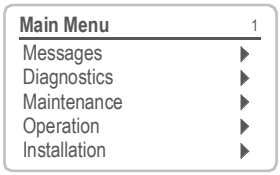
motor valve closed

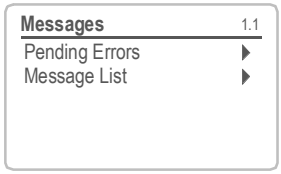
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

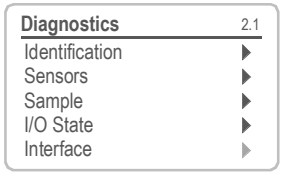
5.3. Software Structure





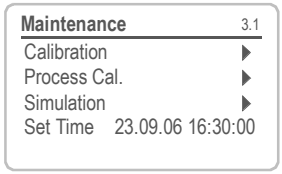
Menu **Messages 1**

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.



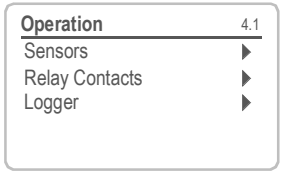
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



Menu **Maintenance 3**

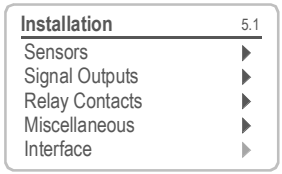
For instrument calibration, relay and signal output simulation, and to set the instrument time.
It is used by the service personnel.



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.



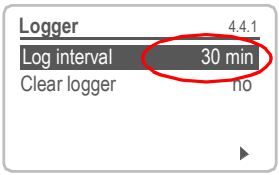
Menu **Installation 5**

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

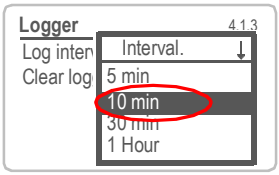
Changing parameters

The following example shows how to change the logger interval:



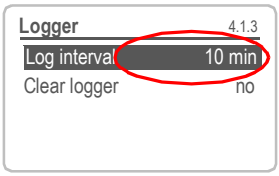
1 Select the parameter you want to change.

2 Press [Enter]



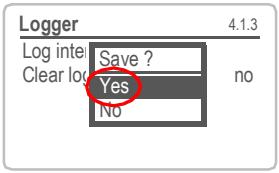
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

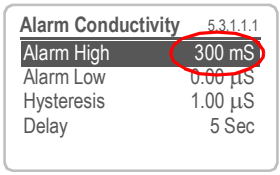
5 Press [Exit].



⇒ *Yes is highlighted.*

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

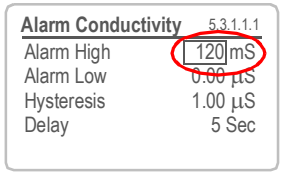
Changing values



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

6.1. Maintenance Schedule

Preventive maintenance frequency depends on water quality, on the application, and on national regulations.

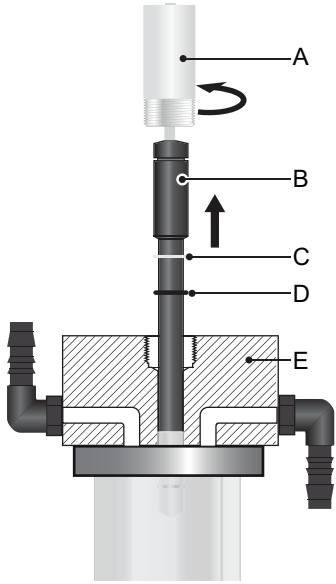
Monthly	◆ Check sample flow.
If required	◆ Clean conductivity sensor ◆ Perform a calibration

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 *Fixing sleeve*
B *Conductivity sensor*
C *Teflon washer*
D *O-Ring*
E *Flow cell block*

6.3.1 Remove the Sensor from the Flow Cell

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

1 Unscrew and remove the fixing sleeve [A].

2 Pull the conductivity sensor [B] out of the flow cell block [B].

Cleaning If the sensor is contaminated, take a small brush and clean it with water and detergents.

In case of heavy contamination with oil or grease, use ethanol to clean it. Take a soft tissue and clean the tip of the sensor cautiously.

After each cleaning, the sensor must be rinsed with clean water.

6.3.2 Install the Sensor into the Flow Cell

1 Make sure that the washer [C] and the O-ring [D] are in correct position.

2 Push the sensor through the flow cell bock [E] into the flow cell.

3 Tighten the fixing sleeve [A] to fix the sensor.

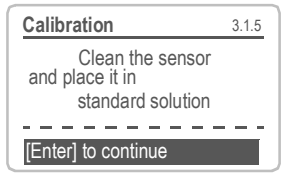
6.4. Calibration

Since the sensor is very reliable a calibration is usually not necessary. A calibration is recommended if:

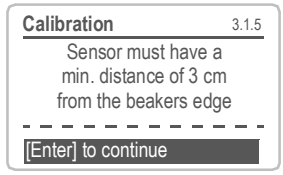
- the cell constant is not known
- the sensor is contaminated
- the maintenance measurement shows a discrepancy.

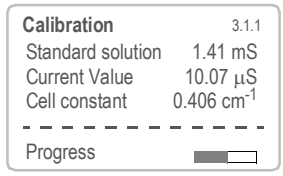
Reagent for the Calibration: Calibration solution 1.413 mS/cm (25 °C) 1000 ml. Prepare according to DIN 38404 / ISO 7888: 1985 / EN 27888.

1. Stop the 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, see Maintenance of the Sensor, p. 43.
6. Use a beaker and fill it with one liter calibration solution.
   ⇒ *The beaker's diameter must be large enough to allow a distance of at least 3 cm between the sensor and the edge of the beaker.*
7. Put the sensor into the beaker filled with calibration solution.



8. Wait at least 5 minutes to permit temperature equilibration between sensor and 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.

6.5. Longer Stop of Operation

1. Stop sample flow.
2. Shut off power of the instrument.
3. Remove the sensor from the flow cell and dry it with a soft tissue.
4. Empty and dry the flow cell.

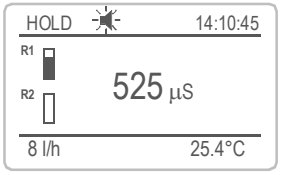
7. Troubleshooting

7.1. Error List

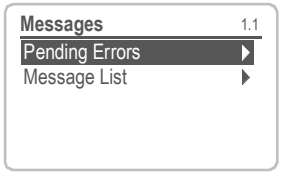
Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded.
Such Errors are marked **E0xx**.

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:

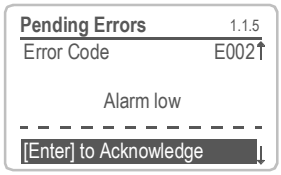
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx**
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx**



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



Navigate to menu <Messages>/ <Pending Errors>.



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

Error	Description	Corrective action
E001	Cond. Alarm high	– check process – check programmed value, see 5.3.1.1, p. 64
E002	Cond. Alarm low	– check process – check programmed value, see 5.3.1.1, p. 64
E003	Conc. Alarm high	– check process – check programmed value, see 5.3.1.5, p. 66
E004	Conc. Alarm low	– check process – check programmed value, see 5.3.1.5, p. 66
E007	Sample Temp. high	– check process – check programmed value, see 5.3.1.3, p. 65
E008	Sample Temp. low	– check process – check programmed value, see 5.3.1.3, p. 65
E009	Sample Flow high	– check sample inlet pressure – check programmed value, see 5.3.1.2.2, p. 65
E010	Sample Flow low	– check sample inlet pressure – Check flow regulating valve – check programmed value, see 5.3.1.2.35, p. 65
E011	Temp. shorted	– Check wiring of sensor
E012	Temp. disconnected	– Check wiring of sensor
E013	Case Temp. high	– check case/environment temperature – check programmed value, see 5.3.1.4.1, p. 65
E014	Case Temp. low	– check case/environment temperature – check programmed value, see 5.3.1.4.2, p. 65

Error	Description	Corrective action
E017	Control time-out	– Check control device or programming in Installation, Relay contact, Relay 1/2 5.3.2 and 5.3.3, p. 66
E018	Temp. out of Table	– Check sample temperature
E019	Conc. out of Table	–
E024	Input active	– See If Fault Yes is programmed in Menu see 5.3.4, p. 70
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	Power-on	– none, normal status
E034	Power-down	– none, normal status

7.2. Replacing Fuses

WARNING

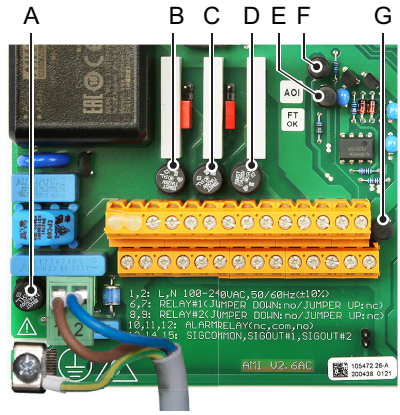
External Voltage.

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 replacing it with a new one.

Use tweezers or needle-nosed pliers to remove the defective fuse. Use original fuses provided by SWAN only.



A *AC variant: 1.6 AT/250 V Instrument power supply*
DC variant: 3.15 AT/250 V 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*

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, p. 55.

- 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
Message List 1.2*	*Number*	1.2.1*	
	Date, Time		

8.2. Diagnostics (Main Menu 2)

Identification	Designation	AMI Solicon4		* Menu numbers
2.1*	Version	V6.20-09/16		
	Factory Test	*Instrument*	2.1.3.1*	
	2.1.3*	*Motherboard*		
		Front End		
	Operating Time	*Years / Days / Hours / Minutes / Seconds*		2.1.4.1*
	2.1.4*			
Sensors	**Cond. Sensor**	*Current value*		
2.2*	2.2.1*	*Raw value*		
		Cell constant		
		Contamination		
		Cal. History	*Number,*	2.2.1.5.1*
		2.2.1.5*	*Date, Time*	
			Cell Constant	
	Miscellaneous	Case Temp.	*2.2.2.1**	
	2.2.2*			
Sample	*Sample ID*	2.3.1*		
2.3*	*Temperature*	°C		
	(Pt1000)	Ohm		
	Sample Flow	l/h		
	Raw value	Hz	*if Q-Flow*	
	DeltaT 1	°C	*It deltaT sensor*	
	DeltaT2	°C	*It deltaT sensor*	
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1 and 2*	2.4.2*		
	Input			
	Signal Output 1 and 2			
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			Interface)

8.3. Maintenance (Main Menu 3)

Calibration	*Follow instructions*	3.1.5*
3.1*		
Simulation	*Alarm Relay*	3.3.1*
3.2*	*Relay 1*	3.3.2*
	Relay 2	3.3.3*
	Signal Output 1	3.3.4*
	Signal Output 2	3.3.5*
Set Time	*(Date), (Time)*	
3.3*		

*Menu numbers

8.4. Operation (Main Menu 4)

Sensors	*Filter Time Const.*	4.1.1*		
4.1*	*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*
	If concentration	**Alarm Concentration**	*Alarm High*	4.2.1.2.1*
	is chosen	4.2.1.2*	*Alarm Low*	4.2.1.2.25*
			Hysteresis	4.2.1.2.35*
			Delay	4.2.1.2.45*
	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*		

8.5. Installation (Main Menu 5)

Sensors	**Sensor parameters**	*Cell Constant*	5.1.1.1*	*Menu numbers
5.1*	5.1.1*	*Temp. Corr.*	5.1.1.2*	
		Cable length	5.1.1.3*	
	Temp.Compensation	Comp.	*none*	
	5.1.2*	5.1.2.1*	*Coefficient*	
			non-linear DIN	
	Flow	Flow measurement	*none*	
	5.1.3*	5.1.3.1*	*Q-Flow*	
			deltaT	
	Conc.	*none*		
	5.1.4*	*nitric acid*		
		hydrochloric acid		
		sodium chloride		
		caustic soda		
		sulfuric acid		
		salinity		
		TDS as NaCl		
		TDS		
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	Case Temp. high	5.3.1.4.1*
		5.3.1.4*	Case Temp. low	5.3.1.4.2*

		Alarm Concentration	*Alarm High*	5.3.1.1.5.1*
		5.3.1.5*	*Alarm Low*	5.3.1.1.5.25*
			Hysteresis *	5.3.1.1.5.35
			Delay	5.3.1.1.5.45*
	Relay 1/2	*Function*	5.3.2.1/*	
	5.3.2/5.3.3*	*Parameter*	5.3.2.20*	
		Setpoint	5.3.2.300 *	
		Hysteresis	5.3.2.400*	
		Delay	5.3.2.50*	
	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 Message List

1.2.1 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

Designation: Designation of the instrument.

Version: Firmware of instrument (e.g. V6.20-09/16)

2.1.3 Factory Test: Test date of the Instrument, Motherboard and Frontend

2.1.4 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
- Contamination

2.2.1.5
- *Cal. History*: In this menu the calibration values of the last calibrations are saved.
- Number: Numbers the calibrations in descending order.
- Date, Time: Date and time of each calibration.
- Cell constant: Shows the cell constant of the sensor in use.

Max. 64 data records are memorized. One process calibration corresponds to one data record.

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 identification assigned to a sample. This identification is defined by the user to identify the location of the sample.

Temperature: Shows the current sample temperature in °C.

(Pt 1000): Shows the current sample temperature in Ohm.

Sample Flow: If Q-Flow is chosen

Shows the current sample flow in l/h

Raw Value: shows the sample flow in Hz.

Sample Flow: If deltaT is chosen

Shows the current sample flow in l/h

deltaT 1: Temperature measured at sample inlet of the deltaT sensor

deltaT 2: Temperature measured at sample outlet of the deltaT sensor

2.4 I/O State

Shows current status of all in- and outputs.

2.4.1/2.4.2

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

2.5 Interface

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

3 Maintenance

3.1 Calibration

Follow the commands on the screen. Save the value with the [Enter] key.

3.2 Simulation

To simulate a value or a relay state, select the

- alarm relay,
- relay 1or 2
- signal output 1or 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 and 2:	Active or inactive
Signal Output 1 and 2:	Actual current in mA
Signal Output 3 (option):	Actual current in mA

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.

3.3 Set Time

Adjust date and 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: 5–6‘000 Sec

4.2 Relay Contacts

See Relay Contacts, p. 31

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. Records consist of: Date, time, alarms, measured value, measured value uncompensated, temperature, flow.
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 If option USB interface is installed.
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.

5 Installation

5.1 Sensors

5.1.1 Sensor parameters

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

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

5.1.1.3 *Cable length*: Enter the cable length. Set the cable length to 0.0 m if the sensor is installed in the flow cell on the AMI monitor.

5.1.2 Temp. Compensation

5.1.2.1 *Comp.*: Available compensation models are:

- none
- Coefficient
- non-linear DIN

5.1.3 Flow

5.1.3.1 *Flow measurement*: Select the type of flow sensor if a flow sensor is installed.

Possible flow sensors: None; Q-Flow; deltaT.

5.1.3.2 *Slope*: If flow measurement is set to deltaT.

The slope value is used to adjust the flow measurement of the deltaT sensor if the ambient temperature is higher or lower than 20 °C.

5.1.4 Conc.

The menu <Concentration> (Conc.) allows the additional measurement of a known substance in the sample. The concentration of the substance is calculated based on the conductivity of any of the following substances. The calculated value is displayed in %. As an exception, TDS is displayed in mg/l.

- none
- nitric acid
- hydrochloric acid
- sodium chloride
- caustic soda
- sulfuric acid
- salinity
- TDS as NaCl
- TDS

5.2 Signal Outputs

5.2.1 and 5.2.2 **Signal Output 1 and 2:** Assign process value, the current loop range and a function to each signal output.

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

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

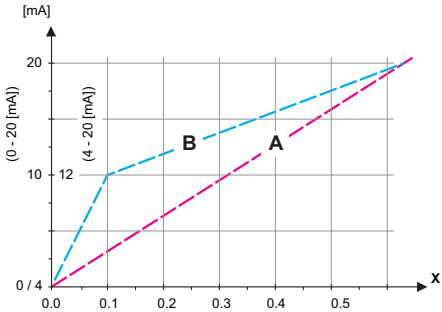
- Conductivity
- Temperature
- Sample flow
- Cond. uc (uncompensated)
- Concentration

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

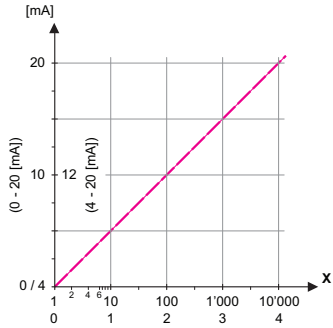
5.2.1.3 *Function:* Define if the signal output is used to transmit a process value or to drive a control unit. Available functions are:

- 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 Conductivity:

5.2.1.40.10 *Range low*: 0 µS–300 mS

5.2.1.40.20 *Range high*: 0 µS–300 mS

Parameter 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

Parameter Cond. uc:

5.2.1.40.13 *Range low*: 0 µS–300 mS

5.2.1.40.23 *Range high*: 0 µS–300 mS

Parameter Concentration

5.2.1.40.14 *Range low:* 0–100% or 0.0 mg/l–20.00 g/l

5.2.1.40.24 *Range high:* 0–100% or 0.0 mg/l–20.00 g/l

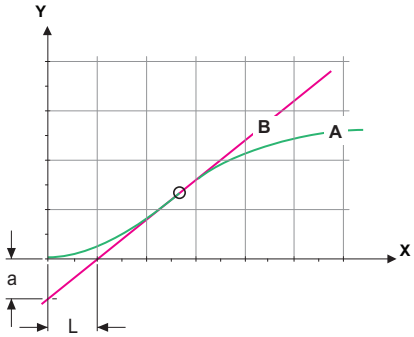
As control output

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 = Conductivity

5.2.1.43.10 Setpoint
Range: 0 µS–300 mS

5.2.1.43.20 P-Band:
Range: 0 µS–300 mS

5.2.1.43 **Control Parameters:** if Parameters = Temperature

5.2.1.43.11 Setpoint
Range: -25 to +270 °C

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

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

5.2.1.43.12 Setpoint
Range: 0 –50 l/h

5.2.1.43.22 P-Band:
Range: 0 –50 l/h

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

5.2.1.43.13 Setpoint
Range: 0 µS–300 mS

5.2.1.43.23 P-Band:
Range: 0 µS–300 mS

5.2.1.43 **Control Parameters:** if Parameters = Concentration

5.2.1.43.14 Setpoint
Range: 0–100 % or 0.0 mg/l–20.00 g/l

5.2.1.43.24 P-Band:
Range: 0–100 % or 0.0 mg/l–20.00 g/l

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:

- Alarm Conductivity
- Sample Flow
- Sample Temp.
- Case Temp.
- Alarm Concentration (visible if a Conc. parameter has been selected)

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 is activated and E001, is displayed in the message list.
Range: 0 µS–300 mS

5.3.1.1.25 *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 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 µS–300 mS

5.3.1.1.45 *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

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

5.3.1.2.1 *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

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

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

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

5.3.1.3 Sample Temp.

5.3.1.3.1 *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

5.3.1.3.25 *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

5.3.1.4 Case Temp.

5.3.1.4.1 *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

5.3.1.4.2 *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

5.3.1.5 **Alarm Concentration:** Visible if a Conc. parameter has been selected. TDS is displayed in mg/l, all other parameters are displayed in %.

5.3.1.5.1 *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: 0.00%–99.90%

5.3.1.5.25 *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: 0.00%–99.90%

5.3.1.5.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.
Range.0.00%–99.90%

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

5.3.2 and 5.3.3 **Relay 1 and 2:** The contacts can be set as normally open or normally closed with a jumper. See Relay Contacts 1 and 2, p. 32. The function of relay contacts 1 or 2 are defined by the user.

Note: *The navigation in the menu <Relay 1> and <Relay 2> is identical. 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.

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
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:* 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.

- Conductivity)
- Temperature
- Sample Flow
- Cond. uc

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. 69.
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:

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

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

Cont.:	Controller continues normally.
Hold:	Controller continues 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.

Language
German
English
French
Spanish

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

Set defaults
no
Calibration
In parts
Completely

- **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.

Load Firmware
no
yes

5.4.4 Password: Select a password different from 0000 to prevent unauthorized access to the following menus:

5.4.4.1 Messages

5.4.4.2 Maintenance

5.4.4.3 Operation

5.4.4.4 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:* Define if message E028 should be issued in case of a line break on signal output 1 or 2.

Choose between <Yes> or <No>.

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. 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	Sensor Parameters; Cell Constant	0.4000 cm^{-1}
	Sensor Parameters; Temp. corr.	0.00 °C
	Sensor Parameters; Cable length	0.0 m
	Temp. Compensation; Comp.	none
	Flow; Flow measurement	none
	Conc.:	none
Signal Output 1	Parameter:	Conductivity
	Current loop:	4–20 mA
	Function:	linear
	Scaling: Range low:	0.000 µS
	Scaling: Range high:	100 mS
Signal Output 2	Parameter:	Temperature
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0.0 °C
	Scaling: Range high:	50.0 °C
Alarm Relay:	Alarm Conductivity:	
	Alarm high:	300 mS
	Alarm low:	0.00 µS
	Hysteresis:	1.00 mS
	Delay:	5 s
	Sample Flow *(if Flow measurement = yes)*:	
	Flow Alarm	yes
	Alarm high:	50.0 l/h
	Alarm low:	5.0 l/h
	Sample Temp:	
	Alarm High:	120 °C
	Alarm Low:	0 °C

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

Relay 1 and 2
Function: ..... limit upper
Parameter: ..... Conductivity
Setpoint: ..... 100 mS
Hysteresis: ..... 1 mS
Delay: ..... 30 s

If Function = Control upw. or dnw:

Parameter: ..... Conductivity
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 100 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
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

11. Index

12. Notes

swan
ANALYTICAL INSTRUMENTS

A-96.250.321 / 270121

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.

Swan Analytical Instruments · CH-8340 Hinwil
www.swan.ch · swan@swan.ch

SWISS MADE

AMI Solicon4