ANALYTICAL INSTRUMENTS

A-96.250.221 / 250121

Operator’s Manual

Firmware V6.20 and higher

SWISS MADE

AMI Sodium A

Customer Support
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Table of Contents

AMI Sodium A–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.

1.3. Restrictions for use

The sample must not contain any particles, which may block the flow cell. Sufficient sample flow is coercive for the correct function of the instrument.

This instrument is only applicable to waters of a pH value higher 2 and lower 8, i.e. after the cation exchanger.

WARNING

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

- Etching kit for sodium electrode (powder + liquid)
- Sodium calibration solution
- Electrolyte for reference electrode
- Alcalizing reagent (e. g. diisopropylamine)

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

Download MSDS

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

2. Product Description

Application

Sodium measurement is used for quality control in high purity water applications and to monitor break through of ion exchangers. This instrument is only applicable to waters of a pH value higher 2 and lower 8, i.e. after the cation exchanger.

Measuring principle

The sodium measurement used in this instrument is based on a potentiometric measuring method. For this purpose a proven glass ion sensitive electrode and a reference electrode is used. These two electrodes produce an electrical potential which is used to calculate the sodium concentration of the sample. According to Nernsts Law, the ion concentration depends on the temperature, therefore a temperature sensor measures the sample temperature. With the current temperature the measuring value is expressed for the standard temperature of 25 °C by using programmed temperature compensation curves.

Sodium measurements below 1 ppb require a special glass formulation for the sensing electrode response.

Ammonium and pH interferences from the unconditioned sample are eliminated by a suitable reagent. The measuring limit of 0.1 ppb sodium requires the conditioning of the sample to a minimum of pH 11 while sample integrity has to be maintained. The best results are obtained with Diisopropylamine (DIPA).

Signal Outputs

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

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

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

Relay

Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function.

Maximum load: 1 A / 250 VAC

Alarm Relay

One potential free contact, alternatively:

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

Summary alarm indication for programmable alarm values and instrument faults.

Input

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

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.

Communication Interface (optional)

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

On-line Operation

The sample flows via the sample inlet [N] and the flow regulating valve [K] into the constant head [E]. Adjust the flow regulating valve so that always a small part of the sample flows through the overflow tube into the waste [P]. This adjustment ensures a sufficient sample flow through the measuring chambers [I] and [J]. During normal operation, the standard bottle holder [L] is turned down and the sample flows via the constant head [E] through the standard bottle holder into the air lift pump [M]. For grab sample measurement or calibration the standard bottle holder is turned up and the flow is switched from the constant head to the standard bottle.

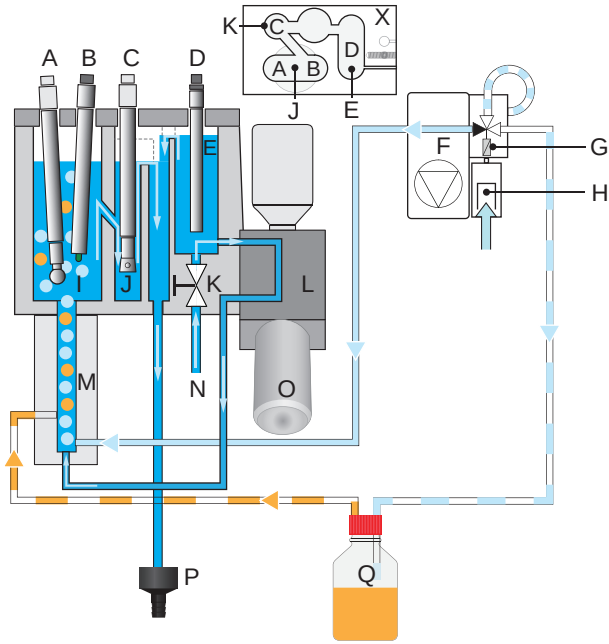
Due to the air pump [F], a constant sample stream is guaranteed. The optimum measurement accuracy is achieved at a pH value of 11, therefore the pH value is controlled by the pH electrode [B]. Depending on the pH value the 3-way solenoid valve [G] is switched so that either the air stream enters the air lift pump [M] directly or it is led through the reagent bottle [Q] to add DIPA vapor to the sample stream.

After the air lift pump, the sample flows into the chamber [I] of the flow cell where pH and Sodium will be measured; from there it flows into the chamber [J] where the reference electrode is located and finally into the waste [P].

The flow rate is monitored by pH measurement. If the pH value is constant over a long time without DIPA addition it means that there is no sample flow, and a “Sample Flow low” alarm is issued.

Note: *To visualize the sample flow more clearly, the flow cell is shown only schematically. The position of the individual measuring cells and sensors does not correspond with the real flow cell. The top view X shows the correct position of the individual measuring cells and sensors.*

Fluidics



A *Sodium electrode*
B *pH electrode*
C *Reference electrode*
D *Temperature sensor*
E *Constant head*
F *Air pump*
G *3-way solenoid valve*
H *Air inlet with filter*
I *Sodium/pH measuring chamber*
J *Reference measuring chamber*
K *Flow regulating valve*
L *Standard bottle holder*
M *Air lift pump*
N *Sample inlet*
O *Standard bottle/grab sample*
P *Waste*
Q *Reagent bottle*
X *Flow cell top view*

Second Sample Stream	If required the AMI Sodium A can be equipped with the optional second sample stream module.
Sample Sequencer	If measurement of more than two sample streams is required, the AMI Sodium A can be connected to a Sample Sequencer which allows to measure up to six sample streams.
Grab Sample	The standard bottle holder can also be used for a grab sample measurement. Grab sample measurement see Grab Sample, p. 51.
Calibration	The standard bottle [O] is screwed in the standard bottle holder [L] and turned upwards to vertical position, thus the sample flow is switched from the flow cell to the standard bottle. Constant pressure within the standard bottle is maintained by the pressure-equalizing tube inside the bottle. 1 liter standard is consumed in approx. 10 min. The sodium electrode must reach constant readings within this time to obtain an exact calibration. For details, see Calibration, p. 64.
Consumables	The filling of the 100 ml KCl Bottle lasts for one month of operation.

2.1. Instrument Specification

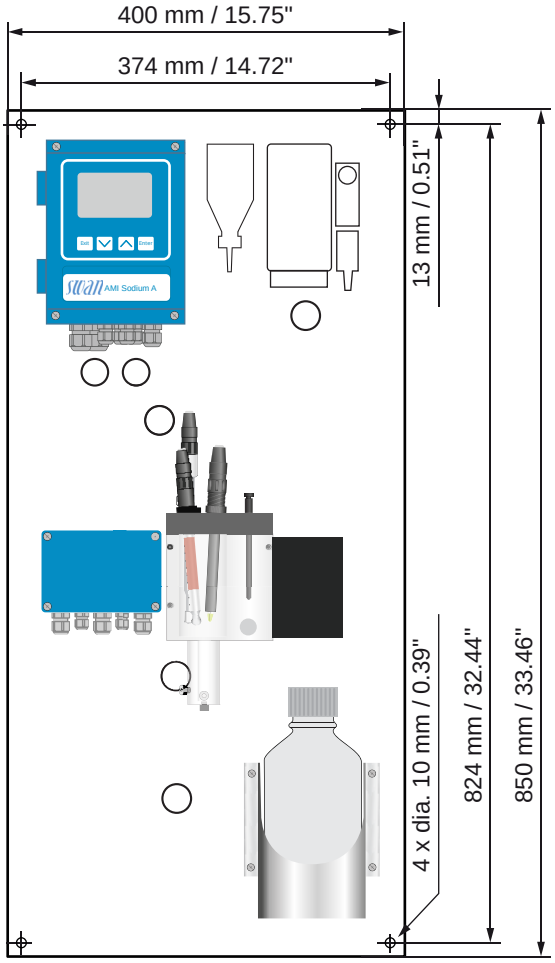
Power Supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	-10 to +50 °C
	Storage and transport:	-30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Sample requirements	pH Value:	≥ pH 2.0, < pH 8.0
	Ammonium concentration:	< 50 ppm
	Flow rate:	min. 100 ml/min.
	Temperature:	5–45 °C (41–113 °F)
	Inlet pressure:	0.3–3 bar (4–43 PSI)
	Outlet pressure:	pressure free

Note: *No oil, no grease, no sand.*

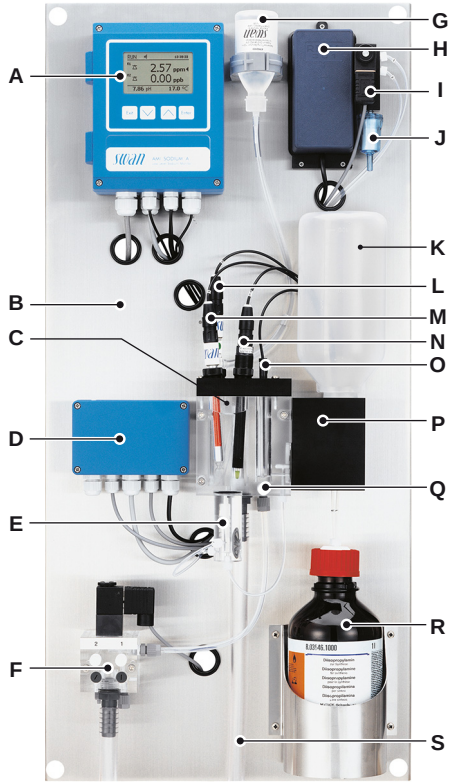
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Tube 4 x 6 mm
	Sample outlet:	1/2” hose nozzle for flexible tube diam. 20x15 mm

Dimensions

Panel:	stainless steel
Dimensions:	400 x 850 x 200 mm
Screws:	8 mm diameter
Weight:	12.0 kg / 26.5 lbs without sample water



2.2. Instrument Overview



A *Transmitter*
B *Panel*
C *Flow cell*
D *Pump valve module*
E *Air lift pump*
F *2nd Sample stream (optional)*
G *Reference electrolyte bottle*
H *Air pump*
I *Solenoid valve*
J *Air filter*
K *Standard bottle/Grab sample*
L *Reference electrode*
M *Sodium electrode*
N *pH electrode*
O *Temperature sensor*
P *Standard bottle holder*
Q *Flow regulating valve*
R *Reagent bottle*
S *Sample outlet*

3. Installation

3.1. Installation Check List

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. 15).
Installation	Mount the instrument in vertical position. Display should be at eye-level. Connect the sample and waste line. See Connect Sample and Waste, p. 20.
Electrodes	**Sodium electrode**: Install the Sodium Electrode, p. 22. Etch the sodium electrode. Rinse it well and check for air bubbles inside the electrode. Install the sodium electrode. Connect cable S to the sodium electrode. **Reference electrode**: Install the Reference Electrode, p. 24. Install KCl bottle. Check the ground joint diaphragm. Install the reference electrode. Puncture the KCl bottle. Connect cable R to the reference electrode. **pH electrode**: Install the pH Electrode, p. 28. Install the pH electrode. Connect cable pH to the pH electrode
Reagent and filter connections	We recommend to use DIPA to operate the instrument. Use a reagent bottle with either G45 thread (Schott) or a bottle from Merck using a thread adapter. For installation see Install Reagent Bottle, p. 44. Install air filter.
Electrical Wiring	Do not switch on the Instrument until all electrical connections are made. Connect all external devices like limit switches, and pumps. Connect power cord; do not switch on power yet! See Electrical Connections, p. 34.

Power-up	Turn on the sample flow and wait until the flow cell is completely filled. Switch on power. See Establish Sample Flow, p. 45.
Instrument Setup	Program all parameters for external devices (interface, recorders, etch.). Program all parameters for instrument operation (limits, alarms, measuring interval).
Run-in period	Let the instrument run continuously for 1 h.
Calibrate pH	See pH Process Calibration, p. 64.
Calibration Sodium electrode	Rinse the standard bottles well with deionized water. Prepare the sodium standards directly in the graduated standard bottles using a precision pipette. Make sure the concentrations are programmed correctly. Perform a two point calibration. See Calibration, p. 64.

3.2. Mounting of Instrument Panel

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

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

Mounting requirements

The instrument is only intended for indoor installation.
For dimensions see Dimensions, p. 16

3.3. Connect Sample and Waste

3.3.1 FEP Tube at Sample Inlet

CAUTION

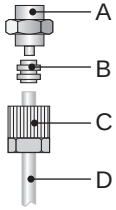
Damage of acrylic glass flow cell

Never screw steel fittings directly into the threads of the acrylic glass.

- Only use steel tubings with special fitting.

Use plastic tube (FEP, PA, or PE 4 x 6 mm) to connect the sample line.

Mounting of SERTO fitting



A *Screw connection*
B *Compression ferrule*
C *Knurled nut*
D *Flexible tube*

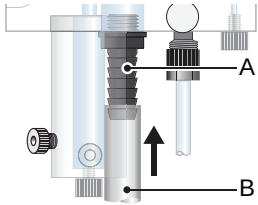
3.3.2 Sample Outlet

WARNING

Risk of water pollution

The drain of the Flow cell outlet contains Diisopropylamine (DIPA)

- At no means recirculate it into the water system.



A *Hose nozzle*
B *1/2" tube*

Connect the 1/2" tube [B] to the hose nozzle [A] and place it into a pressure free drain with sufficient capacity.

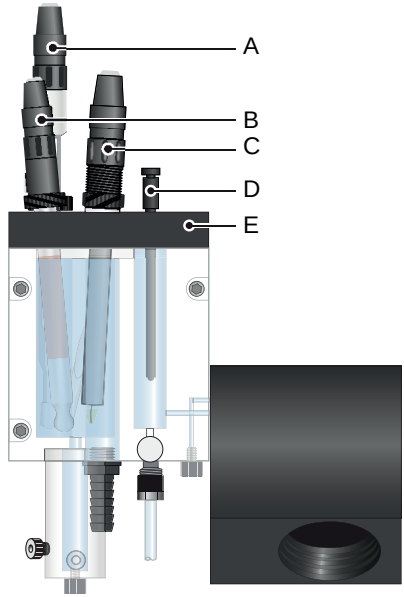
3.4. Install Sensors

CAUTION

The electrodes are made of glass and therefore very sensitive.

- Handle with care.

Position of sensors



A *Reference electrode, cable marked with* ***R***
B *Sodium electrode, cable marked with* ***S***
C *pH electrode, cable marked with* ***PH***
D *Temperature sensor, cable marked with* ***T***
E *Flow cell cover*

Unpacking

The electrodes are supplied separately and are installed into the flow cell after mounting of the instrument panel. The electrodes are protected with protective caps at their tips as well as on the electrical connectors.
Remove the connector caps from the connector only when the electrode is mounted in the measuring cell.

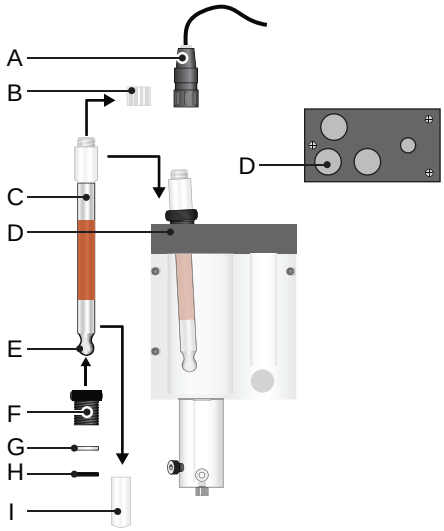
3.4.1 Install the Sodium Electrode

General

Sodium electrodes are sensitive, electrochemical devices with a very high internal impedance. To maintain correct operation make sure that:

- the sensing glass bulb stays clean.
- no air bubbles are trapped in the glass bulb of the electrode.
- the electrical connectors stay clean and dry.

The electrode is delivered with protective caps on the sensing glass bulb as well as on the electrical connector.



A *Sensor plug*
B *Connector cap*
C *Electrode shaft*
D *Measuring chamber hole*
E *Sensing glass bulb*
F *Union screw*
G *Washer*
H *O-ring*
I *Protective cap*

Install the sodium electrode as follows:

1 Remove the protective cap [I] from the electrode with a careful turning and pulling movement.

2 Etch the electrode, see Cleaning and etching, p. 54 and note the warning about handling of the chemicals.

3 Rinse the electrode with demineralized water.

4 Slip the union nut [F], and washer [G] on the electrode shaft [C].

5 Wet the O-ring [H] and slip it carefully over the electrode shaft [C].

6 Make sure no air bubbles are trapped in the sensing glass bulb [E]. If so, shake the electrode like a clinical thermometer until the bubble is vanished.

7 Insert the electrode through the measuring chamber hole [D] into the measuring chamber and push down completely.

8 Tighten the union screw [F] finger tight.

9 Remove the connector cap [B] from the electrode.

10 Screw the connector [A] onto the electrode. The cable is marked with [S].
⇒ *Avoid twisting the cable.*

11 Connect the cable marked with S to the front end in the AMI Transmitter, see Electrical Connections, p. 34.

3.4.2 Install the Reference Electrode

General

The SWAN reference electrode is a double junction Calomel / KCl type electrode. The outer liquid junction is a liquid glass sleeve, guaranteeing easy maintenance and long life time.

To maintain correct operation make sure that:

- the ground joint diaphragm stays clean and a KCl flow of about 1ml/day is maintained.
- no air bubbles are trapped in the electrode and in the tube to the KCl reservoir.
- the electrical connectors stay clean and dry.

CAUTION

KCL is corrosive

Avoid splashing KCl onto the flow cell cover when preparing the KCl bottle.

Prepare the KCl Bottle

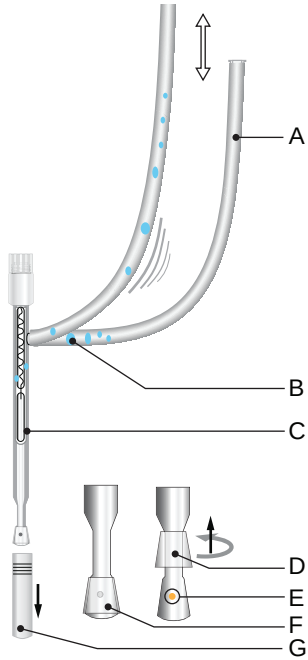
A *Seal cap*
B *Dosing tip*
C *KCl bottle*

1 Remove the seal cap [A] from the dosing tip [B].

2 Cut off the upper sealed part of the dosing tip.

Prepare the reference electrode

After longer storage of the reference electrode, the diaphragm may be clogged with salt deposits of KCl. Therefore it is recommended to open and clean the diaphragm before installing the reference electrode.

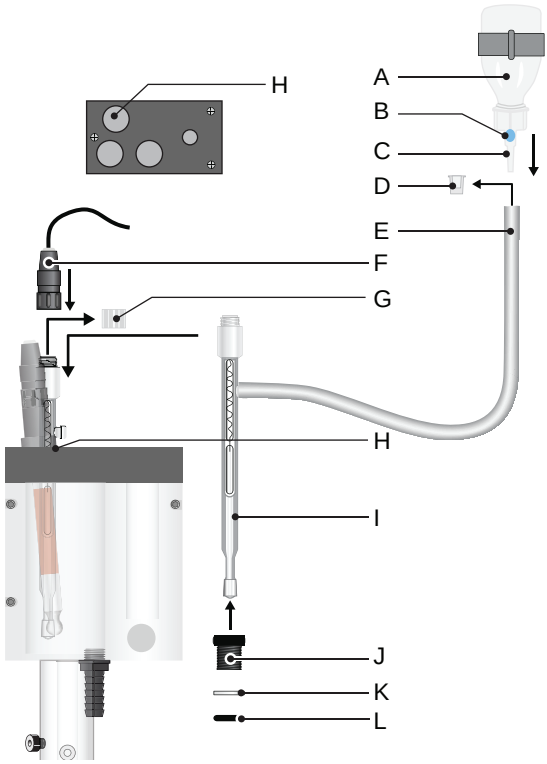


A *KCl supply tube*
B *Trapped air bubble*
C *Reference electrode*
D *Ring-shaped sleeve opened*
E *Electrolyte outlet hole*
F *Ring-shaped sleeve closed*
G *Protective cap*

To clean the reference electrode proceed as follows:

1. Remove the protective cap [G] from the ground joint diaphragm with a careful turning and pulling movement.
2. Hold the reference electrode with the ground joint diaphragm pointing downwards.
3. Slightly lift the ring-shaped sleeve of the ground-joint diaphragm and allow a little electrolyte to flow out into a tissue.
4. Rinse the electrode tip well with deionized water.
5. Push the ring-shaped sleeve carefully over the ground-joint diaphragm.
6. While holding the electrode tip pointing downwards pull the KCl supply tube several times so that the air bubbles can escape upwards.

Install the references electrode



A *KCl Bottle*
B *Trapped air bubble*
C *Dosing tip*
D *Stopper*
E *KCl supply tube*
F *Sensor plug*
G *Connector cap*
H *Reference chamber hole*
I *Electrode shaft*
J *Union screw*
K *Washer*
L *O-ring*

Install the reference electrode as follows:

1 Remove the stopper [D] from the KCl supply tube [E].
2 Connect the KCl supply tube to the dosing tip [C] of the KCl bottle.
3 Fix the KCl bottle upside down in the holder on the panel.
4 Puncture the bottle bottom to allow pressure equilibration.

5 Knock against the KCl bottle to remove trapped air bubbles [B] in the dosing tip.

Note: *Air bubbles trapped in the dosing tip of the KCl bottle may stop the KCl flow to the reference electrode, which results in wrong measuring values.*

6 Slip the union screw [J], and washer [K] on the electrode shaft [I].

7 Wet the O-ring [L] and slip it carefully over the electrode shaft [I].

8 Insert the electrode through the hole [H] into the reference chamber and push it down until the ground joint diaphragm is about 0.5 cm above the bottom.

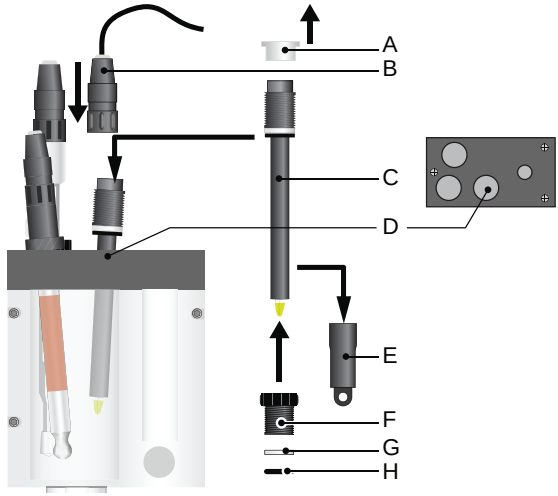
9 Tighten the union screw [J] finger tight.

10 Remove the connector cap [G] from the electrode.

11 Screw the connector [F], of the cable marked with R, onto the electrode.

12 Connect the cable marked with R to the front end in the AMI Transmitter, see Electrical Connections, p. 34.

3.4.3 Install the pH Electrode



A *Connector cap*
B *Sensor plug*
C *Sensor shaft*
D *pH sensor hole*
E *Protective cap*
F *Union screw*
G *Washer*
H *O-ring*

1 Carefully remove the protective cap [E] from the electrode tip. Turn it clockwise only.

2 Rinse the electrode tip with clean water.

3 Slip union screw [F], and washer [G] on the electrode shaft [C].

4 Wet the O-ring [H] and slip it carefully over the electrode shaft.

5 Insert the electrode through the hole [D] in into the flow cell.

6 Tighten the union screw hand-tight.

7 Remove the connector cap [A].

8 Screw the connector [B] of the cable marked with pH onto the sensor.

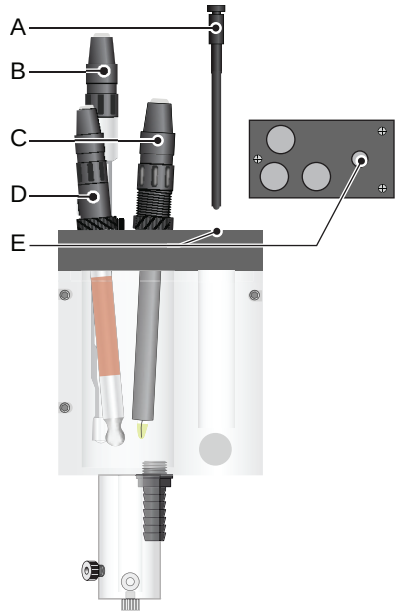
9 Keep the protective caps on a secure place for later use.

10 Connect the sensor cable marked with pH to the AMI transmitter.

11 Connect the cable to the front end in the AMI Transmitter, see Electrical Connections, p. 34.

3.4.4 Install the Temperature Sensor

The temperature sensor is fixed to the panel with an adhesive tape and already connected to the front end PCB in the AMI transmitter.



A *Temperature sensor*
B *Reference sensor*
C *pH sensor*
D *Sodium sensor*
E *Temperature sensor hole*

To install the temperature sensor proceed as follows:

1 Remove the temperature sensor [A] from the panel.

2 Insert the temperature sensor through the hole [E] into the constant head.

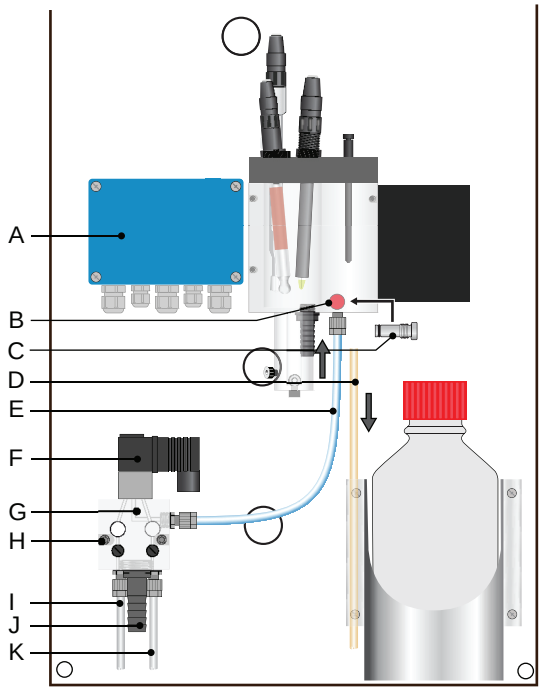
3 Push it into the hole as far as it will go.

3.4.5 Install reagent bottle

The DIPA bottle will be installed only shortly before commissioning, see chapter 4, Install Reagent Bottle, p. 44.

3.5. Install 2nd Sample Stream (Option)

The following description assumes that the installation of the 2nd sample stream takes place after commissioning of the monitor



A *Pump valve module*
B *Flow regulating valve*
C *Blind plug*
D *Existing sample inlet tube*
E *Connection tube*
F *Solenoid valve*
G *Housing block*
H *Fixing screw*
I *Sample stream 2*
J *Hose nozzle*
K *Sample stream 1*

Procedure

1. Stop sample flow at the main tap.
2. Switch off the instrument.
3. Empty the flow cell.
4. Replace the flow regulating valve [B] with the blind plug [C].

5 Remove the existing sample inlet tube [D] from the flow cell.

6 Screw the housing block [G] with the two fixing screws [H] to the panel, see Mounting of SERTO fitting, p. 20.

7 Install the connection tube [E] between the 2nd sample stream outlet and the flow cell inlet.

8 Connect sample inlet 1 [I] and sample inlet 2 [K] to the corresponding inlets at the housing block (G).

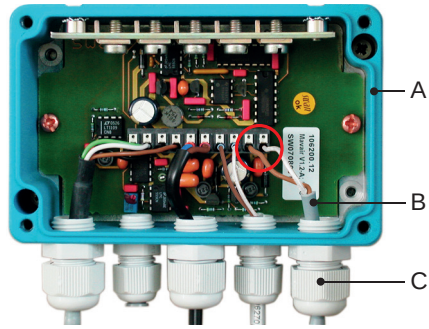
9 Connect a 1/2” tube to the hose nozzle [J] and place it into a pressure free drain with sufficient capacity.

3.5.1 Connect the solenoid valve

1 Feed the cable [B] of the solenoid valve through the cable gland [C] into the pump-valve module housing [A].

2 Connect the wires to the terminals in the pump-valve module according to the Connection Diagram, p. 36, see also Picture below.

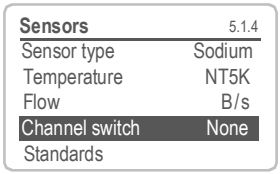
Pump-Valve module



A *Pump-valve module housing*
B *Solenoid valve cable*
C *Cable Gland*

3.5.2 Firmware settings for 2nd sample stream option

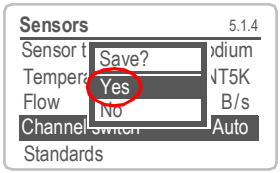
After the 2nd sample stream option is installed and connected, set the firmware according to your requirements.



1 Navigate to menu <Installation/ Sensors>.

2 Navigate to <Channel switch> with the[▲] or[▼] key.

3 Press [Enter].



4 Set <Channel switch> to the required mode with the [▲] key.

5 Confirm with [Enter].

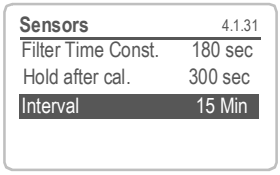
6 Press [Exit], choose <Save> “Yes” Confirm with [Enter].

With 2nd sample stream option the AMI Sodium A can be operated in the following 4 different modes.

- None
- Auto
- User defined
- Fieldbus

None The switch over between the channels is disabled, channel 1 is active.

Auto Only visible if <Channel switch> in menu 5.1.4 is set to <Auto>. The switch over between the two sample streams is controlled by the AMI Transmitter according to the programmed measuring interval in the menu <Operation>.

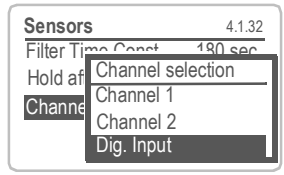


1 Navigate to menu <Operation/ Sensors>.

2 Choose <Interval> with the [▲] or[▼] key.

3 Press [Enter] and set the interval according your requirements between 15 and 120 Min.

User defined Only visible if <Channel switch> in menu 5.1.4 is set to <User defined>.
Choose either Channel 1, Channel 2 or Digital Input (Dig. Input).



1 Navigate to menu <Operation/ Sensors>.
2 Choose <Channel selection> with the [▲] or[▼] key.
3 Press [Enter] to select required function.

Channel 1: Only channel 1 is measured.

Channel 2: Only channel 2 is measured.

Dig. Input: The channel can be selected via input. The function Input in menu 5.3.4 is set to <Active = no>.

Fieldbus The switch over between the two sample streams is controlled by the Profibus.

3.6. AMI connected to a Sample Sequencer

If more than two sample streams are required, an AMI Sample Sequencer can be connected to the AMI Sodium A which allows to measure up to six sample streams. The electrical connection is described in the Manual of the AMI Sample Sequencer.

Note: *If the AMI is already equipped with a 2nd Sample Stream option, it is not possible to operate it with an AMI Sample Sequencer. Before connecting an AMI Sample Sequencer remove the 2nd Sample Stream option.*

3.7. Electrical Connections

WARNING

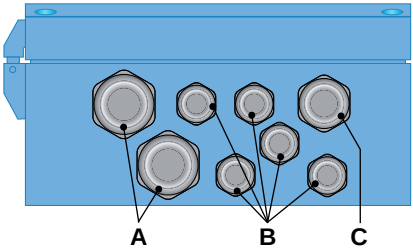
Risk of electrical shock.

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

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

Cable thicknesses

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



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

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

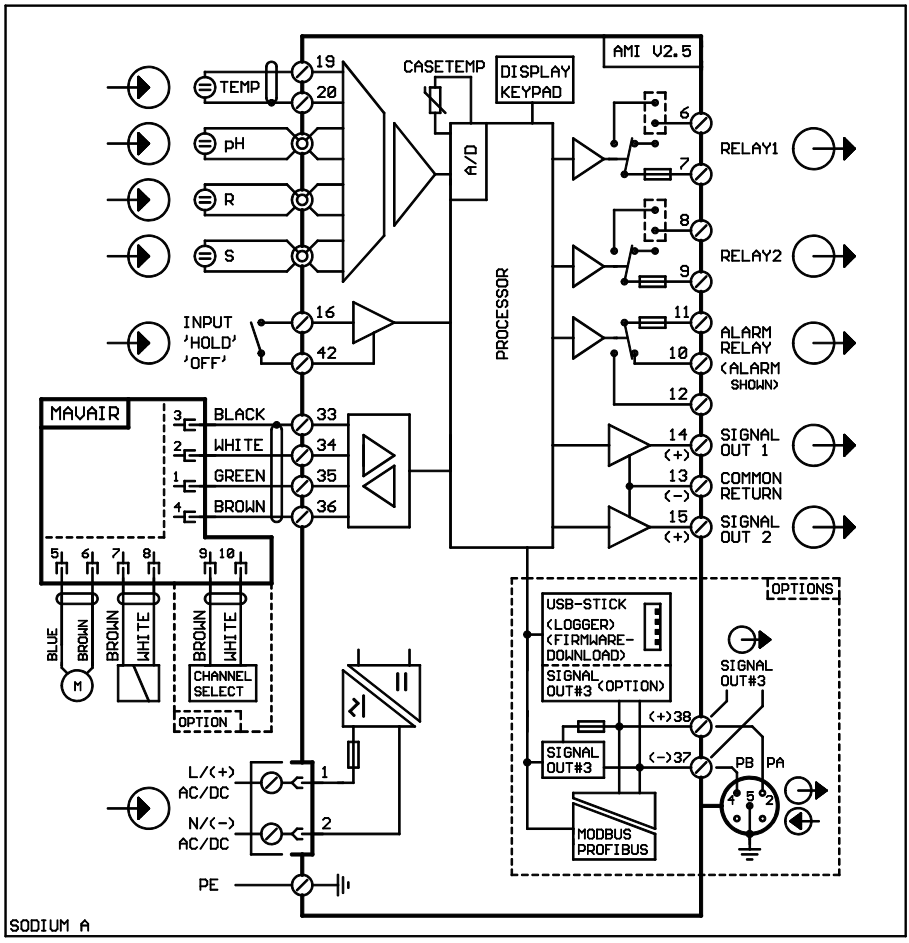
WARNING

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.

3.8. Connection Diagram



CAUTION

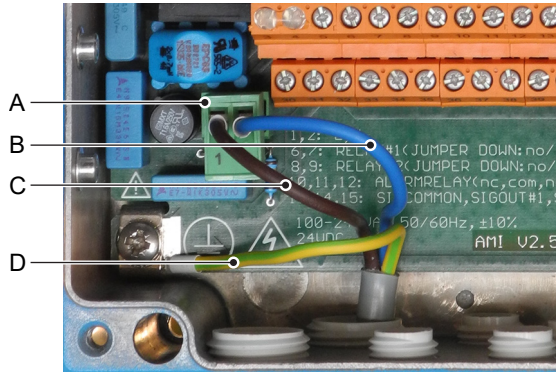
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.9. Power Suppy

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 Sodium A

3.10. Relay Contacts

3.10.1 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 explanation, 5.3.4, p. 95.

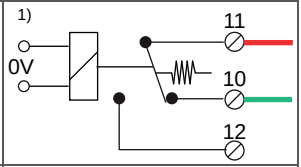
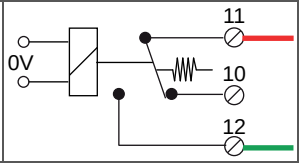
3.10.2 Alarm Relay

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

Alarm output for system errors.

Error codes see Troubleshooting, p. 72.

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.	

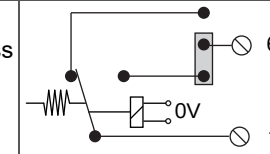
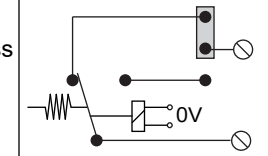
1) *usual use*

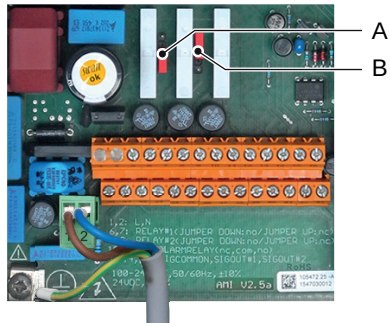
3.10.3 Relay 1 and 2

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

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

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 5.3.2 and 5.3.3, p. 91, Menu Installation

CAUTION

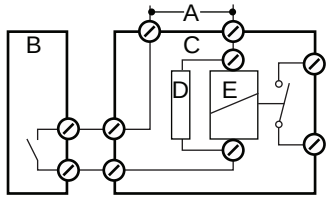
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

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

Inductive load

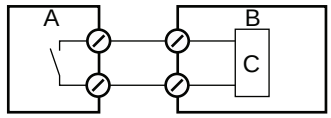
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load.
A snubber circuit is not necessary if an AMI relaybox is used.



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

Resistive load

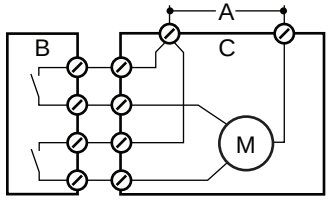
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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

Actuators

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



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

3.11. Signal Outputs

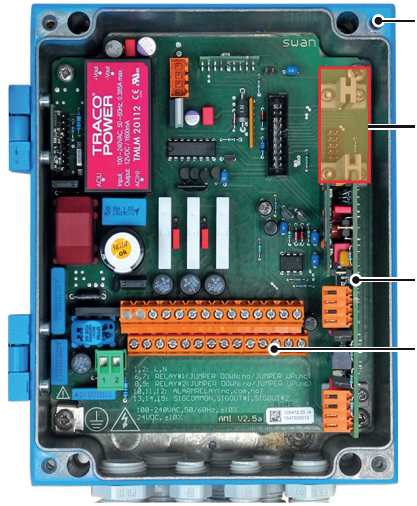
3.11.1 Signal Output 1 and 2 (current outputs)

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. 81, Menu Installation

3.12. Interface Options



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

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

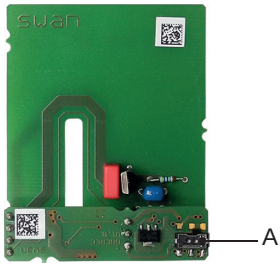
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- an USB Interface

3.12.1 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

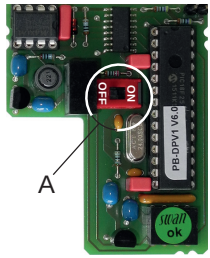
A *Operating mode selector switch*

3.12.2 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.*



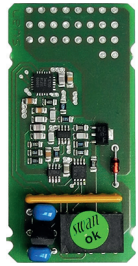
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.12.3 HART Interface

Terminals 38 (+) and 37 (-).

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

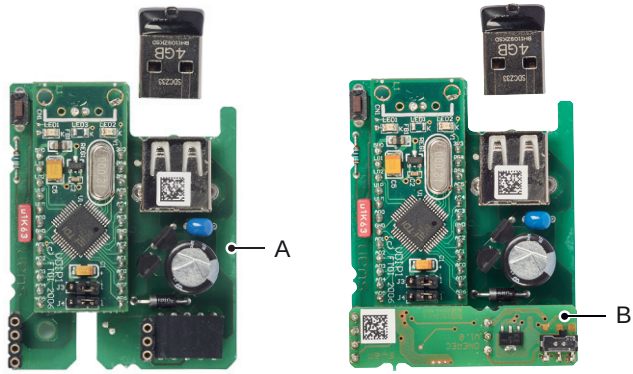


HART Interface PCB

3.12.4 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

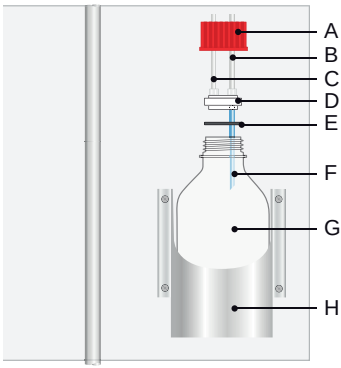
4.1. Install Reagent Bottle

CAUTION

Formation of reagent vapor

To prevent formation of reagent vapors:

- close the reagent bottle firmly
- check the EPDM seal regularly
- install air tubes and filter properly



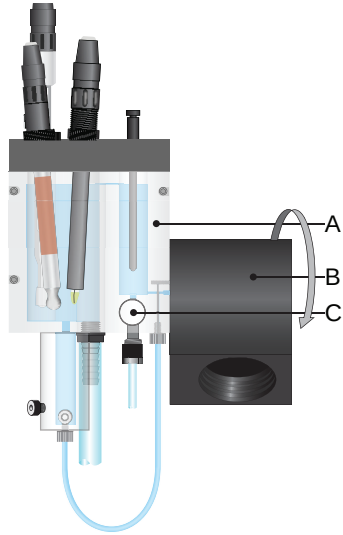
A *Screw cover G 45*
B *Tube 1 from Solenoid valve*
C *Tube 2 to air lift pump*
D *Tube holder*
E *EPDM seal*
F *Air inlet tube*
G *Reagent bottle*
H *Bottle holder*

Note: *Operate the instrument only with Diisopropylamine.*

The Tubes are already installed into the tube holder [D] and the EPDM seal [E] seats on the bottom of the tube holder. To install the DIPA bottle proceed as follows:

1. Put the DIPA bottle [G] into the bottle holder [H]
2. Put the tube holder onto the DIPA bottle
3. Screw the screw cover [A] onto the DIPA bottle and tighten it firmly.
4. Screw the tube fitting of tube 1 [B] into the tube holder [D], so that it is connected to the air inlet tube.
5. Screw the tube fitting of tube 2 [C] into the tube holder [D], so that it is connected to the DIPA vapor outlet.

4.2. Establish Sample Flow



A *Flow cell*
B *Standard bottle holder*
C *Flow regulating valve*

WARNING

Risk of water pollution

The drain of the Flow cell outlet contains Diisopropylamine (DIPA)

- At no means recirculate it into the water system.

1 Swing down the bottle holder [B] as far as it will go.

2 Open the flow regulating valve [C].

3 Adjust the sample flow so that a small part of the sample overflows into the waste.

4 Check tubing connections and flow cell for leaks and repair if necessary.

4.3. Switch on Power

After the analyzer is installed according to the previous instructions connect the power cord.
First, the analyzer performs a self test, displays the firmware version and then starts normal operation.

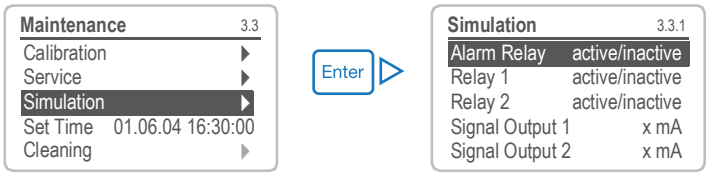
1 Let the instrument run continuously for 1 hour with sample.

4.4. Programming

Program all parameters for external devices (interface, recorders, etc.) Program all parameters for instrument operation (limits, alarms). See Program List and Explanations, p. 81.

4.5. Check Outputs and Relays

Terminal designations see Connection Diagram, p. 36.
Check signal outputs and relay function by means of the connected device or a multimeter.



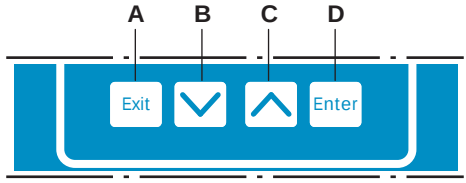
4.6. Perform a calibration

1 Prepare the standards, see Prepare Standard, p. 64.
2 Calibrate pH electrode, see pH Process Calibration, p. 64.
3 Perform sodium calibration, see Standard Sodium 1-Point-Calibration, p. 66.

5. Operation

5.1. Keys, Display

Keys



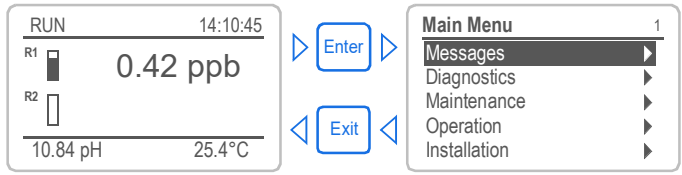
A to exit a menu or command (rejecting any changes) to move back to the previous menu level

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

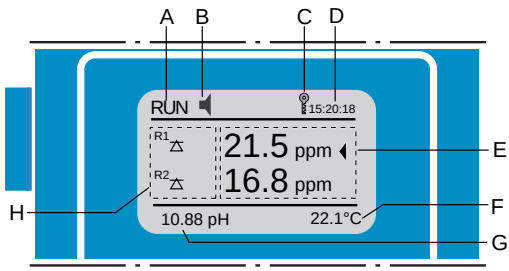
C to move UP in a menu list and to increase digits

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

Program Access, Exit



Measured Value 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 Transmitter control via Profibus

D Time

E Process Values:
2 channel operation: the active channel is flushed
measurement of active channel
1 channel operation: In 1 channel operation no symbols are displayed.

F Sample Temperature

G pH Value in flow cell

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

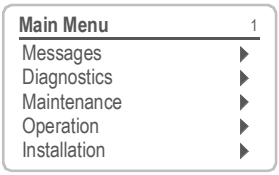
motor valve closed

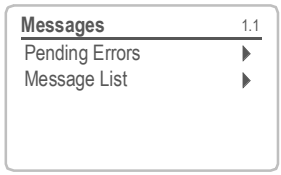
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

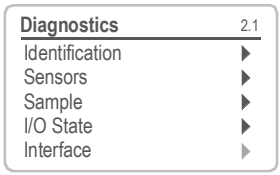
5.2. Software Structure





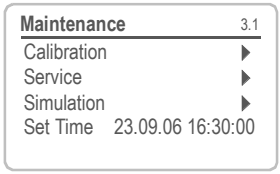
Menu **Messages 1**

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.



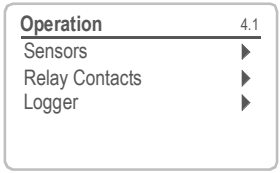
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



Menu **Maintenance 3**

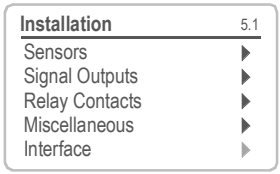
For instrument calibration, relay and signal output simulation, and to set the instrument time. It is used by the service personnel.



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.



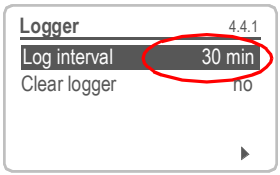
Menu **Installation 5**

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

5.3. Changing Parameters and Values

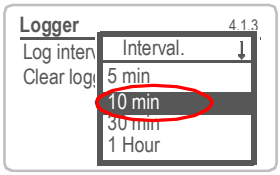
Changing parameters

The following example shows how to change the logger interval:



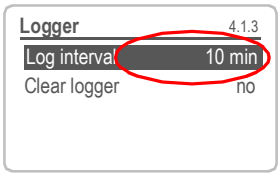
1 Select the parameter you want to change.

2 Press [Enter]



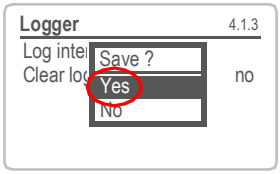
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

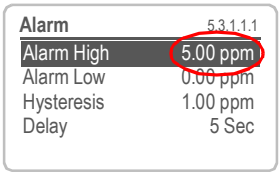
5 Press [Exit].



⇒ *Yes is highlighted.*

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

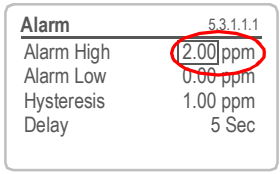
Changing values



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.*

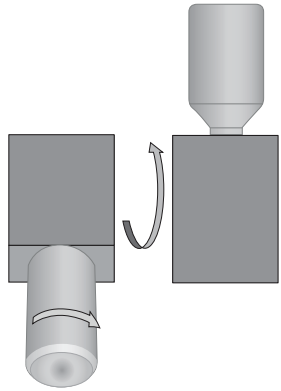
6 Press [Enter] to save the new value.

5.4. Grab Sample

To perform a grab sample measurement proceed as follows:

1 Rinse a standard bottle well and fill it with grab sample.
⇒ *Do not use closed bottles*

2 Screw the grab sample bottle into the standard bottle holder and swing it upwards



3 Press the [▼] key.
⇒ *GRAB appears on the left side of the upper status line and the instrument is measuring the grab sample now*

Note: *The measuring value of the grab sample will not be saved in the transmitter. Wait until the measuring value is stable and the write it down for later use.*

4 After the grab sample bottle is empty, swing the bottle holder down and unscrew the grab sample bottle.

5 Press the [▼] key again.
⇒ *HOLD appears in the display (= cal delay).*

6. Maintenance

6.1. Maintenance Schedule

Weekly or every 2 weeks	◆ Check for regular bubble formation. ◆ Check level of reagent bottle. ◆ Etch sodium electrode with SWAN's etching solution. ◆ Carry out a 1-point calibration.
Monthly	◆ Check sealing of reagent bottle, replace if necessary. ◆ Refill or replace KCl bottle. ◆ Etch sodium electrode in SWAN's etching solution. ◆ Carry out a 2-point calibration. ◆ Carry out a pH measurement and correct value if necessary.
Yearly	◆ Replace sodium electrode, see Maintenance of Sodium Electrode, p. 53. ◆ Replace reference electrode, see Maintenance of Reference Electrode, p. 55. ◆ Replace pH sensor, see Maintenance of pH Electrode, p. 56. ◆ Clean solenoid valve, see Maintenance of Solenoid Valves, p. 57 ◆ If necessary, remove deposited iron in the system by washing in soft detergent and by using rust remover. ◆ If necessary replace the air filter.

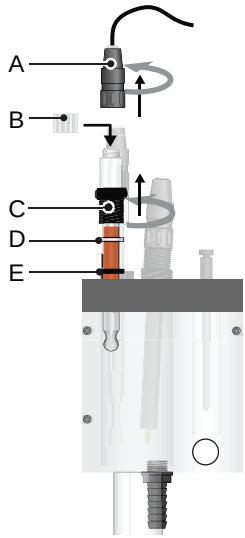
6.2. Stop of Operation for Maintenance

1 Stop sample flow.
2 Shut off power of the instrument.
3 Empty the flow cell completely.

6.3. Maintenance of Sodium Electrode

Sodium electrodes are sensitive electrochemical devices with very high internal impedance. To maintain correct operation, make sure that

- the sensing glass bulb stays clean
- no air bubbles are trapped between glass bulb and glass tube
- the electrical connectors stay absolutely clean and dry.



A *Sensor plug*
B *Connector cap*
C *Union screw*
D *Washer*
E *O-ring*

Remove the sodium electrode

1. Unscrew and remove the sensor plug [A].
   ⚠ *Prevent the connector from getting wet.*
2. Put on the connector cap [B] onto the sensor.
3. Completely unscrew the union screw [C] from the threaded hole.
4. Remove the electrode together with the union screw, washer and O-ring from the measuring cell.
5. Slip the O-ring carefully over the measuring bulb and remove both nut and washer.

Mix the etching solution

WARNING

Health hazard

Diluted acidic fluoride solutions are harmful and irritating. Harmful if ingested, irritates skin and eyes. Contains less than 0.5% hydrofluoric acid. Contains less than 1% acetic acid. For laboratory use only.

- Short contact with skin is harmless, nevertheless wash with lots of water.

Note: *Only use the original etching solution from SWAN.*

The etching solution is delivered in two bottles, one containing the acidic solvent, the other containing the fluoride salt.

Dissolve the salt in the solvent before use and mark the date of mixing.

Note: *Once the fluoride salt is dissolved, the life time of the solution is limited to 6 months.*

Cleaning and etching

1. Remove adhered iron deposits by wiping the electrode gently with a paper tissue.
2. Rinse the electrode with distilled water.
3. Insert the electrode for 2 minutes into the etching solution.
4. Rinse the electrode with distilled water again.

   ⚠ *Do not dry the sensing glass bulb.*

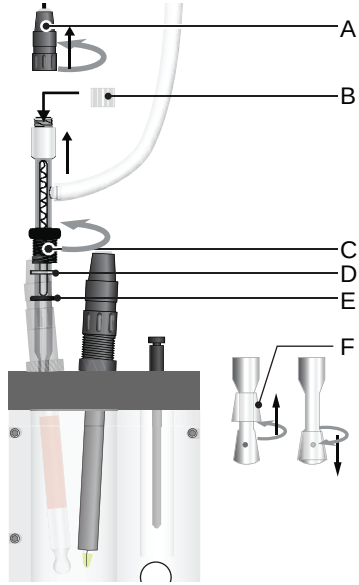
Install

See Install the Sodium Electrode, p. 22.

Replace the sodium electrode

1. Proceed according to Remove the sodium electrode, p. 53.
2. Insert the new electrode for 2 minutes into the etching solution.
3. Rinse the electrode with distilled water again.
4. Do not dry the sensing glass bulb.
5. Install the sodium electrode, see Install the Sodium Electrode, p. 22.

6.4. Maintenance of Reference Electrode



A *Sensor plug*
B *Connector cap*
C *Union screw*
D *Washer*
E *O-ring*
F *Ring-shaped sleeve*

Remove the reference electrode

1. Unscrew and remove the sensor plug [A].
   ⚠ *Prevent the connector from getting wet.*
2. Put on the connector cap [B] onto the sensor.
3. Completely unscrew the union screw [C] from the threaded hole.
4. Remove the KCl bottle from its holder.
   ⚠ *Remember that the bottle was punctured - do not spill KCl.*
5. Remove the reference electrode from the flow cell.

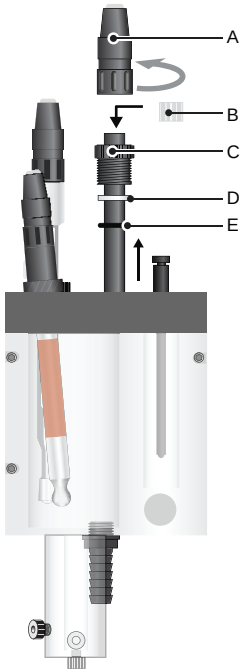
Cleaning

1. Remove any iron deposits with a soft paper tissue.
2. Slip the ring-shaped sleeve [F] upwards with a turning and pushing movement and allow a little electrolyte to flow out.
3. Fix the ring-shaped sleeve finger tight with a gentle turning and pulling movement.
4. Replace or refill KCl reservoir. Use only original SWAN KCl.

Install

See Install the Reference Electrode, p. 24

6.5. Maintenance of pH Electrode



A *Sensor plug*
B *Connector cap*
C *Union screw*
D *Washer*
E *O-ring*

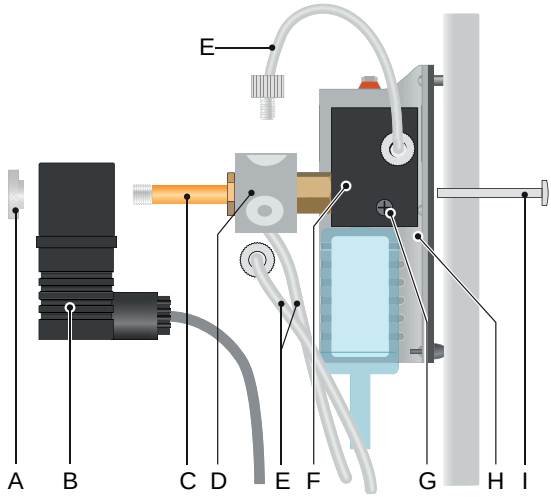
Clean pH sensor

1. Unscrew and remove the sensor plug [A].
   ⚠ *Prevent the connector from getting wet.*
2. Put on the connector cap [B] onto the sensor.
3. Completely unscrew the union screw [C] from the threaded hole.
4. Remove the pH electrode together with the union screw [C], washer [D] and O-ring [E] from the measuring cell.
5. If necessary wipe the pH sensor shaft and the green tip cautiously with a soft, clean, and damp paper tissue.
6. Rinse the pH sensor with clean water.

Install See Install the pH Electrode, p. 28

6.6. Maintenance of Solenoid Valves

6.6.1 Solenoid Valve for DIPA dosing



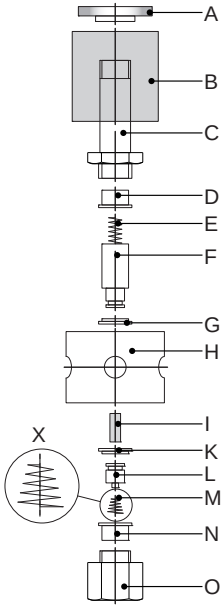
A *Knurled nut*
B *Housing with exciter coil*
C *Solenoid support*
D *Solenoid valve body*
E *Tubes*
F *Holder*
G *Holder fixing screw*
H *Air pump*
I *Solenoid valve fixing screw*

Disassemble

1. Switch off power of the instrument,
2. Remove the tubes [E] from the solenoid valve body [D].
3. Unscrew knurled nut [A].
4. Remove the exciter coil housing [B] from the solenoid support [C].
5. Unscrew and remove the holder fixing screw [G] and remove the holder [F] from the air pump [H].
6. Unscrew the solenoid valve fixing screw and remove the solenoid valve from the holder.
7. Unscrew the solenoid support and carefully remove it from the solenoid valve body.
   ⇒ *Take care not to loose the springs*
8. Remove the membrane holders.
   ⇒ *Normally the membranes stick to the valve body.*

9 Remove the membranes with pointed pliers.
Note: *Do not use the membranes again.*

10 Clean the valve body with soft detergent.



A *Knurled nut*
B *Housing with exciter coil*
C *Solenoid support*
D *Washer 2*
E *Long spring*
F *Solenoid with membrane holder*
G *Membrane 2*
H *Solenoid valve body*
I *Teflon distance bar*
K *Membrane 1*
L *Membrane holder*
M *Conical spring*
N *Washer 1*
O *Bottom screw*

X *mounting direction*

Assemble

1 Put new membranes on the membrane holders.
2 Place membrane 1 with holder in valve body.
3 Place washer 1 on membrane and push down carefully.
4 Place conical spring with smaller end on membrane holder.
5 Screw on bottom screw finger tightly.
6 Turn valve body upside down and place Teflon distance bar in center hole of valve body.
7 Place membrane 2 with holder in valve body.
8 Place washer 2 on membrane and push down carefully.
9 Place long spring in solenoid.
10 Screw on solenoid support finger tightly.
11 Push valve assembly in coil body.
12 Mount all tubes.
13 Screw on knurled nut finger tightly.

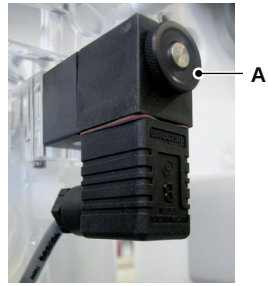
6.6.2 Solenoid Valve for 2nd Sample Stream Option

Only applicable if 2nd sample stream option is installed.

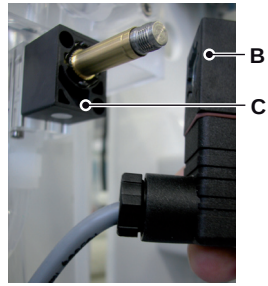
Disassemble the solenoid valve

The solenoid valve is mounted below the constant head. The solenoid valve should be disassembled if it does not switch anymore or if it is clogged.

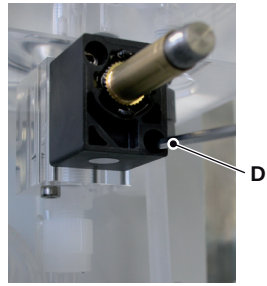
1 Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 52.



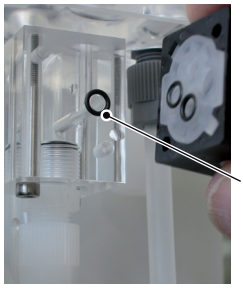
2 Loosen the nut (A).



3 Remove the solenoid coil (B) from the valve body (C).

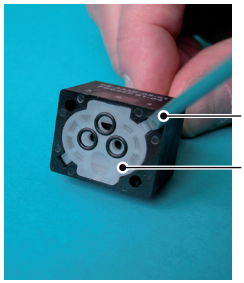


4 Loosen the fixing screws of the valve body with a 2.5 mm Allen key (D).

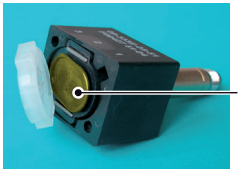


Note: *The O-rings inside the valve body may stick on the flow cell and fall down if the valve body is removed.*

5 Remove the valve body from the flow cell.



6 Remove the white plate (G) with a screw driver size 0 (F).



⇒*The membrane (H) is now visible.*

7 Clean base plate (G) and membrane (H) with clean water.

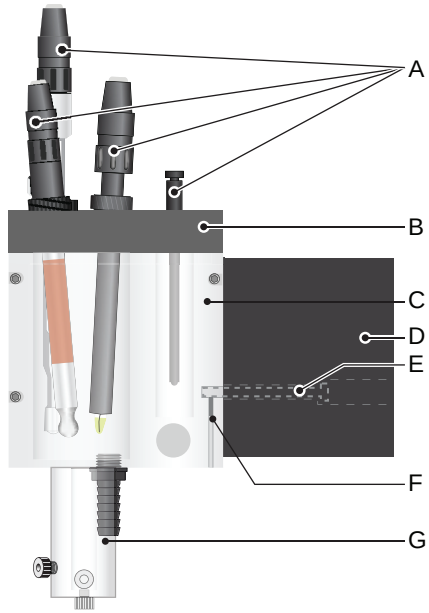
Assemble Assemble the solenoid valve in reverse order.

6.7. Maintenance of Flow Cell

CAUTION

Acrylic glass parts are fragile and scratch-sensitive.
Possible damage of acrylic glass parts due to scrubbing materials.

- Never use organic solvents or scrubbing materials to clean acrylic glass parts.
- Use soft detergent and rinse well.
- Remove iron deposits with a rust remover (i.e. iron x)



A *Sensors*
B *Flow cell cover*
C *Flow cell*
D *Standard bottle holder*
E *Fixing screw*
F *Set screw*
G *Air lift pump*

6.7.1 Cleaning the Flow cell

Disassemble the flow cell

1. Shut off the instrument.
2. Close the sample flow main tap.
3. Drain the flow cell [C] completely.
4. Remove all sensors [A].
5. Remove all tube connections.
6. Unscrew the three screws of the flow cell cover [B] and remove it.
7. Pull the airlift pump [G] out of the flow cell bottom.
8. Clean the flow cell with a soft brush.

Assemble the flow cell

1. Install the airlift pump.
2. Screw the cover onto the flow cell.
3. Install all tubes, see Tube numbering, p. 69.
4. Install all sensors, see Install Sensors, p. 21.
5. Open sample flow main tap.
6. Switch on the instrument.

6.7.2 Replace the O-Rings of the Standard Bottle Holder

Dismantle the standard bottle holder

1. Shut off the instrument.
2. Stop sample flow.
3. Drain the flow cell [C] completely.
4. Loose M3 setscrew [F].
5. Loose the screw [E] of the standard bottle holder [D].
6. Remove the standard bottle holder from the flow cell.
7. Remove the O-rings.

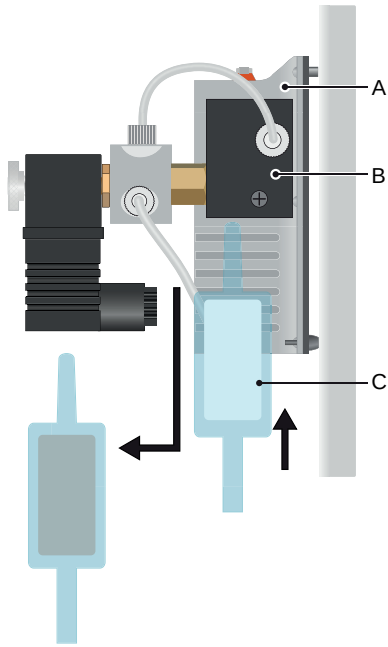
Assemble the standard bottle holder

Note: *Grease the O-rings only with teflon paste or spray. Screws which are screwed into the flow cell may be tightened only slightly.*

1. Grease the new O-rings with Teflon paste or spray.
2. Put the O-rings into the grooves of the flow cell.
3. Screw the standard bottle holder to the flow cell.
4. Secure the screw with the set screw.

6.8. Replace the Air Filter

A *Air Pump*
B *Holder*
C *Air filter*



To replace the air filter proceed as follows:

1 Pull out the polluted air filter.

2 Push the new air filter [C] into the hole of the holder [B] as far as it will go.

6.9. Prepare Standard

Rinse the standard bottles well with deionized water. Prepare the sodium standards directly in the graduated standard bottles using a precision pipette (i.e. Eppendorf). Make sure the concentrations are programmed correctly. See Menu 5.1.5, p. 85.

Prepare two standards

Prepare the 2 standards directly in the marked bottle using the 1000 ppm stock solution. The final concentration must correspond to the concentrations programmed in the instrument.

The standard stock solution has a concentration of 1000 ppm.

Mixing standard

Amount of standard	Filled up to 1 l with high purity water	Result
0.2 ml (= 200 µl)	- - -	200 ppb
1 ml	- - -	1000 ppb
2 ml	- - -	2000 ppb

6.10. Calibration

Before each sodium calibration, first carry out a pH calibration! The sodium measurement depends on the pH value.

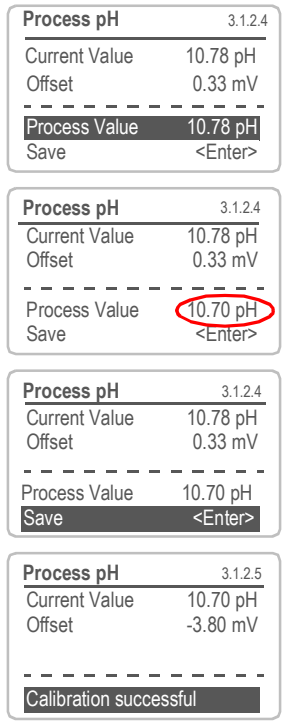
6.10.1 pH Process Calibration

You need a high quality pH meter to do the correction. We recommend using a Chematest series instrument with pH electrode. The hand held pH meter must be calibrated correctly!

Navigate to menu <Maintenance>/<Calibration>/<Process pH>.

The signal outputs and alarms are on hold.

1. Stop the sample flow by swinging the standard bottle holder halfway upwards.
2. Take the sodium electrode out of the flow cell and insert the pH electrode of your hand held pH meter instead.
3. Wait until the value of your instrument is stable.



4 Press <Enter>.

5 Enter the correct value with the [▲] or [▼] key.

6 Press <Enter> to save.

7 Remove pH electrode from the measuring cell.

8 Remount the sodium electrode.

9 Press <Exit> to leave programming mode.

Note: *If you get an error message, clean or replace the electrode.*

6.10.2 Standard Sodium 1-Point-Calibration

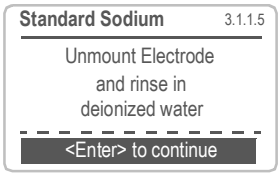
Navigate to menu <Maintenance>/<Calibration>/<Standard Sodium>.

Note: *Before each calibration:*

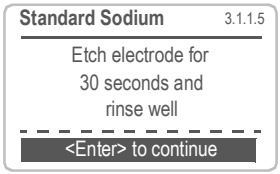
- *Etch the sodium electrode for half a minute.*
- *Use SWAN's etching kit only.*

Electrode Offset

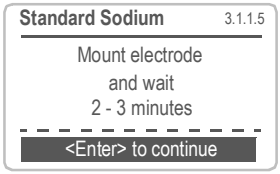
The instrument guides you through the complete calibration process. If you have completed the required action press <Enter> to proceed.



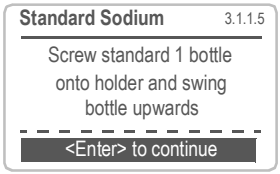
1 Dismount electrode and rinse in deionized water.



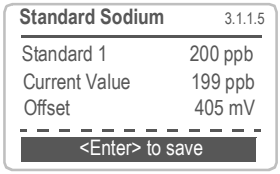
2 Etch sodium electrode for 30 seconds and rinse well.



3 Mount electrode and wait 2-3 minutes.

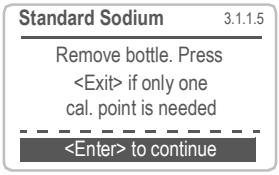


4 Screw standard bottle 1 onto the holder and swing bottle upwards.



5 Wait until the process has finished.

6 Press <Enter> to save.

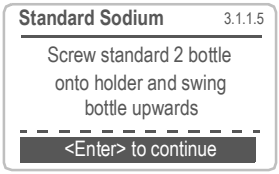


7 Remove the bottle from the bottle holder.

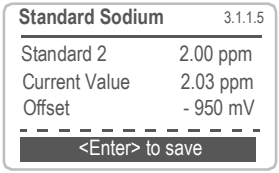
8 Press <Enter> for 2-point-calibration or <Exit> if you only want to make a one-point calibration.

6.10.3 2-Point-Calibration

Electrode Slope

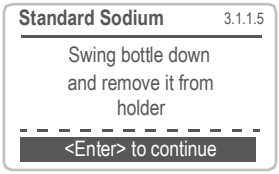


1 Screw standard bottle 2 onto the holder and swing bottle upwards.

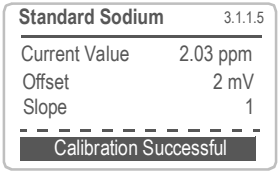


2 Wait until the process has finished.

3 Press <Enter> to save.



4 Remove the bottle from the bottle holder.



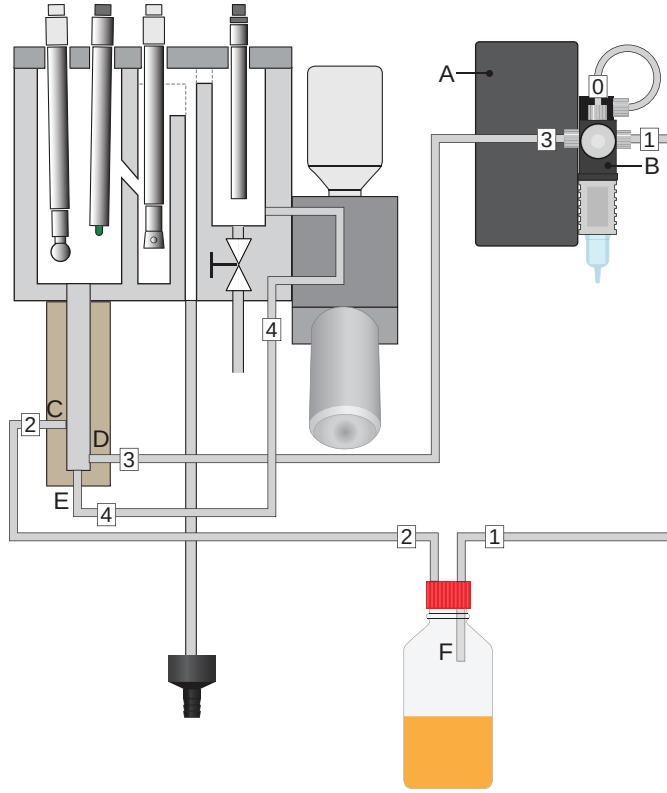
Note: *If no stable value is reached before the bottle is empty (approx. 10 min) take the following actions:*

- *Check if the flow is regular*
- *Clean and etch the sodium electrode*
- *Clean the reference electrode (see Install the Reference Electrode, p. 24)*
- *Replace sodium electrode*

By pressing [Exit], an running calibration can be aborted at any time.

During calibration procedure plus programmed delay time the signal outputs are frozen. If the delay time is 0 the outputs show the measured value. During calibration delay, HOLD is displayed.

6.11. Tube numbering



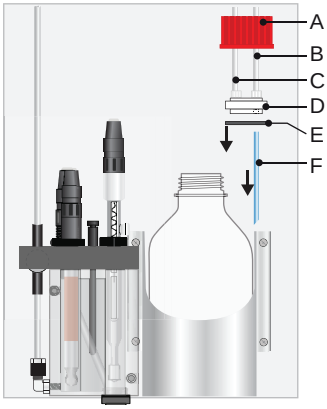
Tube No	Length [mm]	from	to
0	152	Holder [A]	Solenoid valve [B]
1	670	Solenoid valve [B]	Reagent bottle [F]
2	700	Reagent bottle [F]	Airlift Pump side-fed upper [C]
3	700	Solenoid valve [B	Airlift Pump side-fed lower [D]
4	186	Sample inlet	Airlift Pump bottom [E]

6.12. Replace the EPDM Seal and the Air Inlet Tube

WARNING

Diisopropylamine is corrosive.

- Read the Material Safety Data Sheets (MSDS) first.
- Wear suitable protective clothing, gloves and eye/face protection.
- Avoid inhalation of DIPA vapor.
- In case of contact with eyes, rinse immediately with plenty of water eyelid wide open for at least 10 min, summon medical advice. In case of accident or if you feel unwell, summon medical advice immediately (show the label where possible).



A *Screw cover G 45*
B *Tube 1 from air filter*
C *Tube 2 to air lift pump*
D *Tube holder*
E *EPDM seal*
F *Air inlet tube*

1. Carefully unscrew and remove the screw cover with tube holder from the DIPA bottle.
2. Close the DIPA bottle with the original cover.
3. Remove the EPDM seal [E] and replace it with a new one.
4. Pull the air inlet tube [F] out of the tube holder [D].
5. Push the new air inlet tube into the hole of the tube holder which is connected with the tube 1 from air filter [B].
6. Unscrew and remove the original cover from the DIPA bottle and screw the screw cover with tube holder on it instead.
7. Tighten the screw cover well.

6.13. Longer Stop of Operation

Note: *Store all sensors with tip pointing downwards in a frost-protected room.*

1. Shut off the instrument.
2. Stop sample flow.
3. Drain the measuring cell completely.
4. Fill deionized water into the rubber caps of the electrodes.
5. Put the rubber caps on the tips of the electrodes.

pH sensor

1. Unscrew and remove the connector from the pH sensor.
2. Put the connector cap onto the sensor connector.
3. Fill 2 molar KCl (if not available: water) into the rubber cap.
4. Remove the pH sensor from the flow cell and place the rubber cap on the tip of the sensor.

CAUTION

Damage of pH sensor
Wrong storage will damage the pH sensor.
- Never store the pH sensor dry.

Reference sensor

1. Remove the electrolyte bottle from its holder.
   ⚠ *Remember that it is punctured.*
2. Remove the supply pipe from the electrolyte bottle
3. Let the remaining electrolyte in the supply pipe.
4. Seal the supply pipe with a stopper.

Reagent bottle

Remove the DIPA reagent bottle and replace it by an empty one.

Note: *If the DIPA reagent bottle remains connected to the instrument, the DIPA vapor may damage the membrane of the solenoid valve.*

Standard bottle

Remove the standard calibration bottle from the bottle holder and close it.

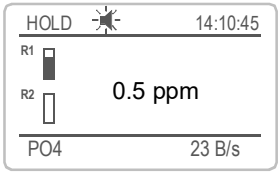
7. Troubleshooting

7.1. Error List

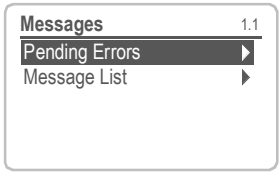
Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded.
Such Errors are marked **E0xx** (bold and black).

Fatal Error (blinking symbol)
Control of dosing devices is interrupted.
The indicated measured values are possibly incorrect.
Fatal Errors are divided in the following two categories:

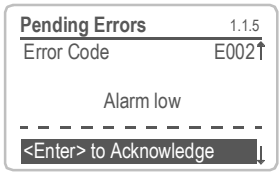
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



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



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	Sodium 1 Alarm high	– check process – check program value 5.3.1.1 and 2, p. 90
E002	Sodium 1 Alarm low	– check process – check program value 5.3.1.1 and 2, p. 90
E003	pH Alarm high	– check process (sample pH > 11.5) – check if dosing valve works correctly – check process, 5.3.1.3, p. 90
E004	pH Alarm low	– check if reagent bottle is empty – refill reagent – sample pH < 2.0
E005	Sodium 2 Alarm high	– check process – check program value 5.3.1.1 and 2, p. 90 – check if 2nd stream is installed 5.1.3, p. 85
E006	Sodium 2 Alarm low	– check process – check program value 5.3.1.1 and 2, p. 90 – check if 2nd stream is installed 5.1.3, p. 85
E007	Sample Temp. high	– check sample temperature – check program value 5.3.1.5, p. 91
E008	Sample Temp. low	– check sample temperature – heck program value 5.3.1.1 and 2, p. 90
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 program value 5.3.1.6, p. 91
E014	Case Temp. low	– check case/environment temperature – check program value 5.3.1.7, p. 91

Error	Description	Corrective action
E017	Control Timeout	– check control device or programming in Installation, Relay 5.3.2 and 5.3.3, p. 91
E018	Reagent empty	– refill Reagent – if Reagent bottle is not empty, check the valve if it is still in working order
E019	No Sample	– establish Sample flow by using the flow regulating valves – check if the tubes are blocked
E020	pH low	– check process – check program value 5.3.1.3, p. 90
E024	Input active	– information that the Input is active – see If Fault Yes is programmed in Menu 5.3.4, p. 95
E026	IC LM75	– call service
E028	Signal output open	– check wiring on signal outputs 1 and 2
E030	EEprom Frontend	– call service
E031	Calibration 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

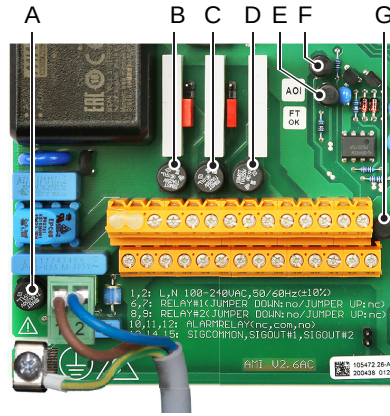
External Voltage.

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. 81

- 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 2.1*	*Designation*	*AMI Sodium A*	
	Version	*V6.20 - 08/16*	
	Factory Test 2.1.3*	*Instrument*	2.1.3.1*
		Motherboard	
		Front End	
	Operating Time 2.1.4*	*Years / Days / Hours / Minutes / Seconds*	2.1.4.1*

Sensors	**Sodium Sensor**	*Current Value*		* Menu numbers
2.2*	2.2.1*	*(Raw value 1)*		
		Cal. History	*Number*	2.2.1.5.1*
		2.2.1.5*	*Date, Time*	
			Offset	
			Slope	
	pH Electrode	*Current Value*		
	2.2.2*	*(Raw value)*		
		Cal. History	*Number*	2.2.2.5.1*
		2.2.2.5*	*Date, Time*	
			Offset	
			Slope	
	Miscellaneous	*Case Temp.*	2.2.3.1*	
	2.2.3*			
Sample	*Sample ID*	2.3.1*		
2.3*	*Temperature*			
	(Nt5k)			
	pH Ctl Actual			
	pH Ctl Average			
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1*	2.4.2*		
	Relay 2			
	Input			
	Signal Output 1			
	Signal Output 2			
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Calibration	*Standard Sodium*	*(Progress)*	
3.1*	3.1.1*		
	Process pH	*Current Value*	
	3.1.2*	*Offset*	
		Process Value	3.1.2.4*
		Save <Enter>	3.1.2.5*

Simulation	*Alarm Relay*	3.2.1*		* Menu numbers
3.2*	*Relay 1*	3.2.2*		
	Relay 2	3.2.3*		
	Signal Output 1	3.2.4*		
	Signal Output 2	3.2.5*		
	Magnetic valve	3.2.6*		
Set Time	*(Date), (Time)*			
3.3*				

8.4. Operation (Main Menu 4)

Sensors	*Filter Time Const.*	4.1.1*		
4.1*	*Hold after Cal.*	4.1.2*		
	Channel selection	4.1.3*		
Relay Contacts	**Alarm Relay**	**Alarm Sodium 1 and 2**	*Alarm High*	4.2.1.x.1*
4.2*	4.2.1*	4.2.1.1* - 4.2.1.2*	*Alarm Low*	4.2.1.x.x*
			Hysteresis	4.2.1.x.x*
			Delay	4.2.1.x.x*
		Alarm pH	*Alarm High*	4.2.1.3.1*
		4.2.1.3*	*Alarm Low*	4.2.1.3.x*
			Hysteresis	4.2.1.3.x*
			Delay	4.2.1.3.x*
	Relay 1 and 2	*Setpoint*	4.2.x.x*	
	4.2.2* and 4.2.3*	*Hysteresis*	4.2.x.x*	
		Delay	4.2.x.x*	
	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)

				* Menu numbers
Sensors	*Sensor type*	*Sodium*		
5.1*	*Temperature*	*NT5K*		
	Channel switch	*None / Auto / User defined / Fieldbus*		5.1.3*
	Standards	*Standard 1*	5.1.5.1*	
	5.1.5*	*Standard 2*	5.1.5.2*	
Signal Outputs	**Signal Output 1 and 2**	*Parameter*	5.2.1.1 - 5.2.2.1*	
5.2*	5.2.1* and 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.x*
		5.2.x.40	*Range High*	5.2.x.40.x*
Relay Contacts	**Alarm Relay**	**Alarm Sodium 1 and 2**	*Alarm High*	5.3.1.x.1*
5.3*	5.3.1*	5.3.1.1* - 5.3.1.2*	*Alarm Low*	5.3.1.x.x*
			Hysteresis	5.3.1.x.x*
			Delay	5.3.1.x.x*
		Alarm pH	*Alarm High*	5.3.1.3.1*
		5.3.1.3*	*Alarm Low*	5.3.1.3.x*
			Hysteresis	5.3.1.3.x*
			Delay	5.3.1.3.x*
		Sample Flow	*Flow Alarm*	5.3.1.4.1*
		5.3.1.4*	*Alarm High*	5.3.1.4.x*
			Alarm Low	5.3.1.4.x*
		Sample Temp.	*Alarm High*	5.3.1.5.1*
		5.3.1.5*	*Alarm Low*	5.3.1.5.x*
		Case Temp. high	5.3.1.6*	
		Case Temp. low	5.3.1.7*	
	Relay 1 and 2	*Function*	5.3.2.1 - 5.3.3.1*	
	5.3.2* - 5.3.3*	*Parameter*	5.3.2.x - 5.3.3.x*	
		Setpoint	5.3.2.x - 5.3.3.x*	
		Hysteresis	5.3.2.x - 5.3.3.x*	
		Delay	5.3.2.x - 5.3.3.x*	
	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*		* Menu numbers
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: View the Designation of instrument.
Version: Firmware of instrument (e.g. V6.20-08/16)

2.1.3 **Factory Test**: Test date of the instrument, motherboard and frontend QC factory test.

2.1.4 **Operating Time**: Years / days / hours / minutes / seconds

2.2 Sensors

2.2.1 **Sodium Sensor:**

o *Current value*: Shows the actual Sodium Sensor signal ppm.
o *Raw value*: Uncompensated potential in mV.

Typical offset of Sodium Sensor	+	125	mV
Max. tolerated offset	≤ ±	20	mV
Typical slope of Sodium Sensor		59	mV/decade Na
Max. limits	±	3	mV

2.2.1.5 **Cal. History:** Shows the diagnostic values of the last calibrations of the sodium electrode.Max. 65 data records are memorized.

2.2.2 **pH Electrode:**

o *Current Value:* Shows the actually measured pH value in pH.
o *Raw value:* Shows the actual electrode voltage in mV.

2.2.2.5 **Cal. History:** Shows diagnostic values of the last pH electrode calibrations Offset in mV and slope in mV/pH.

Typical offset of pH electrode:	< ± 30 mV.
Max. tolerated offset:	< ± 60 mV
Typical slope of pH electrode:	55–65 mV/pH unit.
Max. limits:	40–65 mV/pH

2.2.3 Miscellaneous:

2.2.3.1 *Case Temp*: Read actual 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 actual sample temperature in °C and in Ohm (NT5K).
- *pH Ctl Actual*: actual dosing of Diisopropylamine.
- *pH Ctl Average: average* dosing of Diisopropylamine.

2.4 I/O State

Read actual status of all in- and outputs.

2.4.1/2.4.2

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

2.5 Interface

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

3 Maintenance

3.1 Calibration

In this menu, you can correct measuring values or calibrate offset and slope of pH electrode.

3.1.1 Standard Sodium: Possibility to correct the sodium sensor value. Follow the commands on the screen. Save the value with the <enter> key. See Calibration, p. 64, for more details.

3.1.2 **Process pH:** Correction of pH electrode. See Calibration, p. 64, for details.

3.2 Simulation

To simulate a value or a relay state, select the

- alarm relay,
- relay 1 or 2
- signal output 1 or 2
- valve 1

with the [▲] or [▼] key.
Press the [Enter] key.
Change the value or state of the selected item with the [▲] or [▼] key.
Press the [Enter] key.
⇒ *The value is simulated by the relay/signal output.*

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

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.

3.4 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: 0–6‘000 sec

4.1.31 *Interval:* Only visible if <Channel switch> in menu 5.1.4 is set to <Auto>. The measuring interval can be set in steps of 15 min.
Range: 15 min to 120 min

4.1.32 *Channel selection:* Only visible if <Channel switch> in menu 5.1.4 is set to <User defined>. The following selections are available:

Channel 1: Only channel 1 is measured.

Channel 2: Only channel 2 is measured.

Dig. Input: The channel can be selected via input. Input in menu 5.3.4 is set to <Active = no>.

4.2 Relay Contacts

See 5.3 Relay Contacts, p. 89

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 consists of: Date, time, alarms, measured value, pH, 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 login 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.

5 Installation

5.1 Sensors

- *Sensor type*: Display of the used sensor type.(e.g. Sodium)
- *Temperature*: Display of the temperature sensor type. (e.g. NT5K)

5.1.3 **Channel switch:** For single sample stream select NONE.
If a second sample stream has been installed, select one of the following options, depending on your needs:

- *None:* No channel switch
- *Auto:* Automatic channel switch. The interval can be defined in menu <Operation> 4.1.31, p. 84.
- *User defined:* Channel selection can be defined by the user in menu <Operation> 4.1.32, p. 84.
- *Fieldbus:* Channel switch by fieldbus

5.1.5 **Standards:** Enter the concentration of the standard calibration.

5.1.5.1 *Standard 1:* Solution 1 (low concentration).
Do not select concentrations lower than 100 ppb
Range: 0–20 ppm

5.1.5.2 *Standard 2*: Solution 2 (high concentration).
Select concentration at least 10 times higher than solution 1.
Range: 0–20 ppm

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 equal. 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: Sodium 1 and 2, pH and Temperature.

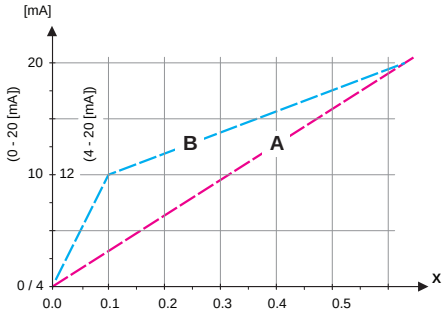
5.2.1.2 *Current Loop:* Select the current range of the signal output.
Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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:

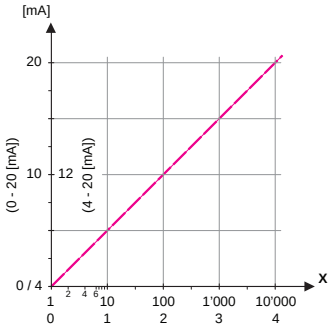
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 86
- Control upwards or control downwards for controllers.
  See As control output, p. 87

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 Sodium 1

5.2.1.40.10 *Range low*: 0 ppb–20 ppm

5.2.1.40.20 *Range high:* 0 ppb–20 ppm

Parameter Sodium 2

5.2.1.40.11 *Range low*: 0–20 ppm

5.2.1.40.21 *Range high:* 0–20 ppm

Parameter pH

5.2.1.40.12 *Range low*: 0 – 14 pH

5.2.1.40.22 *Range high*: 0 – 14 pH

Parameter Temperature

5.2.1.40.13 *Range low*: -30 to +120 °C

5.2.1.40.23 *Range high*: -30 to +120 °C

Parameter Sample flow

5.2.1.40.14 *Not applicable for AMI Sodium A*

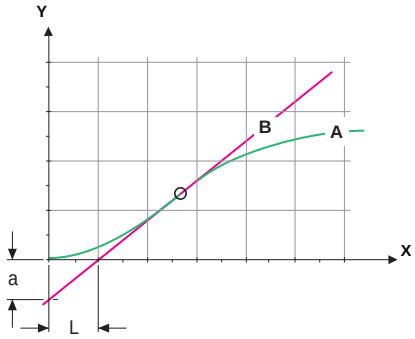
5.2.1.40.24

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/downwards

Setpoint: User-defined process value (Measured value or flow)
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 set-point without overshooting.

5.2.1.43 **Control Parameters:** if Parameters = Sodium1
5.2.1.43.10 *Setpoint*: 0–20 ppm
5.2.1.43.20 *P-Band*: 0–20 ppm

5.2.1.43 **Control Parameters:** if Parameters = Sodium 2
5.2.1.43.11 *Setpoint*: 0–20 ppm
5.2.1.43.21 *P-Band*: 0–20 ppm

5.2.1.43 **Control Parameters:** if Parameters = pH
5.2.1.43.12 *Setpoint*: 0–14 pH
5.2.1.43.22 *P-Band*: 0–14 pH

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

5.2.1.43.13 *Setpoint*: -30 to +120 °C

5.2.1.43.23 *P-Band*: 0–100 °C

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

5.2.1.43.14 *Not applicable for AMI Sodium A*

5.2.1.43.24

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
- Lack of reagents or ion exchanger exhaustion
- Process values out of programmed ranges.

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

- Sodium 1
- Sodium 2
- pH
- sample flow (*Not applicable for AMI Sodium A)*
- sample temperature
- case temperature.

5.3.1.1 and 2 **Alarm Sodium 1 and 2**

5.3.1.x.x *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: 0.00–20.00 ppm

5.3.1.x.x *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: 0.00–20.00 ppm

5.3.1.x.x *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. 0.00–20.00 ppm

5.3.1.x.x *Delay:* During run time plus the delay time the signal and control outputs are held in the operating mode.
Range: 0.00–28‘800 sec

5.3.1.3 **Alarm pH:** Define the measuring value, which should issue an alarm high respectively low.

5.3.1.3.1 *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: 0–14.00 pH

5.3.1.3.25 *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: 0–14.00 pH

5.3.1.3.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value
Range: 0–14.00 pH

5.3.1.3.45 *Delay:* During run time plus the delay time the signal and control outputs are held in the operating mode
Range: 0–28‘800 Sec

5.3.1.4 **Sample Flow:** *Not applicable for AMI Sodium A*

5.3.1.4.1 *Flow Alarm*

5.3.1.4.2 *Alarm High*

5.3.1.4.35 *Alarm Low*

5.3.1.5 **Sample Temperature:** Define the measuring value, which should trigger an alarm high respectively low.

5.3.1.5.1 *Alarm High:* If the sample temperature rises above the programmed value E007 is issued.
Range: 30–70 °C

5.3.1.5.x *Alarm Low:* If the sample temperature falls below the programmed value E008 is issued.
Range: 0–20 °C

5.3.1.6 *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

5.3.1.7 *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: -10–20 °C

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 1 and 2, p. 39.
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 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
- Channel Selection (relay 2 only)

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
Sodium 1	0–20 ppm
Sodium 2	0–20 ppm
pH	0–14 pH
Temperature	-30 to +120 °C
Sample flow	*Not applicable for AMI Sodium A*

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
Sodium 1	0–20 ppm
Sodium 2	0–20 ppm
pH	0–14 pH
Temperature	0 to +100 °C
Sample flow	*Not applicable for AMI Sodium A*

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.

- Sodium 1
- Sodium 2
- pH
- Temperature
- Sample flow (*Not applicable for AMI Sodium A)*

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. 88
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. 88
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. 88
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. 94.
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.

5.3.2.1 Function = Channel Selection:

If the 2nd sample stream option is installed, relay 2 can be used to indicate which channel is selected. No further parameters are needed.

Relay 2 inactive:	Channel 1 is selected
Relay 2 active:	Channel 2 is selected

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.

Note: *If <Channel Selection> in Menu < Installation>/<Sensors> is set to <User defined/Dig. Input>, the Input is set to "Active = no" and can be used to switch the 2nd Sample Stream Option via an external device.*

5.3.4.1 *Active:* Define when the input should be active. The measurement is interrupted during the time the input is 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: 1200–115 200 Baud
5.5.41	Parity:	Range: none, even, odd

5.5.1 *Protocol:* **USB-Stick:**
Only visible if an USB interface is installed. No further settings are possible.

5.5.1 *Protocol:* **HART**
Device address: Range: 0–63

10. Material Safety Data Sheets

10.1. Reagents

Catalogue No.:	A-87.729.010A
Product name:	Etching Kit A
Catalogue No.:	A-87.729.010B
Product name:	Etching Kit B
Catalogue No.:	A-85.141.400
Product name:	Sodium Standard Solution 1’000 ppm
Catalogue No.:	803646
Product name:	Diisopropylamine
Catalogue No.:	A-85.810.200
Product name:	Regeneration solution for sodium electrodes
Catalogue No.:	A-87.892.400
Product name:	Electrolyte for Swansensor Sodium Reference

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.: ..... 180 s
	Hold after Cal.: ..... 300 s
Alarm Relay	..... same as in Installation
Signal Output	..... same as in Installation
Relay 1 and 2	..... same as in Installation
Input	..... same as in Installation
Logger:	Logger Interval: ..... 30 min
	Clear Logger: ..... no

Installation:

Sensor:	Sensor type: ..... Sodium
	Temperature: NT5K
	Channel switch: ..... none
	Standard: Standard 1: ..... 200 ppb
	Standard: Standard 2: ..... 2.00 ppm
Signal Output 1	Parameter: ..... Sodium 1
	Current loop: ..... 4 - 20 mA
	Function: ..... linear
	Scaling: Range low: ..... 0.00 ppb
	Scaling: Range high: ..... 1.00 ppm
Signal Output 2	Parameter: ..... Temperature
	Current loop: ..... 4 - 20 mA
	Function: ..... linear
	Scaling: Temperature: Range low: ..... 0.0 °C
	Scaling: Temperature: Range high: ..... 50.0 °C
	Further Parameters:
	Scaling: pH: Range low: ..... 0.00 pH
	Scaling: pH: Range high: ..... 14.00 pH
	Scaling: Sample Flow: Range low: ..... 0 B/s
	Scaling: Sample Flow: Range high: ..... 1000 B/s
Alarm Relay	Alarm Sodium:
	Alarm high: ..... 20.00 ppm
	Alarm low: ..... 0.00 ppb
	Hysteresis: ..... 10.0 ppb
	Delay: ..... 5 s
	pH: Alarm high: ..... 14.00 pH
	pH: Alarm low: ..... 0.00 pH

pH: Hysteresis: ..... 0.10 pH
pH: Delay: ..... 5 s
Flow Alarm: *Not applicable for AMI*

Sample Temp.: Alarm High: ..... 55 °C
Sample Temp.: Alarm Low: ..... 5 °C
Case temp. high: ..... 65 °C
Case temp. low: ..... 0 °C

Relay1 and 2

Function: ..... Limit upper
Parameter: Relay1 and 2 ..... Soduim 1
Setpoint: Relay1 and 2 ..... 1.00 ppm
Hysteresis: ..... 10 ppb
Delay: ..... 30 s

If Function = Control upw. or dnw:

Parameter: ..... **Sodium 1 and 2**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 1.00 ppm
Settings: Control Parameters: P-band: ..... 10 ppb

Parameter: ..... **pH**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 7.00 pH
Settings: Control Parameters: P-band: ..... 0.10 pH

Parameter: ..... **Temperature**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 30 °C
Settings: Control Parameters: P-band: ..... 1 °C

Parameter: ..... **Sample Flow**
Not applicable for AMI

Common settings
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

12. Index

13. Notes

swan
ANALYTICAL INSTRUMENTS

A-96.250.221 / 250121

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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SWISS MADE

AMI Sodium A