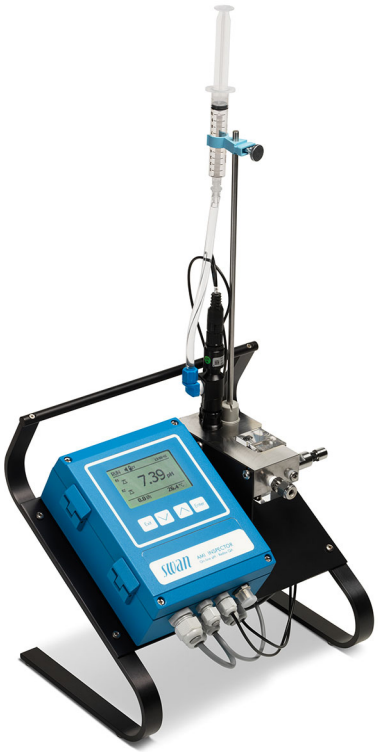
swan
ANALYTICAL INSTRUMENTS

AMI INSPECTOR pH

Version 6.00 and higher



Operator's Manual

A-96.250.761 / 170719

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AMI INSPECTOR pH - 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 significance:

DANGER

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

- Follow the prevention instructions carefully.

WARNING

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

- Follow the prevention instructions carefully.

CAUTION

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

- Follow the prevention instructions carefully.

Mandatory Signs

The importance of the mandatory signs in this manual.

Safety goggles

Safety gloves

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


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

1.2. General Safety Regulations

Legal Requirements

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

Spare Parts and Disposables

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

Modifications

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

WARNING

Risk of Electrical Shock

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

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

WARNING

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

WARNING

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

2. Product Description

This chapter contains technical data, requirements and performance data.

2.1. Description of the System

The portable AMI INSPECTOR instrument is a complete monitoring system mounted on a small panel with supporting stand and a rechargeable battery for stand-alone operation (>24h), designed as an inspection equipment for quality assurance of online process monitors.

pH Measuring Principle (simplified)

The pH measurement is based on a voltage measurement. A voltage can only be measured between two different potentials, therefore, the pH measuring chain contains a measuring electrode and a reference electrode. The reference electrode maintains a constant potential whereas the potential of the measuring electrode changes with the pH value. The voltage which results from this potential difference is measured and displayed on the transmitter as pH value. The measuring chain is designed so that the voltage is zero at pH 7.

pH Electrode

The Swansensor pH SI is a combined electrode with liquid electrolyte (KCl) for the measurement of pH.

Features

General Features of AMI INSPECTORs are:

- Battery life after full charge:
  - >24h at full load (use of 3 relays, USB, signal output, logger)
  - >36h at minimum load (use of logger only)
- Charging time: approx. 6 hours
- Controlled shut-down if battery is empty.
- Display of remaining battery life in hours.
- For longer battery life the back light of the LC Display is disabled.
- Continuous operation using power adapter. The battery should be discharged at least once a month (normal usage until the monitor automatically shuts down).

Battery

The Li-Ion battery is located in the housing of the AMI transmitter. See chapter Power Supply, S. 19 regarding power supply and charging of the battery.

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.

Temperature compensation
The pH value depends on the sample temperature. To compensate temperature fluctuations a temperature sensor is installed in the flow cell

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

USB interface
Built-in USB interface for logger download. Use the USB stick supplied by Swan only (other USB sticks can dramatically reduce battery life).

Relays
Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function.
Rated load: 100 mA/50 V

Signal Output
One programmable signal output for measured values (freely scalable, linear, bilinear or logarithmic) or as continuous control output (control parameters programmable).

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

Flow Cell
Flow cell QV-Flow IS1000 made of stainless steel SS316L with built-in temperature sensor (Pt1000), flow adjustment valve, digital sample flow meter, quick release vessel for easy sensor access and calibration.

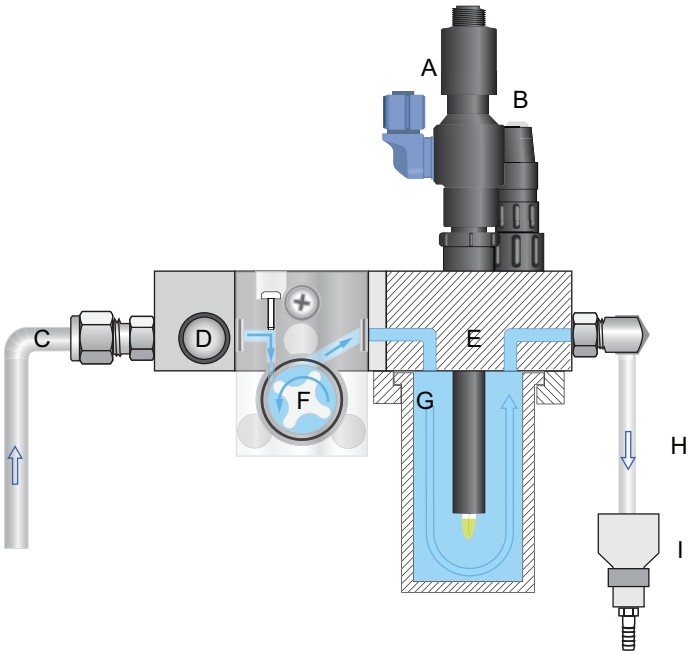
Fluidics

The flow cell (QV-Flow) consists of the flow cell block [E] and the vessel [G].

The pH sensor [A] and the temperature sensor [B] are screwed into the flow cell block [E].

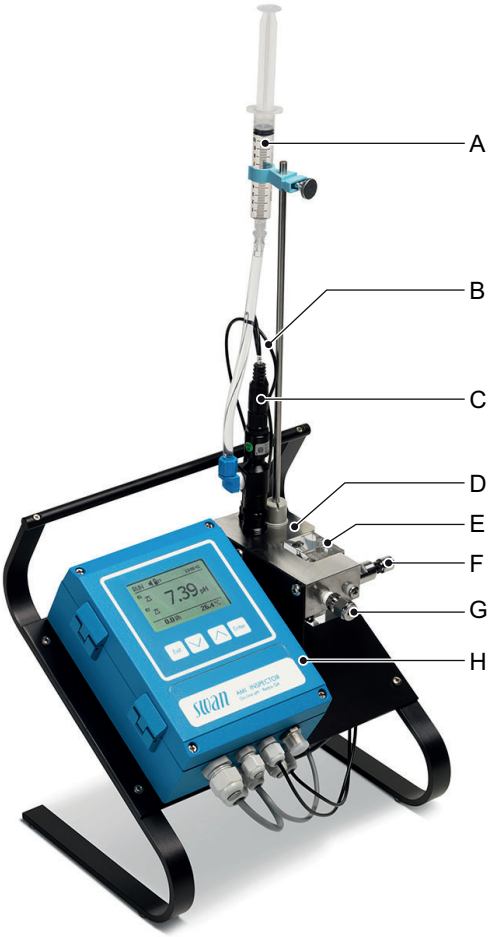
The sample enters at the sample inlet [C]. It flows through the flow regulating valve [D], where the flow rate can be adjusted. Then the sample flows via the flow sensor [F] and the flow cell block [E] into the vessel [G], were the pH of the sample is measured. The pH value depends on the sample temperature. The measuring value of the temperature sensor [B] is used to recalculate the pH measuring value to a predefined average sample temperature.

The sample leaves the vessel via flow cell block through the sample outlet [H] and flows into the drain [I].



A *pH Sensor*
B *Temperature sensor*
C *Sample inlet*
D *Flow regulating valve*
E *Flow cell block*
F *Flow sensor*
G *Vessel*
H *Sample outlet*
I *Drain*

2.2. Instrument Overview



A *KCl reservoir*
B *Temperature sensor (cable)*
C *pH sensor*
D *Flow cell*
E *Flow sensor*
F *Flow regulating valve*
G *Sample inlet*
H *AMI Transmitter*

2.3. Technical Data

Power Supply

Battery

Use original, supplied power adapter only.

Voltage:	85–265 VAC, 50/60 Hz
Power consumption:	max. 20 VA
Charging Time:	~ 6h
Battery type:	Li-Ion

During charging protect from heat impact and keep splash-proof (not IP66).

Measuring Range

pH:	1 to 12 pH
Resolution:	0.01 pH

Temperature Input

for Pt1000 type sensor

Measuring range:	- 30 to +130 °C
Resolution:	0.1 °C

Sample conditions

Flow Rate:	5–10 l/h
Temperature:	up to 50 °C
Inlet pressure:	0.2–2 bar

Temperature monitoring

Alarm if the transmitter temperature is higher than + 65 °C or lower than 0 °C.

3. Installation

3.1. Installation Checklist

Check	◆ Instrument's specification must conform to your AC power ratings. See External power adapter, p. 20. ◆ Check if the battery is fully charged.
Installation	◆ Connect sample inlet and outlet to the flow cell.
pH electrode	◆ Install the sensor (see Install Swansensor pH SI, p. 14). ◆ Connect sensor cables. ◆ Store the protective caps for later use.
Power-up	◆ Turn on the sample flow and wait until the flow cell is completely filled. ◆ Switch on power.
Instrument set-up	◆ Adjust sample flow. ◆ Program all parameters for sensor. ◆ Program all parameters for instrument operation (limits, alarms).
Run-in period	◆ Let the instrument run continuously for 1 h.

3.2. Connecting Sample Inlet and Outlet

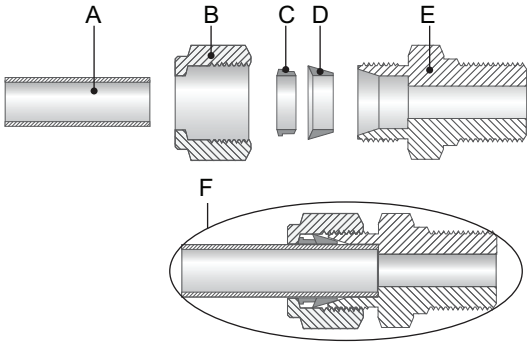
3.2.1 Swagelok Fitting Stainless Steel at Sample Inlet

Preparation

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

Installation

1. Insert the compression ferrule [C] and the compression cone [D] into the union nut [B].
2. Screw on the union nut onto the body, do not tighten it.
3. Push the stainless steel pipe through the union nut as far as it reaches the stop of the body.
4. Tighten down the union nut 1¾ rotation using an open ended spanner. Hold Body from turning with a second wrench.



A *Tube*
B *Union nut*
C *Compression ferrule*
D *Compression cone*
E *Body*
F *Tightened connection*

3.2.2 Connect the Sample Outlet

Connect the 1/2” tube to the waste funnel of the AMI INSPECTOR pH.

3.3. Install Swansensor pH SI

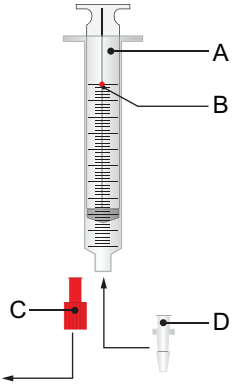
The pH electrode SI is packed separately and protected with a cap filled with KCl. After the AMI INSPECTOR pH has been installed and connected to the sample line, install the pH electrode SI as follows:

CAUTION

Fragile parts.
The pH electrode is fragile.
- Handle with care.
- Do not spill KCL when removing the protection cap.

Prepare the KCl Reservoir

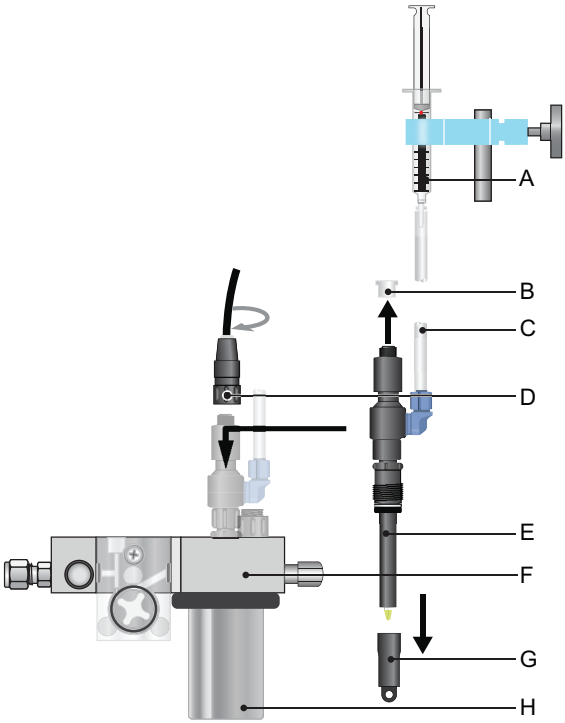
The KCl supply to the reference electrode is ensured by a syringe [A] with a volume of 10ml. The syringe is connected to the reference electrode with a Luer-Lock connector [D].
To ensure a continuous flow of KCl to the reference electrode, pull the plunger of the syringe over the punched hole [B].



A *Syringe*
B *Punched hole*
C *Luer-Lock seal cone*
D *Luer-Lock connector*

1. Remove the Luer-Lock seal cone [C] from the tip of the syringe [A].
2. Insert the Luer-Lock connector [D] into the tip of the syringe.

Install the Electrode



A *Syringe (KCl reservoir)*
B *Connector cap*
C *KCl supply tube*
D *Connector*
E *Electrode*
F *Flow cell block QV-Flow*
G *Protective cap*
H *Calibration vessel*

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

2 Rinse the electrode tip with clean water.

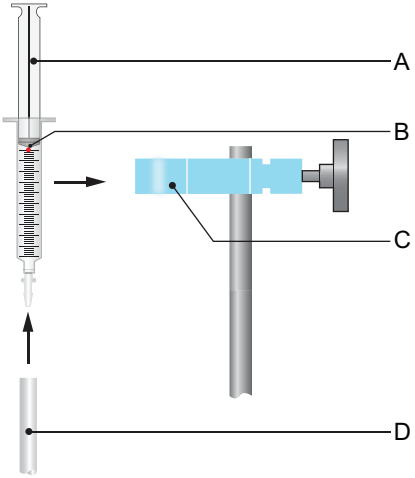
3 Insert the electrode through the flow cell block [F] into the calibration vessel [H].

4 Tighten it hand-tight.

5 Remove the connector cap [B].

6 Screw the connector [D] marked with pH onto the sensor.

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



A *Plunger*
B *Punch hole*
C *Holder*
D *KCl supply tube*

1 Fill the KCl supply tube [D] of the electrode completely with electrolyte.

⇒ *Ensure that no air bubbles remain in the tube.*

2 Fill the syringe completely with electrolyte by pulling the plunger just below the punch hole [B].

3 Connect the syringe to the KCl supply tube (Luer-Lock) and clip it to the holder [C].

4 Pull the plunger slightly over the air hole.

3.4. Temperature Sensor

The temperature sensor is permanently glued to the flow cell block. Screw the connector marked with T onto the temperature sensor.

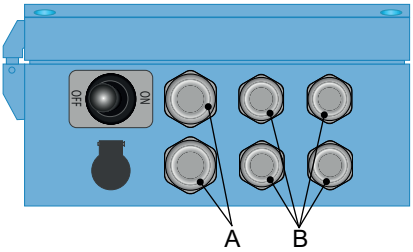
3.5. Electrical Connections

WARNING

Always turn off DC power before manipulating electric parts. Make sure the power specification of the wall mount adapter corresponds to the power on site.

Cable thicknesses

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



A *PG 9 cable gland: cable $Ø_{outer}$ 4–8 mm*

B *PG 7 cable gland: cable $Ø_{outer}$ 3–6.5 mm*

NOTICE: *Protect unused cable glands*

Wire

- For 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.

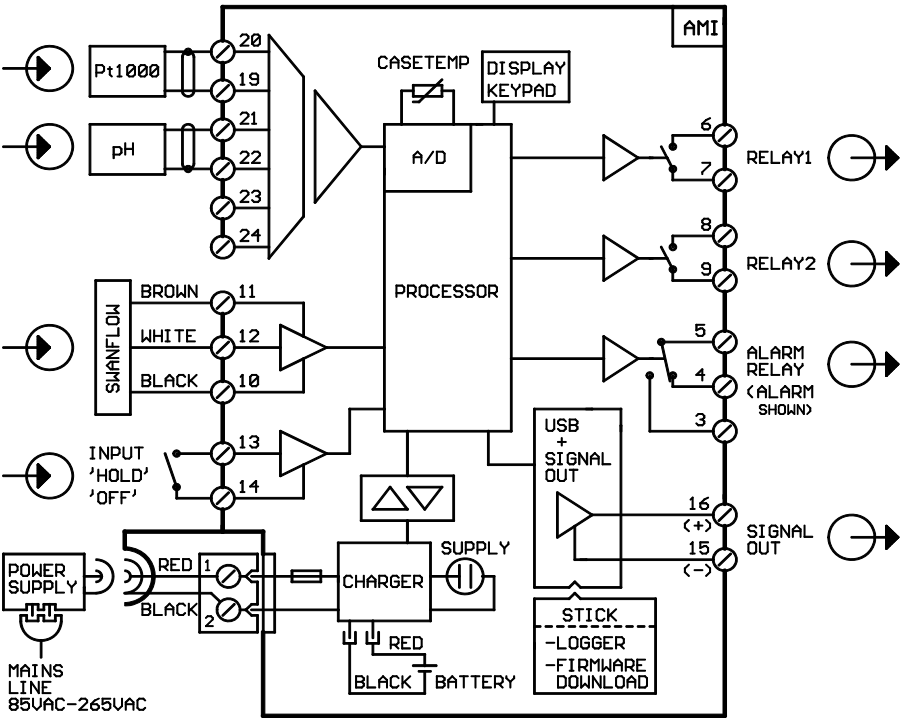
WARNING

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

3.5.1 Connection Diagram



CAUTION

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

3.5.2 Power Supply

Contrary to all other Swan online process monitors the AMI INSPECTOR transmitter is supplied with power by battery only. The rechargeable battery (Li-Ion) enables a stand-alone operation for at least 24 hours.

WARNING

Do not provide power directly to the transmitter as this will destroy the motherboard. All AMI INSPECTOR transmitters are supplied with power by battery only.

Charging

Use the original supplied power adapter to charge AMI INSPECTOR only. Charging time: approx 6h.

Fully charged stand-alone operating time of at least 24h is guaranteed:

- >24h at full load (use of 3 relays, USB, signal output, logger)
- >36h at minimal load (use of logger only)

In case that the battery is discharged completely the firmware will automatically shut down.

Switch Power ON - OFF

Switch the instrument ON or OFF using the toggle switch on the transmitter.

Continuous operation

For continuous operation use the power adapter as well.

CAUTION

- If the AMI powers ON and then immediately shuts OFF, the battery is empty. Do not hold the toggle switch in ON position, as this can damage the battery.

CAUTION

- During charging protect from heat impact and keep splash-proof (plug of power adapter is not IP66).
- Do not supply external devices, e.g. pumps, magnetic valves or any other current consumers with AMI INSPECTOR.

CAUTION

- Use the original supplied power adapter to charge AMI INSPECTOR only. Use of any other power adapter can damage the battery or cause malfunction.

External power adapter

- Universal input range 85 - 265 VAC
- Continuous short circuit protection
- Over voltage protection
- LED indicator for power on
- 2-pin AC inlet (IEC 320-C8) for country-specific power cord

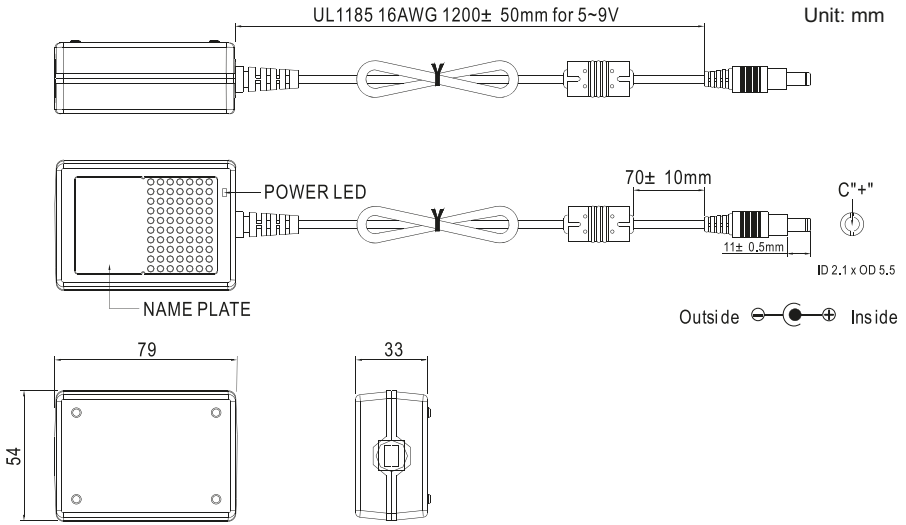
Power cords

Two different power cords are supplied:

- Power cord with type C plug (Europlug)
- Power cord with type A plug (NEMA-1)

If a different plug type is needed, please purchase a suitable power cord from your local supplier.

Dimensions



3.6. Relay Contacts

Programming of the relay contacts see 5.3 Relay Contacts, p. 59.

3.6.1 Input

NOTICE: *Use only potential-free (dry) contacts.*

Terminals 13/14

If signal output is set to hold, measurement is interrupted if input is active.

For programming see menu 5.3.4, p. 65.

3.6.2 Alarm Relay

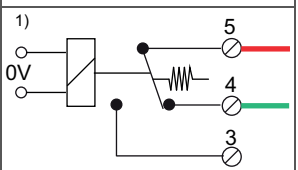
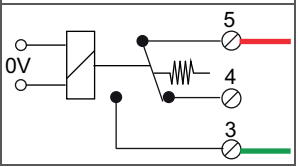
NOTICE: *For resistive loads only; do not use with capacitive or inductive loads. Max. load 1 A/250 VAC.*

Alarm output for system errors.

Error codes see Error List, p. 42.

Programming see 5.3.1, p. 59

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

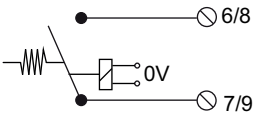
	Terminals	Description	Relay connection
NC[1] Normally Closed	5/4	Active (opened) during normal operation. Inactive (closed) on error and loss of power.	
NO Normally Open	5/3	Active (closed) during normal operation. Inactive (opened) on error and loss of power.	

1) *usual use*

3.6.3 Relay 1 and 2

NOTICE: *For resistive loads only; do not use with capacitive or inductive loads. Max. load 100 mA/50 V.*

For programming see Menu Installation 5.3.2/3, p. 61.

	Terminals	Description	Relay connection
NO 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.	

3.7. Signal Output

The signal output 0/4–20 mA PCB is plugged onto the USB interface PCB.

NOTICE: *Max. burden 510 Ω.*

Terminals 16 (+) and 15 (-).
For programming see menu 5.2 Signal Outputs, p. 55.

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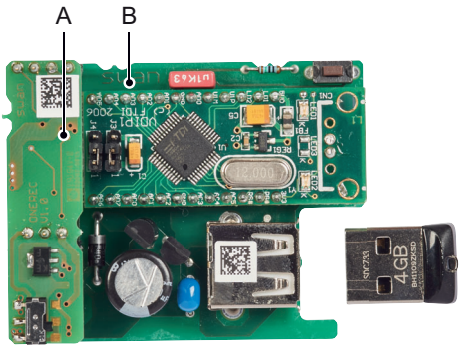


A *Signal output 0/4–20 mA PCB*
B *USB interface*

4. Instrument Setup

4.1. Establish Sample Flow

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

4.2. Programming

Programming

Set all necessary sensor parameters in menu 5.1 Installation/Sensors, further information see 5.1 Sensors, S. 54:

- Type of sensor: set type of sensor to pH.
- Flow measurement: Set the flow measurement to Q-flow.
- Temperature: set Temp. Sensor to yes
- Standards: Program the buffer values (pH buffer table) if you do not use the SWAN standards.

NOTICE: *The standards must be ordered separately.*

Program all parameters for instrument operation (limits, alarms). See Program Overview, S. 45, for explanations, see Program List and Explanations, S. 50.

Calibration of pH electrode

The instrument should be operating for 1 h before performing a pH calibration.
Calibrate the pH electrode with two buffers, e.g. pH 7.00 and pH 9.00. See Calibration, S. 31, for details.

Set Buffer Values

Please note that this list is only valid for Swan buffers. If you use different buffers please ask the manufacturer.

The temperature curves for the buffer solutions for:

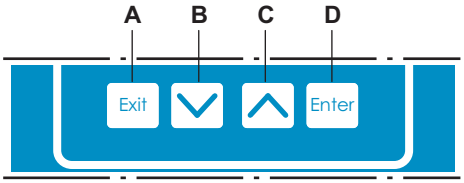
- Standard 1 = pH7
- Standard 2 = pH9

are already implemented in the transmitter firmware. To program the temperature curve for the buffer solution pH4 overwrite standard 2.

Temperature	Value pH7	Value pH9	Value pH4
Buffer value at 0°C	**7.13**	**9.24**	
Buffer value at 5°C	**7.07**	**9.16**	**3.99**
Buffer value at 10°C	**7.05**	**9.11**	**3.99**
Buffer value at 15°C	**7.02**	**9.05**	**3.99**
Buffer value at 20°C	**7.00**	**9.00**	**3.99**
Buffer value at 25°C	**6.98**	**8.95**	**4.01**
Buffer value at 30°C	**6.97**	**8.91**	**4.01**
Buffer value at 35°C	**6.96**	**8.88**	
Buffer value at 40°C	**6.95**	**8.85**	**4.03**
Buffer value at 50°C	**6.95**	**8.79**	**4.05**
Buffer value at 60°C			**4.09**

5. Operation

5.1. Keys



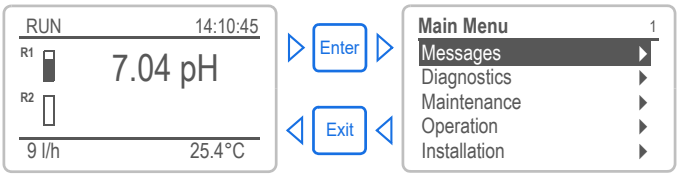
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

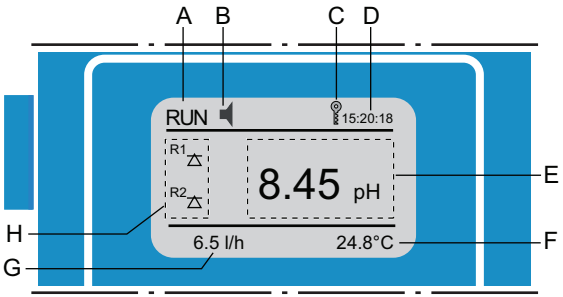
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Display



A RUN — normal operation

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

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

B ERROR — Error — Fatal Error

C Battery status (remaining operating time in h)

D Time

E Process values

F Sample temperature

G Sample flow

H Relay status

Relay status, symbols

upper/lower limit not yet reached

upper/lower limit reached

control upw./downw. no action

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

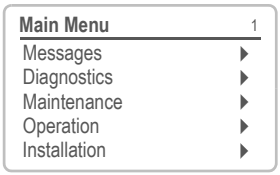
motor valve closed

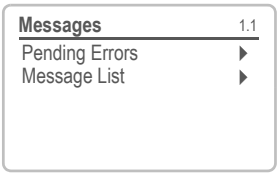
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

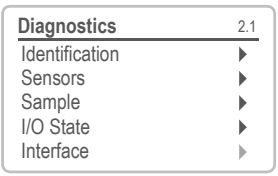
5.3. Software Structure





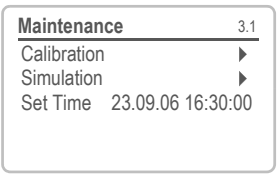
Menu **Messages 1**

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



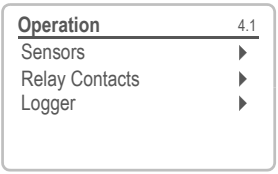
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



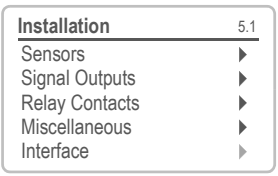
Menu **Maintenance 3**

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



Menu **Operation 4**

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



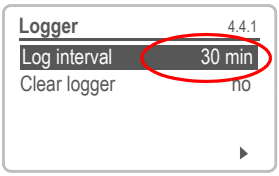
Menu **Installation 5**

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

5.4. Changing Parameters and values

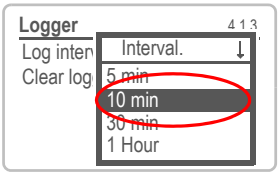
Changing parameters

The following example shows how to change the logger interval:



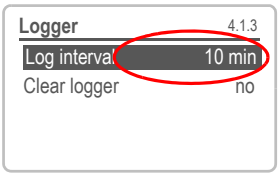
1 Select the parameter you want to change.

2 Press <Enter>



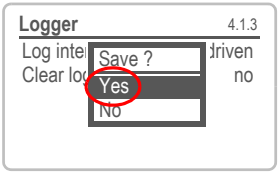
3 Press < ▲ > or< ▼ > to highlight the required parameter.

4 Press <Enter> to confirm the selection or <Exit> to keep the previous parameter).



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

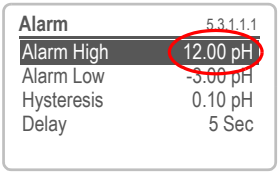
5 Press <Exit>.



⇒ *Yes is highlighted.*

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

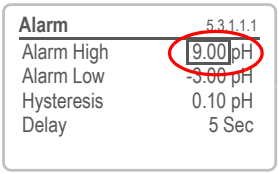
Changing values



1 Select the value you want to change.

2 Press <Enter>.

3 Set required value with < ▲ > or< ▼ >.



4 Press <Enter> to confirm the new value.

5 Press <Exit>.
⇒ *Yes is highlighted.*

6 Press <Enter> to save the new value.

6. Maintenance

6.1. Maintenance Table

Swansensor pH SI

Weekly	Check level in syringe. If necessary refill.
Monthly	Calibrate electrode.
Quarterly	Open cap of reference electrode slightly and let flow out 5 ml of electrolyte. Fasten cap hand-tight.

6.2. Stop of Operation for Maintenance

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

6.3. Maintenance of Electrode

WARNING

Chemicals can be toxic, caustic, and flammable.

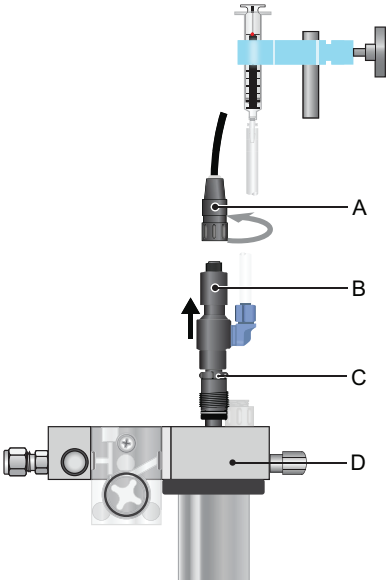
- Read the Material Safety Data Sheets (MSDS) first.
- Only persons trained in handling dangerous chemicals are allowed to prepare the reagents.
- Wear suitable protective clothing, gloves and eye/face protection.

6.3.1 Clean pH SI Electrode

NOTICE: *Do not put the electrode into acids to clean it.*

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

1 Unscrew and remove the connector [A] from the electrode [B].
2 Unscrew and remove the electrode [B] from the flow cell block by turning the union screw [C] counterclockwise.



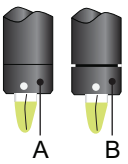
A *Connector*
B *Electrode*
C *Union screw*
D *Flow cell block*

Clean pH Electrode

1 If necessary wipe the electrode shaft and the green tip cautiously with a soft, clean, and damp paper tissue.

2 Remove grease with a tissue moistened with alcohol.

3 Slightly open the sensor cap of reference electrode and let flow out about 5 ml of electrolyte.



A *Sensor cap tightened*
B *Sensor cap slightly opened*

4 Rinse the electrode tip thoroughly with clean water.

5 Tighten the sensor cap hand tight.

6 Install the electrode into the flow cell again.

7 Let the electrode run-in for 1 h before the first calibration.

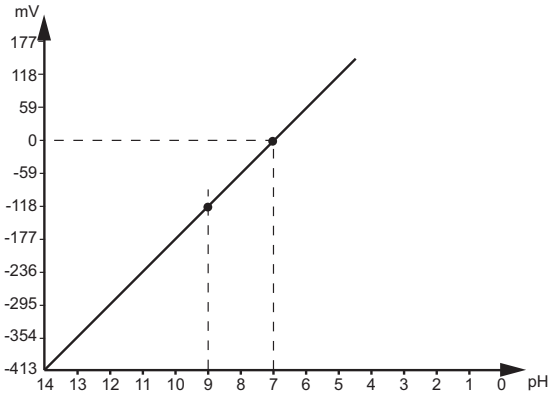
6.4. Calibration

Process pH Calibration

The process calibration is based on a comparative measurement of the on-line instrument with a calibrated comparative electrode. Perform a valid manual measurement with the calibrated comparative electrode. Then compare the measuring value with the on-line instrument and if necessary, enter the correct measuring value in the menu <Maintenance/Electrode 1/2/Process Cal.> of the on-line instrument.
The deviation of the measuring values is shown as offset in mV. Select <Save> and press <Enter> to save the correct measuring value.

Standard pH Calibration

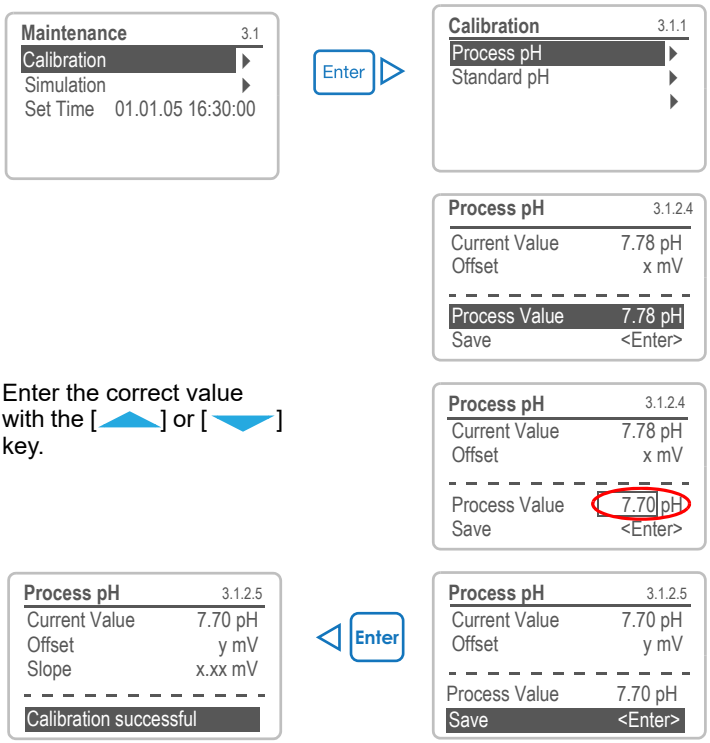
The ideal pH electrode has an offset of 0 mV at pH 7 and a slope of 59.16 mV/pH unit. Real electrodes differ from this ideal. Therefore, pH electrodes are calibrated with two buffer solutions, of different pH values.



Process Calibration pH

Use a Chematest 25 photometer (or equivalent) to determine the sample pH value.

***NOTICE:** Make sure your reference instrument is calibrated correctly!*



Possible error message

Offset error:

- Last calibration wrong.
- Electrode old or dirty.
- Cable wet or brocken.
- Reference measuring wrong

6.5. Quality Assurance of the Instrument

Every SWAN on-line instrument is equipped with integrated, autonomous quality assurance functions to survey the plausibility of each measurement.

For AMI pH-Redox these are:

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

Further a manual, menu driven inspection procedure can be carried out using a certified reference instrument. Running at the same sampling point as an inspection equipment, the AMI Inspector pH verifies the measuring results. After enabling the quality assurance procedure by defining the quality assurance level, the instrument reminds the user periodically to run the procedure and results are stored in a history for review.

Quality assurance level

Central feature of the quality assurance function is the assignment of the monitored process to a Quality assurance level.

There are three predefined levels plus a user level. Hereby the inspection interval, the deviation limits of temperature and measuring result between the inspection equipment and the monitoring instrument are defined.

- Level 1: Trend; Measurement used as an additional information to follow the process indicating trends.
- Level 2: Standard; Monitoring of several parameters of a process (e.g. oxygen, hydrazine and pH in feedwater). In case of instrument failure, other parameters can be used for process monitoring.
- Level 3: Crucial; Monitoring of critical processes, value is used for control of another part or subsystem (valve, dosing unit, etc.).

Additional level:

- Quality level 4: User; User defined inspection interval, maximal deviation of temperature and measuring result.

Limits and interval for AMI pH-Redox:

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

a) sample temperature must have 25°C +/- 5°C.

Procedure The standard workflow contains following procedures:

1. Activate SWAN Quality assurance procedure, p. 44
2. Pre-test, p. 45
3. Connect instruments, p. 45
4. Carry out comparison measurement, p. 47
5. Completion of the measurement, p. 48

NOTICE: *The procedure should only be carried out through qualified personnel.*

Materials / Inspection equipment:

- Reference instrument: AMI Inspector pH
- Two tubes made of FEP

6.5.1 Activate SWAN Quality assurance procedure

Enable quality assurance procedure at each instrument by selecting the quality level in menu 5.1.2.1 Quality Assurance [Installation\Sensors].

The corresponding submenus are then activated.

NOTICE: *The activation is necessary the first time only.*

6.5.2 Pre-test

- Reference instrument: AMI INSPECTOR pH:
  - Check certificate; reference instrument certificate not older then one year.
  - Check battery; Battery of the AMI INSPECTOR pH should be completely charged. Remaining operating time on display minimum 20 hours.
  - Disable temperature compensation (set to “none”)
- On-line instrument: Monitor AMI pH/Redox:
  - Good order and condition; Flow cell free of particles, Sensor surface free of deposits.
  - Check message list; Review the message list in menu 1.3 and check for frequently alarms (as for example flow alarms). If alarms occur frequently remove cause before starting the procedure.

6.5.3 Connect instruments

The AMI Inspector pH sample inlet is equipped with a serto fitting for stainless steel pipes. To connect the sample stream to the AMI Inspector pH proceed according to chapter Serto Fitting Stainless Steel, S. 32. The choice of sampling depends strongly on local conditions on site. Possible sampling:

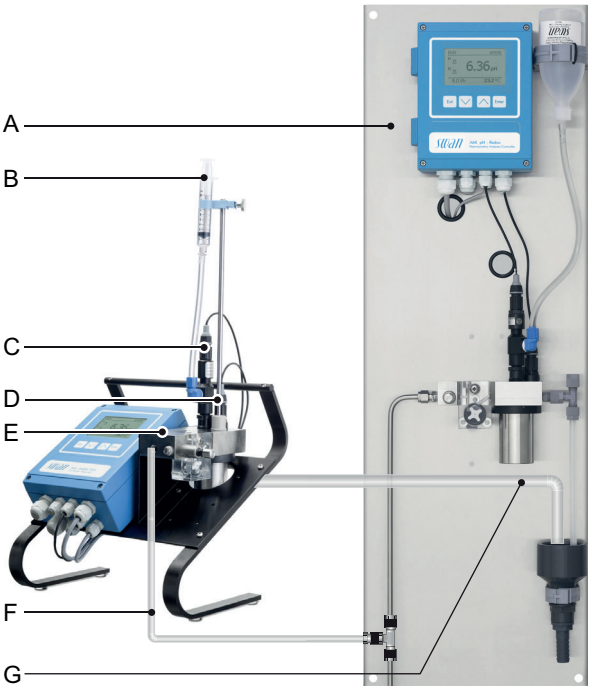
- via Sample point,
- via T-fitting or
- as piggyback / downstream

NOTICE: *Important for correct measurements are in any case:*

- *sample as near as possible to the process monitor,*
- *wait approx. 10 minutes, whilst measurement is running, until measurement value and temperature are stabilized.*

Example: Sampling via T-fitting

The reference instrument, AMI Inspector pH, is connected parallel to the Monitor AMI pH-Redox by installing a T-Fitting at the sample inlet tube and dividing the sample stream to each instrument.



A *Monitor AMI pH-Redox*
B *KCl reservoir*
C *pH electrode*
D *Temperature sensor*
E *Flow cell block*
F *Sample inlet*
G *Sample outlet*

1 Stop sample flow to the monitor AMI pH-Redox by closing the appropriate valve, e.g. back pressure regulator, sample preparation or flow regulating valve at flow cell.

2 Connect sample line of the Monitor AMI pH-Redox [A] with the sample inlet of the reference instrument AMI INSPECTOR pH. Use the supplied tube, made of FEP.

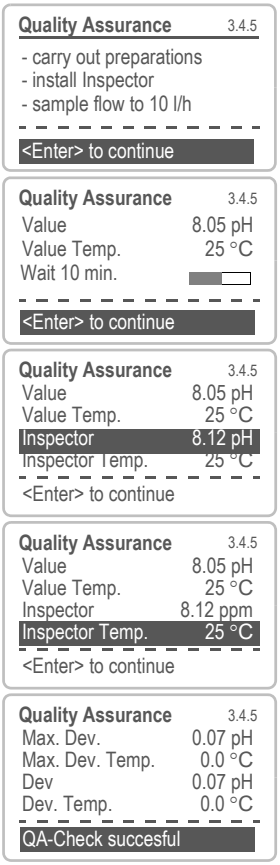
3 Connect sample outlet of the reference instrument AMI INSPECTOR pH to the sample outlet funnel of the monitor.

4 Switch on AMI INSPECTOR pH. Open the flow regulating valve and regulate the sample flow.

6.5.4 Carry out comparison measurement

The comparison measurement is menu driven. Start by selecting Quality assurance in menu 3.4 of the monitor AMI pH-Redox.

***NOTICE:** Temperature compensation is automatically deactivated during comparison measurement.*



1 Carry out pre test preparations.
Connect instruments.
Regulate sample flow to 10 l/h using the appropriate valve.

2 Wait 10 minutes whilst measurement is running.
<Enter> to continue.

3 Read the pH value of the reference instrument and enter under “Inspector.” by using the Up/Down keys. <Enter> to confirm.

4 Read temperature value of the reference instrument and enter under “Inspector Temp.” busing Up/Down keys. <Enter> to confirm.

<Enter> to continue.

5 - Review result.
- Results are saved in QA-History regardless if successful or not.

If QA-Check is not successful it is recommended to clean the sensor, see Maintenance of the Sensor, p. 36.If QA-Check fails again contact your local SWAN distributor for support.

6.5.5 Completion of the measurement

1. Stop the sample flow to the AMI pH-Redox by closing the appropriate valve, e.g. back pressure regulator, sample preparation or flow regulating valve at flow cell again.
2. Close flow regulating valve of the AMI Inspector pH.
3. Disconnect the AMI Inspector pH by removing the tubes and connect the sample outlet of the Monitor AMI pH-Redox to the sample outlet funnel again.
4. Start sample flow again and regulate sample flow.
5. Shutdown AMI Inspector pH.

If the instrument will not be used for a longer period of time, see Longer Stop of Operation, S. 41.

6.6. Replacing Fuses

WARNING

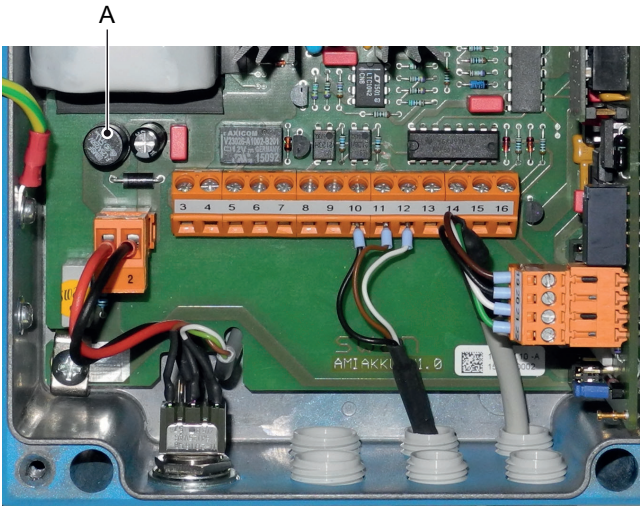
External Voltage.

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

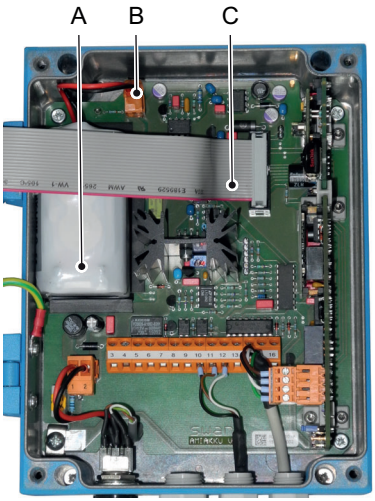
Find and repair the cause for the short circuit before replacing the fuse. Use tweezers or needle-nosed pliers to remove the defective fuse.

Use original fuses provided by SWAN only.



A *1.25 AF/250V Instrument power supply*

6.7. Replacing the Battery



A Battery
B Battery plug
C Ribbon cable

1 Switch the AMI Inspector off.

2 If connected, disconnect the power adapter from the power jack.

3 Open the transmitter housing.

4 Pull out the ribbon cable [C] from the mainboard.

5 Disconnect battery plug [B] and replace the battery.

6.8. Longer Stop of Operation

1. Stop sample flow.
2. Shut off power of the instrument.
3. Unscrew and remove the connector from the electrode.
4. Put the connector cap on it.
5. Remove the electrode from the flow cell and rinse it well with clean water.
6. Fill 3.5 molar KCl (if not available: clean water) into the protective cap and put it on the tip of the electrode.
7. Store the electrode with the tip pointing downwards in a frost-protected room.
8. Stop flow of KCl by pushing the plunger of the syringe under the air hole.
9. Empty and dry the calibration vessel.

CAUTION

Damage of pH sensor

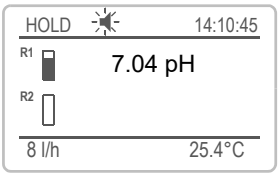
Wrong storage will damage the pH sensor.

- Never store the pH sensor dry.
- Store the pH sensor with tip pointing downwards in a frost-protected room.

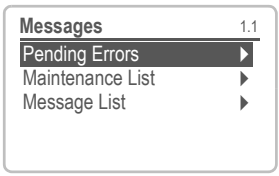
7. Error List

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

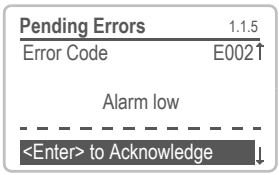
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



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



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



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

Error	Description	Corrective action
E001	Alarm high	– check process – check programmed value, see 5.3.1.1.1, S. 59
E002	Alarm low	– check process – check programmed value, see 5.3.1.1.26, S. 59
E007	Sample Temp. high	– check process – check programmed value, see 5.3.1.3.1, S. 60
E008	Sample Temp. low	– check process – check programmed value, see 5.3.1.3.26, S. 60
E009	Sample Flow high	– check sample flow – check programmed value, see 5.3.1.2.2, S. 60
E010	Sample Flow low	– establish sample flow – clean instrument – check programmed value, see 5.3.1.2.36, S. 60
E011	Temp. shorted	– Check wiring of temperature sensor – Check temperature sensor
E012	Temp. disconnected	– Check wiring of temperature sensor – Check temperature sensor
E013	Case Temp. high	– check case/environment temperature – check programmed value, see 5.3.1.4, S. 60
E014	Case Temp. low	– check case/environment temperature – check programmed value, see 5.3.1.5, S. 60
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 see 5.3.2/3, S. 61
E024	Input active	– See If Fault Yes is programmed in Menu see 5.3.4, S. 65

Error	Description	Corrective action
E026	IC LM75	– call service
E030	EEProm Frontend	– call service
E031	Cal. Recout	– call service
E032	Wrong Frontend	– call service
E033	Power-on	– none, normal status
E034	Power-down	– none, normal status

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, S. 50

- 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	*Pending Errors*	1.1.5*	* Menu numbers
1.1*			
Message List	*Number*	1.2.1*	
1.2*	*Date, Time*		

8.2. Diagnostics (Main Menu 2)

Identification	Desig.	AMI pH/Redox		* Menu numbers
2.1*	Version	V6.00-10/15		
	Factory Test	*Instrument*	2.1.3.1*	
	2.1.3*	*Motherboard*		
		Front End		
	Operating Time	*Years / Days / Hours / Minutes / Seconds*		2.1.4.1*
	2.1.4*			
Sensors	Electrode	*Current Value pH*		
2.2*	2.2.1*	*(Raw value) mV*		
		Cal. History	*Number*	2.2.1.5.1*
		2.2.1.5*	*Date, Time*	
			Offset	
			Slope	
	Miscellaneous	*Case Temp.*	2.2.2.1*	
	2.2.2*			
Sample	*Sample ID*	2.3.301*		
2.3*	*Temperature*			
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1/2*	2.4.2*		
	Input			
	Signal Output 3			
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Calibration	Process pH	*Process pH*	3.1.1.4*	* Menu numbers
3.1*	3.1.1*			
	Standard pH	*Standard pH*	3.1.2.5*	
	3.1.2*			
Simulation	*Alarm Relay*	3.2.1*		
3.2*	*Relay 1*	3.2.2*		
	Relay 2	3.2.3*		
	Signal Output 3	3.2.4*		
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*		
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	4.2.1.1.1*
4.2*	4.2.1*	4.2.1.1*	*Alarm Low*	4.2.1.1.26*
			Hysteresis	4.2.1.1.36*
			Delay	4.2.1.1.46*
	Relay 1 / 2	*Setpoint*	4.2.x.100*	
	4.2.2* - 4.2.3*	*Hysteresis*	4.2.x.200*	
		Delay	4.2.x.30*	
	Input	*Active*	4.2.4.1*	
	4.2.4*	*Signal Outputs*	4.2.4.2*	
		Output / Control	4.2.4.3*	
		Fault	4.2.4.4*	
		Delay	4.2.4.5*	
Logger	*Log Interval*	4.3.1*		
4.3*	*Clear Logger*	4.3.2*		* Menu numbers

8.5. Installation (Main Menu 5)

Sensors	**Flow**	*Flow measurement*	5.1.1.1*	* Menu numbers
5.1*	5.1.1*			
	Parameter	Type of sensor	5.1.2.1*	
	5.1.2*	*Sensor Check*	5.1.2.2*	
	Temperature	*Temp. Sensor*	5.1.3.1*	
	5.1.3*	*Default Temp.*	5.1.3.21*	
		Temp. Compensation	*Comp.*	5.1.3.3.1*
		5.1.3.3*		
	Standards	**Standard 1**	*@ 0 °C–50 °C*	5.1.40.1.1–10*
	5.1.40*	5.1.40.1*		
		Standard 2	*@ 0 °C–50 °C*	5.1.40.2.1–10*
		5.1.40.2*		
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1 - 5.2.2.1*	
5.2*	5.2.1* - 5.2.2*	*Current Loop*	5.2.1.2 - 5.2.2.2*	
		Function	5.2.1.3 - 5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.10/10*
	5.2.x.40		*Range High*	5.2.x.40.20/20*
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.26
			Hysteresis	5.3.1.1.36
			Delay	5.3.1.1.46
		Sample Temp.	*Alarm High*	5.3.1.3.1*
		5.3.1.3	*Alarm Low*	5.3.1.3.26*
		Case Temp. high	5.3.1.5*	
		Case Temp. low	5.3.1.60*	
	Relay 1/2	*Function*	5.3.2.1–5.3.3.1*	
	5.3.2* - 5.3.3*	*Parameter*	5.3.2.20–5.3.3.20*	
		Setpoint	5.3.2.300–5.3.3.301*	
		Hysteresis	5.3.2.400–5.3.3.401*	
		Delay	5.3.2.50–5.3.3.50*	
	Input	*Active*	5.3.4.1*	
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	* Menu numbers

Miscellaneous	*Language*	5.4.1*		
5.4*	*Set defaults*	5.4.2*		
	Load Firmware	5.4.3*		
	Password	*Messages*	5.4.4.1*	
	5.4.4*	*Maintenance*	5.4.4.2*	
		Operation	5.4.4.3*	
		Installation	5.4.4.4*	
	Sample ID	5.4.5*		
Interface	*Protocol*	5.5.1*		(only with RS485
5.5*	*Device Address*	5.5.21*		interface)
	Baud Rate	5.5.31*		
	Parity	5.5.41*		* Menu numbers

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

Desig.: Designation of the instrument.
Version: Firmware of instrument (e.g. V6.00-10/15)

2.1.3 **Factory Test**: Test date of the Instrument and Motherboard

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

2.2 Sensors

2.2.1 Electrode:

Current value: Shows the actual measuring value in pH or mV.
Raw value: Shows the actual measuring value in mV.

2.2.1.5 *Cal. History:* Review diagnostic values of the last calibrations.
pH: Number; Date, Time, Offset, Slope
or
mV: Number; Date, Time, Offset,
Max. 64 data records are memorized. One process calibration corresponds to one data record:

2.2.2 **Miscellaneous**:

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

2.3 Sample

If <Flow measurement> = None and <Temp. Sensor> = no

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

Temperature: Shows the predefined comp. temperature in °C.

If <Flow measurement> = Q-Flow and <Temp. Sensor> = no

2.3.311 *Sample ID*: Same as 2.3.301

Temperature: Same as 2.3.301

Sample flow: Shows the actual sample flow in l/h and the Raw value in Hz

2.4 I/O State

Shows actual status of all in- and outputs.

2.4.1

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

2.5 Interface

Protocol USB Stick.

3 Maintenance

3.1 Calibration

3.1.1 **Process pH/Redox:** The process calibration is based on a comparative measurement of the current electrode with a calibrated comparative electrode. See Calibration, p. 31.

3.1.1.4 *Current Value*: Shows the measuring value of the current electrode.

Offset: Shows the deviation of the measuring value of the current electrode and the calibrated comparative electrode in mV.

Process Value: Enter the measured value of the calibrated comparative electrode.

3.1.1 **Standard pH/Redox:** Performs a standard calibration. Follow the instruction on the screen. See Calibration, p. 31

3.2 Simulation

To simulate a value or a relay state, select the

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

with the [▲] or [▼] key.

Press the [Enter] key.

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

Press the [Enter] key.

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

Alarm Relay:	Active or inactive.
Relay 1:	Active or inactive.
Relay 2:	Active or inactive.
Signal Output 3:	Current in mA

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

3.3 Set Time

Adjust date and time.

4 Operation

4.1 Sensors

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

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

4.2 Relay Contacts

See Relay Contacts, p. 21

4.3 Logger

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

The logger can save approx. 1500 data records. The Records consists of: Date, time, alarms, measured value, measured value uncompensated, temperature, flow.

4.3.1 *Log Interval:* Select a convenient log interval. Consult the table below to estimate the max logging time. When the logging buffer is full, the oldest data record is erased to make room for the newest one (circular buffer).
Range: 1 Second to 1 hour

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

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

4.3.3 *Eject USB Stick:* If <Enter> is pressed, all logger data will be copied to the USB stick and afterwards the USB stick will be deactivated.

5 Installation

5.1 Sensors

5.1.1 Flow

5.1.1.1 *Flow measurement*: Select the type of flow sensor if a flow sensor is installed.
Possible flow sensors: None; Q-Flow; deltaT

5.1.2 Parameters:

5.1.2.1 *Type of Sensor:* Set the type of installed sensor.
Possible types: pH or Redox

5.1.2.2 *Sensor Check*: Not yet implemented. Set to off.

5.1.3 Temperature:

5.1.3.1 *Temp. Sensor*: The pH measurement is temperature dependent therefore it is possible to install a temperature sensor.
Possible settings:
Temp. Sensor; <yes>, <no>
If <no> is set the measuring value is compensated with the default temperature.

5.1.3.21 *Default Temp.*: If no temperature sensor is installed, set the default temperature to the assumed average temperature of the sample. The measuring value is then compensated with this value.

5.1.3.3 Temp. Compensation (only available for pH measurement)

5.1.3.3.1 Comp.: Choose the compensation model which fits best to your application.
Available compensation models: Nernst, non-linear, coefficient.
We recommend: Nernst compensation for potable water, waste water, swimming pools, non-linear or coefficient for high purity water.

5.1.40 Standards: A temperature curve is programmed for SWAN standard 1, pH 7 and SWAN standard 2, pH 9. If you want to use your own standards you can readjust the temperature curve according to your standards.

5.1.5.1 *Standard 1*: Assign the measured pH value to the according temperature from 0–50 °C in steps of 5 °C.

5.1.5.2 *Standard 2*: Assign the measured pH value to the according temperature from 0–50 °C in steps of 5 °C.

5.1.5.3 *Standard*: Enter the mV value of the redox standard.

5.1.5 Quality Assurance:
Not applicable.

5.2 Signal Outputs

5.2.1 Signal Output 3 (signal outputs 1 and 2 are deactivated)

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

- Meas. Value
- Temperature
- Sample Flow (if a flow sensor is selected)

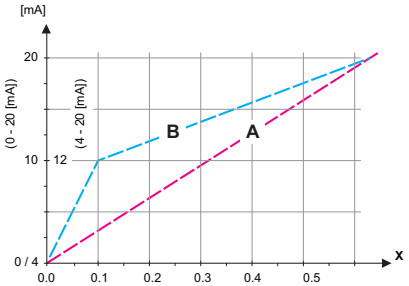
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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:

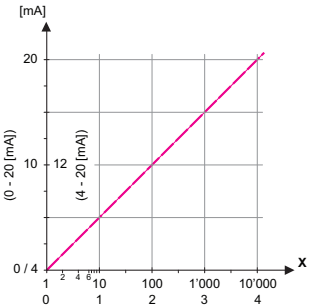
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 56
- Control upwards or control downwards for controllers.
  See As control output, p. 57

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: Meas value

5.2.1.40.10 *Range low*: -3 pH – 15 pH

5.2.1.40.20 *Range high*: -3 pH – 15 pH

Parameter: Temperature

5.2.1.40.11 *Range low*: -25 °C to + 270 °C

5.2.1.40.21 *Range high*: -25 °C to + 270 °C

Parameter: Sample flow

5.2.1.40.12 *Range low*: 0 – 200 l/h

5.2.1.40.22 *Range high*: 0 – 200 l/h

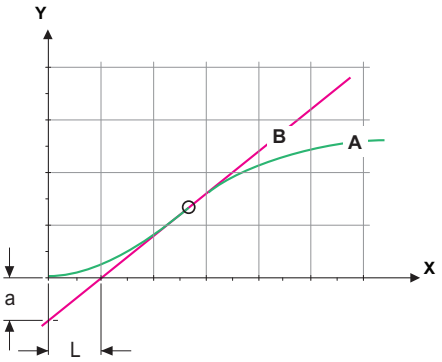
As control output

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.

If Control upwards or Control downwards is active

5.2.1.43 Control Parameters

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: Parameter = Meas. value

5.2.1.43.10 *Setpoint*: -3.00 to +15.00 pH

5.2.1.43.20 *P-Band*: 0 –2.0 pH

5.2.1.43 Control Parameters: Parameter = Temperature

5.2.1.43.11 *Setpoint*: -25 to +270 °C

5.2.1.43.21 *P-Band*: 0 to +100 °C

5.2.1.43 Control Parameters: Parameter = Sample Flow

5.2.1.43.12 *Setpoint*: 0–200 l/h

5.2.1.43.22 *P-Band*: 0–200 l/h

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

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

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

5.3 Relay Contacts

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

The contact is inactive at:

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

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

- Meas. Value
- Temperature
- Sample Flow (if a flow sensor is programmed)
- Case Temperature high
- Case Temperature low

5.3.1.1 Alarm

5.3.1.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E001, is displayed in the message list.
Range: -3.00 pH – 15.00 pH

5.3.1.1.26 *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: -3.00 pH – 15.00 pH

5.3.1.1.36 *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 pH – 2.00 pH

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

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

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

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

5.3.1.2.2 *Alarm High:* If the measuring values rises above the programmed value E009 will be issued.
Range: 0–200 l/h

5.3.1.2.36 *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 0–200 l/h

5.3.1.3 **Sample Temp.:** Define at which sample temperature an alarm should be issued.

5.3.1.3.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E007 is issued.
Range: -25–270 °C

5.3.1.3.26 *Alarm Low:* If the measured value falls below the alarm high value, the alarm relay is activated and E008 is issued.
Range: -25–270 °C

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

5.3.1.5 *Case Temp. low:* Set the alarm low value for temperature of electronics housing. If the value falls below the programmed value E014 is issued.
Range: -10–20 °C

5.3.2/3 **Relay 1 and 2:** The function of relay contacts 1 or 2 are defined by the user

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

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

2 Then enter the necessary data depending on the selected function. The same values may also be entered in menu 4.2 Relay Contacts, p. 53

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
Meas. Value	-3.00 pH–15.00 pH
Temperature	-25 to +270 °C
Sample flow	0–200 l/h

5.3.2.409 *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
Meas. Value	0 pH–2.00 pH
Temperature	0 to +100 °C
Sample flow	0–200 l/h

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 or 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.

- Meas. value
- Temperature
- Sample Flow

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. 58

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. 58

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. 58

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. 64.
Range: 00:00:00–23:59:59

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

5.3.2.44 *Run Time*: see Interval
5.3.2.54 *Delay*: see Interval
5.3.2.6 *Signal Outputs*: see Interval
5.3.2.7 *Output/Control*: see Interval

5.3.2.1 Function = Fieldbus:

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

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

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

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

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

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

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

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

5.3.4.4 *Fault:*

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

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

5.4 Miscellaneous

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

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

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

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

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

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

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

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

5.5 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.

10. Material Safety Data sheets

10.1. Reagents

Catalogue No.:	A-85.112.300
Product name:	Calibration Solution pH 4
Catalogue No.:	A-85.113.300
Product name:	Calibration Solution pH 7
Catalogue No.:	A-85.114.300
Product name:	Calibration Solution pH 9
Catalogue No.:	A-87.893.300
Product name:	Reference filling solution KCl

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.: ..... 30 Sec
- Hold after Cal.: ..... 300 Sec

Alarm Relay ..... same as in Installation

Relay 1 / 2 ..... same as in Installation

Input ..... same as in Installation

Logger:
- Logger Interval: ..... 30 Minutes
- Clear Logger: ..... no

Installation:

Sensors
- Flow: Flow measurement: ..... None
- Parameter: Type of sensor: ..... as set, pH or Redox
- Parameter: Sensor Check: ..... Off
- Temp. Sensor: ..... No
- Default Temp. ..... 25 °C
- Temp. Compensation ..... Nernst
- Standards: Standard 1 ..... see Chap. 4 Set Buffer Values, S. 24
- Standards: Standard 2 ..... see Chap. 4 Set Buffer Values, S. 24
- Standards: Redox Standard ..... 475 mV
- Quality Assurance ..... 0: Off

Signal Output
- Parameter: ..... Meas. Value
- Current loop: ..... 0/4 –20 mA
- Function: ..... linear
- Scaling: Range low: ..... 0.00 pH/0 mV
- Scaling: Range high: ..... 14.00 pH/1000 mV

Alarm Relay:
- Alarm:
- Alarm high: ..... 15.00 pH/1500 mV
- Alarm low: ..... -3.00 pH/-500 mV
- Hysteresis: ..... 0.10 pH
- Delay: ..... 5 Sec
- Sample Temp:
- Alarm High: ..... 55 °C
- Alarm Low: ..... 5 °C
- Case temp. high: ..... 65 °C
- Case temp. low: ..... 0 °C

Relay 1/2	Function:	limit upper
	Parameter:	Meas. Value
	Setpoint:	14.00 pH/1500 mV
	Hysteresis:	0.10 pH/10 mV
	Delay:	30 Sec
	If Function = Control upw. or dnw:	
	Parameter:	Meas. Value
	Settings: Actuator:	Frequency
	Settings: Pulse Frequency:	120/min.
	Settings: Control Parameters: Setpoint:	14.00 pH/1000 mV
	Settings: Control Parameters: P-band:	0.10 pH/10 mV
	Settings: Control Parameters: Reset time:	0 Sec
	Settings: Control Parameters: Derivative Time:	0 Sec
	Settings: Control Parameters: Control Timeout:	0 Min.
	Settings: Act.	Time prop.:
	Cycle time:	60 s
	Response time:	10 s
	Settings: Act.	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 Sec
	Delay:	5 Sec
	Signal output:	cont
	Output/Control:	cont.
Input:	Active	when closed
	Signal Outputs	hold
	Output/Control	off
	Fault	no
	Delay	10 Sec

Miscellaneous	Language:	English
	Set default:	no
	Load firmware:	no
	Password:	for all modes 0000
	Sample ID:	- - - - - - - -
Interface	Protocol:	USB Stick

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13. Notes

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