swan
ANALYTICAL INSTRUMENTS

AMI pH/mV:pH/mV Pool

Version 6.20 and higher

Operator's Manual

A-96.250.711 / 060720

Customer Support
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Table of Contents

AMI pH/mV:pH/mV Pool– Operator's Manual

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

1. Safety Instructions

General

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

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

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

Strictly follow all safety instructions in this publication.

Target audience

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

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

OM Location

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

Qualification, Training

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

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

1.1. Warning Notices

The symbols used for safety-related notices have the following 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 can be the consequence if such warnings are ignored.

- Follow the prevention instructions carefully.

Mandatory Signs

The meaning of the mandatory signs in this manual:

Safety goggles

Safety gloves

Warning Signs The meaning 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.

Download MSDS

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

- Calibration Solution pH 7
- Calibration Solution pH 9
- Calibration Solution pH 4
- Redox Calibration Solution

2. Product Description

2.1. Description of the System

Application Range

This instrument is applicable for the measurement of the pH respectively ORP value in pool water.

Signal Outputs

Two signal outputs programmable for measured values (freely scalable, linear, bilinear, log) or as continuous control output (control parameters programmable).
Current loop: 0/4 - 20 mA
Maximal burden: 510 Ω
Third signal output available as an option. The third signal output can be operated as a current source or as a current sink (selectable via switch).

Relays

Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function. Both contacts can be set as normally open or normally closed with a jumper.
Maximum load: 1 A / 250 VAC

Relay Box

Optional
Since the relays of the AMI transmitter must not be used to switch dosing pumps, a relay box can be mounted to the panel. This relay box is controlled by the AMI pH/mV:pH/mV Pool transmitter and is designed to switch on and off dosing pumps.

Alarm Relay

One potential free contact.
Alternatively:

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

Summary alarm indication for programmable alarm values and instrument faults.

Input

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

Communication interface (optional)

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

Measurement

Meas. parameter	Range	Resolution
pH (pH)	1.00–13.00	0.01 pH
ORP (mV)	-500–1500	1 mV

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

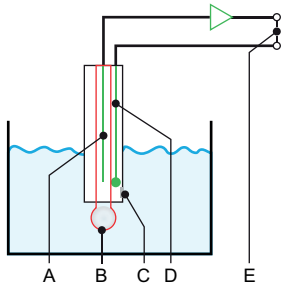
- pH: The pH value depends on the sample temperature. To compensate the temperature deviation a temperature sensor is installed in the flow cell.
- ORP: Temperature compensation is not necessary.

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 pH electrode is a combined gel electrode. Gel electrodes can not be refilled and have a limited life time.



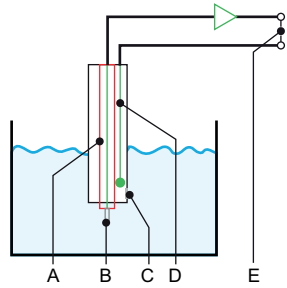
A *Measuring electrode with inner electrode, Ag/AgCl electrode*
B *H+ sensitive glass membrane*
C *Diaphragm: ceramic or gap*
D *Reference electrode with gel*
E *Signal output of electrode*

ORP Measuring Principle (simplified)

The ORP (redox) measurement is based on a voltage measurement. A voltage can only be measured between two different potentials, therefore, the ORP (redox) 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 ORP value. The voltage which results from this potential difference is measured and displayed on the transmitter as ORP value in mV.

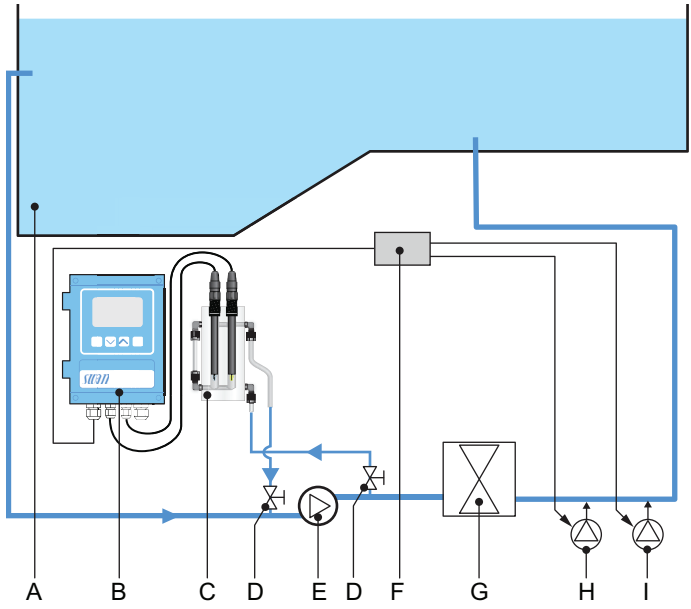
ORP Electrode

The ORP (redox) electrode is a combined gel electrode. Gel electrodes can not be filled again and have a limited life time.



A *Measuring electrode*
B *Platinum tip*
C *Diaphragm: ceramic or gap*
D *Reference electrode with KCl electrolyte, Ag/AgCl electrode*
E *Signal output*

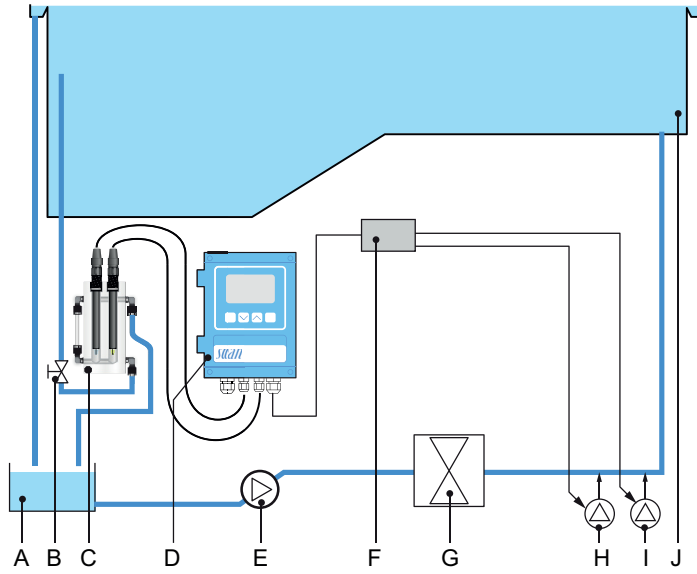
Application 1
Private Pool
Water
Treatment



A *Pool*
B *AMI Transmitter*
C *Flow cell with sensors*
D *Shut-off valves*
E *Pump*
F *Relay box (optional)*
G *Filter*
H *Disinfection pump*
I *pH control pump*

The concentration of the disinfectant and the pH in the pool water is continuously monitored by the sensors of the AMI pH/mV:pH/mV Pool. If necessary disinfectant is added or pH is controlled via the AMI transmitter.

Application 2
Public Pool Water Treatment



A *Catch basin*
B *Shut-off valve*
C *Flow cell with sensors*
D *AMI Transmitter*
E *Pump*
F *Relay box (optional*
G *Filter*
H *Disinfection pump*
I *pH control pump*
J *Pool*

The concentration of the disinfectant and the pH in the pool water is continuously monitored by the sensors of the AMI pH/mV:pH/mV Pool. If necessary disinfectant is added or pH is controlled via the AMI transmitter.

Fluidics

To save space on the panel, the flow cell is divided in a rear and a front flow cell. The flow cells are connected via pipe [F].

The rear part of the flow cell is equipped with a hall effect sensor [A] and a temperature sensor [B].

The front part of the flow cell is equipped with a pH sensor [C] and a ORP (redox) sensor [D].
The sample enters the flow cell at the sample inlet [H] and flows first through the rear part of the flow cell were the sample stream and the sample temperature are monitored.

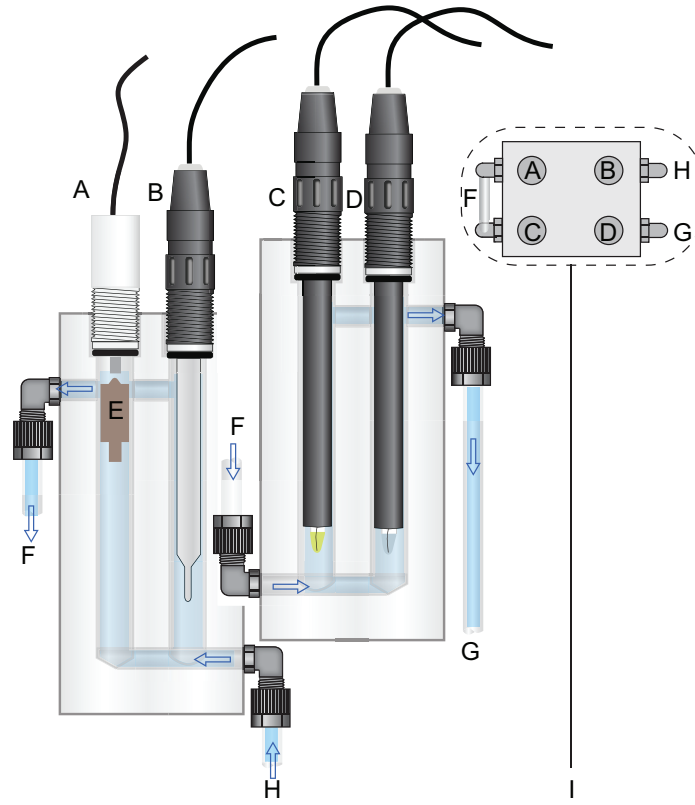
From there the sample flows via connection pipe [F] into the front flow cell where pH with pH sensor [C] and disinfection concentration with ORP sensor [D] are measured.
Depending on the application, the flow cell is connected parallel to the circulation pump or directly to the pool.

Application 1, private pool

The flow cell is connected parallel to the circulation pump. The sample inlet [H] of the flow cell is connected to the pipe at the outlet side of the circulation pump and the sample outlet [G] is connected to the pipe at the inlet side of the circulation pump.

Application 2, public pool

The sample inlet [H] of the flow cell is connected directly to the pool, the sample outlet [G] is led to the catch basin.



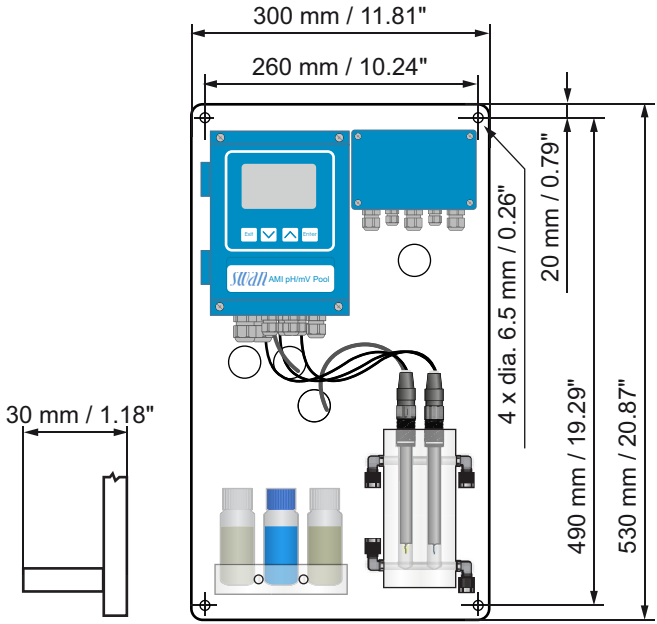
A *Hall effect sensor*
B *Temperature sensor*
C *pH sensor*
D *ORP (redox) sensor*
E *Float gauge*
F *Connection pipe*
G *Sample outlet*
H *Sample inlet*
I *Flow cell top view*

2.2. Instrument Specification

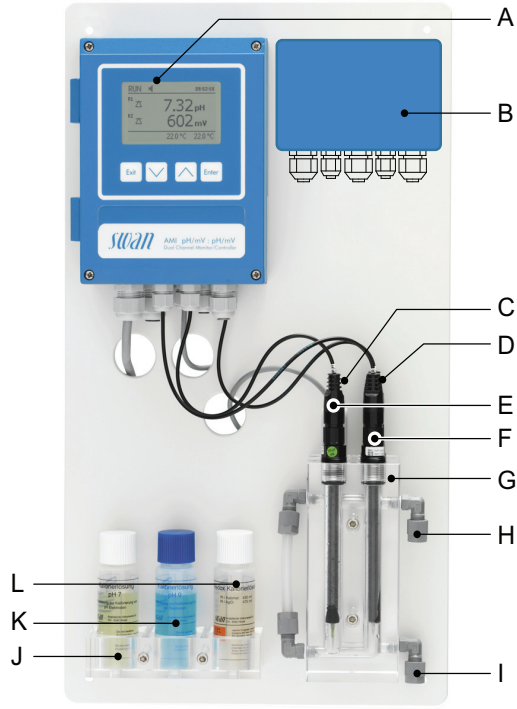
Power Supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Sample requirements	Flow rate:	min. 30 l/h
	Temperature:	up to 50 °C
	Inlet pressure:	0.2–2 bar
	Outlet pressure:	0.2–2 bar
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Tube 6 x 8 mm
	Sample outlet:	Tube 6 x 8 mm

Dimensions

Panel:	PVC
Dimensions:	300x530x150
Screws:	5 or 6 mm diameter
Weight:	5 kg



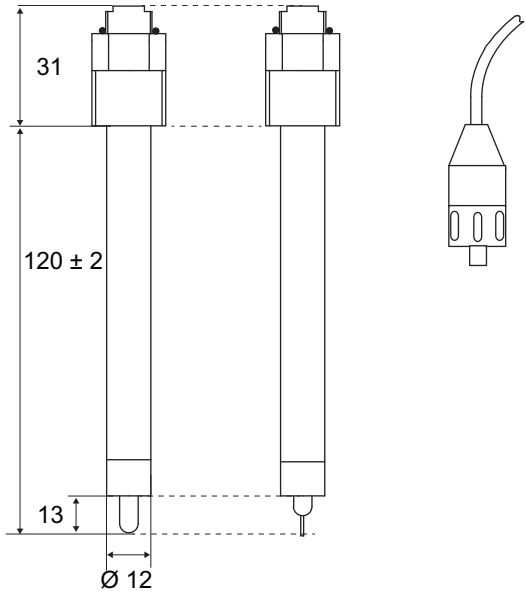
2.3. Instrument Overview



A *Transmitter*
B *AMI relays box (option)*
C *Flow sensor (not visible)*
D *Temperature sensor (not visible)*
E *pH sensor*
F *Redox sensor*
G *Flow cell*
H *Sample outlet*
I *Sample inlet*
J *Calibration solution pH 7*
K *Calibration solution pH 9*
L *Calibration solution Redox*

2.4. Swansensor pH and ORP Standard

Combined electrode with gel electrolyte.



pH sensor **ORP sensor** **Sensor plug**

Specifications pH-Sensor	Operative and measuring range:	1 to 13 pH
	Operating temperature:	0–50 °C
	Pressure	< 2 bar
	Conductivity measuring medium:	> 150 µS/cm
	Connection:	plug PG 13.5
Specifications ORP-Sensor	Operative and measuring range:	- 400 to +1200 mV
	Operating temperature:	0–50 °C
	Pressure	< 2 bar
	Conductivity measuring medium:	> 150 µS/cm
	Connection:	plug PG 13.5

3. Installation

3.1. Installation Checklist Monitors

On site requirements	AC variant: 100–240 VAC (± 10%), 50/60 Hz (± 5%) DC variant: 10–36 VDC Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see Instrument Specification, p. 14).
Installation	Mount the instrument in vertical position. Display should be at eye level. Depending on the application, connect the flow cell parallel to the pump or directly to the pool.
Electrical Wiring	Do not switch on the Instrument until all electrical connections have been completed. Connect all external devices like limit switches, current loops and pumps (see Electrical Connections, p. 23. Connect the power cord.
pH/ORP electrode	Remove protective cap and connector cap (see Installation of Electrodes, p. 21). Install the sensors (see Installation of Electrodes, p. 21). Connect to sensor cables. Store 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 and external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms).
Run-in period	Let the instrument run continuously for 1 h.
pH electrode calibration	Calibrate pH electrode (see Calibration, p. 40).
ORP electrode calibration	Calibrate ORP electrode (see Calibration, p. 40).

3.2. Mounting of the Instrument Panel

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

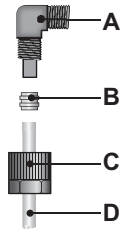
- The instrument must only be installed by trained personnel.
- Mount the instrument in vertical position.
- For ease of operation mount it so that the display is at eye level.
- For the installation a kit containing the following installation material is available:
  - 4 Screws 6x60 mm
  - 4 Dowels
  - 4 Washers 6.4/12 mm

Mounting requirements

The instrument is only intended for indoor installation.

3.3. Connecting Sample Inlet and outlet

Use plastic tube (FEP, PA, or PE 6 x 8 mm) to connect the sample line.

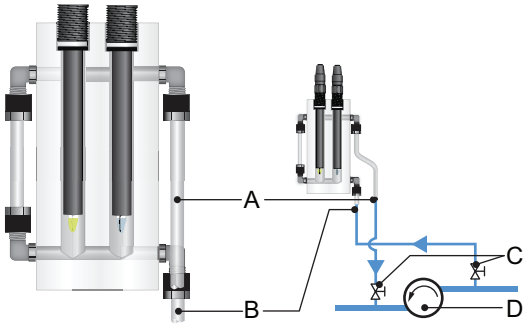


A *Elbow union*
B *Compression ferrule*
C *Knurled nut*
D *Flexible tube*

Application 1, private pool

The flow cell of the AMI pH/mV:pH/mV Pool is connected parallel to the pump [D].

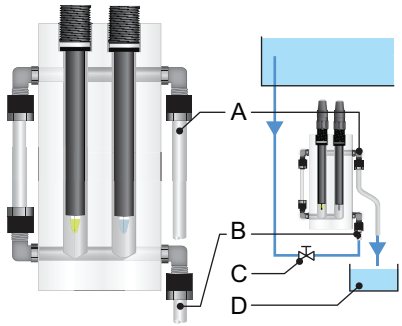
1 Connect the sample inlet [B] to the sample line at the pump outlet.
2 Connect the sample outlet [A] to the sample line at the pump inlet.
3 Open the shut-off valves [C].



Application 2, public pool

The flow cell of the AMI pH/mV:pH/mV Pool is connected directly to the pool and the outlet is connected to the catch basin [D].

1 Connect the sample inlet [B] to the sample line of the pool.
2 Connect the sample outlet [A] to the catch basin.
3 Open the shut-off valve [C].



3.4. Installation of Electrodes

The pH and the ORP electrodes are supplied separately and are installed into the flow cell after the installation of the monitor has been finished. They are protected with a cap filled with KCL.

CAUTION

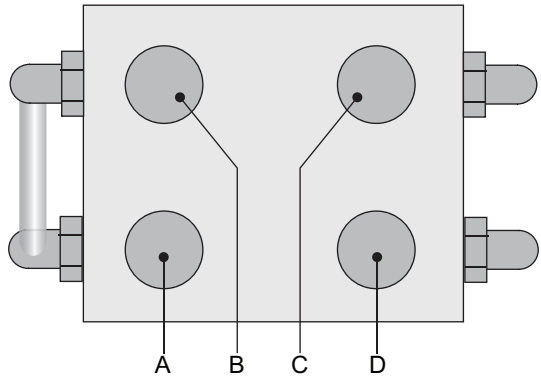
Fragile parts

The pH and the ORP electrode are fragile.

- Handle with care.

Overview

The sensors and electrodes are built in according to the picture below.



A *pH sensor*
B *Hall effect sensor*
C *Temperature sensor*
D *Redox sensor*

Temperature sensor

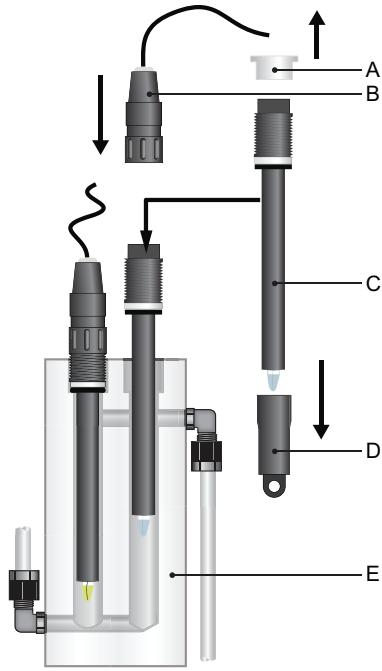
The temperature sensor is already installed and connected to the transmitter.

Hall effect sensor

The Hall effect sensor is already installed and connected to the transmitter.

Electrodes

This instruction applies for both, the pH and the ORP electrode. Install the sensors according to the Overview, p. 21. The sensor cables are marked with “pH” for the pH sensor and with “R” for the ORP sensor. Do not interchange them.



A *Connector cap*
B *Connector*
C *Electrode*
D *Protective cap*
E *Flow cell*

1 Carefully remove the protective cap from the electrode tip.

⚠ *Caution, the Protective cap is filled with KCl!*

2 Rinse the electrode tip with clean water.

3 Insert the electrode into the hole of the Flow cell [E].

4 Tighten it hand-tight.

5 Remove the connector cap [A].

6 Screw to sensor cable onto the sensor.

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

3.5. Electrical Connections

WARNING

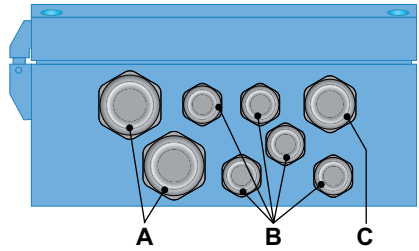
Risk of electrical shock.

Do not perform any work on electrical components if the transmitter is switched on. Failure to follow safety instructions 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*

NOTICE: *Protect unused cable glands*

Wire

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

WARNING

External Voltage.

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

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

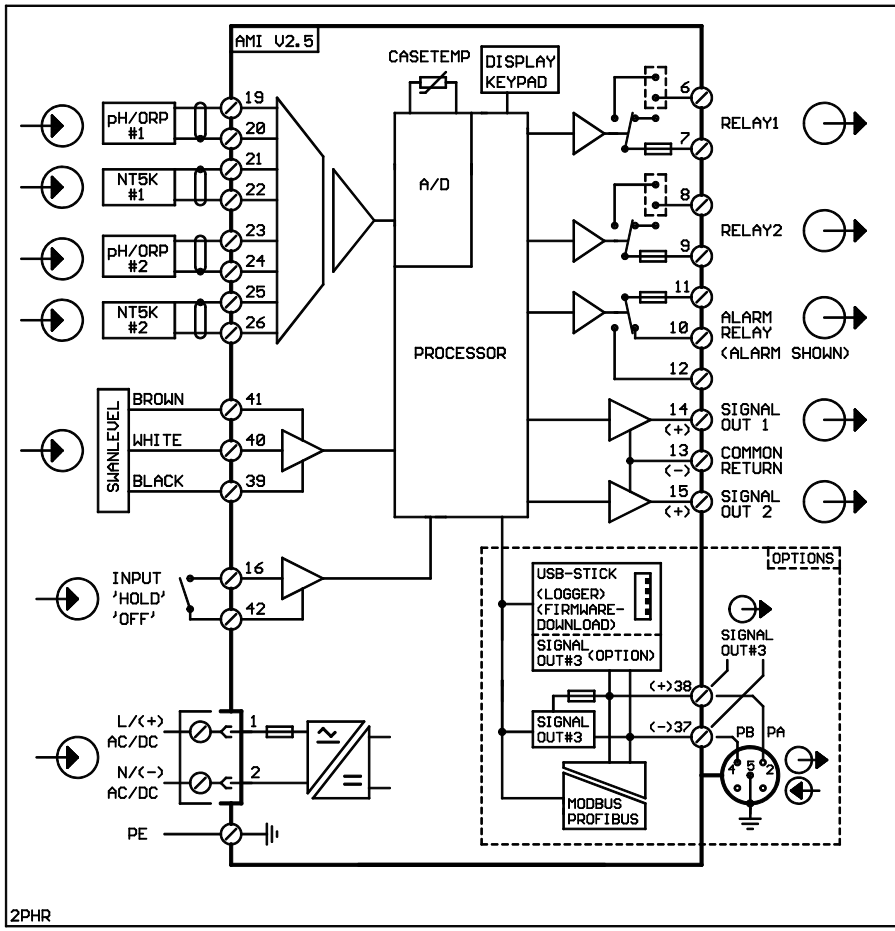
WARNING

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

WARNING

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

3.5.1 Connection Diagram



CAUTION

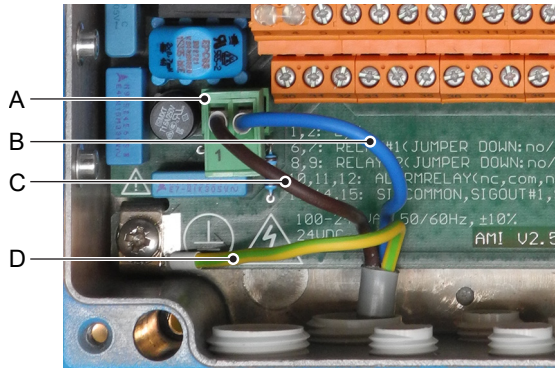
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.5.2 Power Supply

WARNING

Electrical shock hazard

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



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

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

Installation requirements

The installation must meet the following requirements.

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

3.6. Input

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

Terminals 16/42
For programming see Program List and Explanations, p. 53.

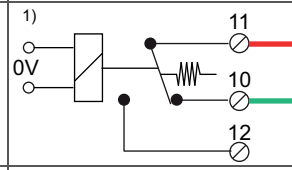
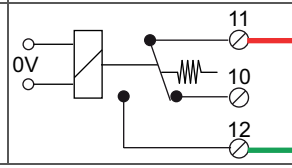
3.7. Relay Contacts

3.7.1 Alarm Relay

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

Alarm output for system errors.
Error codes see Troubleshooting, p. 44.

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

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

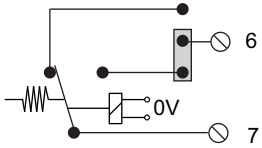
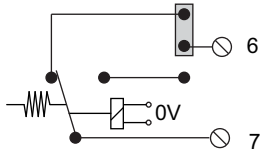
1) *usual use*

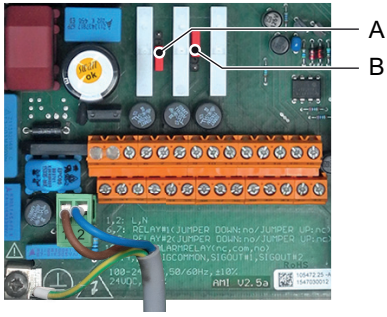
3.7.2 Relay 1 and 2

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

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

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

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



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

For programming see menu Installation 5.3.2 and 5.3.3, p. 65.

CAUTION

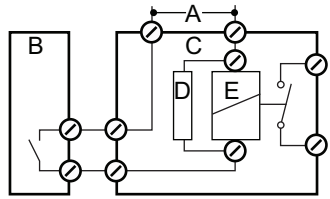
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

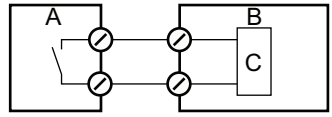
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load.
A snubber circuit is not necessary if an AMI relaybox is used.



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

Resistive load

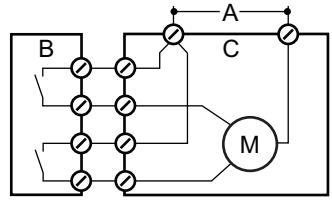
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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*

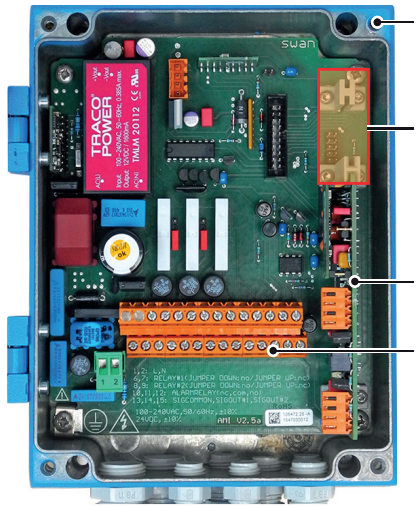
3.8. Signal Outputs

3.8.1 Signal Output 1 and 2 (current outputs)

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

Signal output 1: Terminals 14 (+) and 13 (-)
Signal output 2: Terminals 15 (+) and 13 (-)
For programming see Program List and Explanations, p. 53, Menu Installation.

3.9. Interface Options



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

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

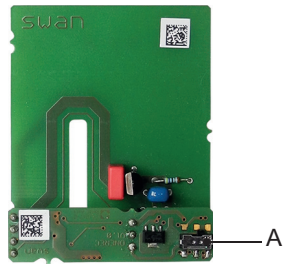
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- an USB Interface

3.9.1 Signal Output 3

Terminals 38 (+) and 37 (-).

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

NOTICE: *Max. burden 510 Ω.*



Third signal output 0/4 - 20 mA PCB

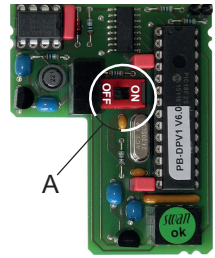
A *Operating mode selector switch*

3.9.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA

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

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



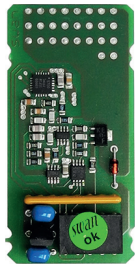
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.9.3 HART Interface

Terminals 38 (+) and 37 (-).

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

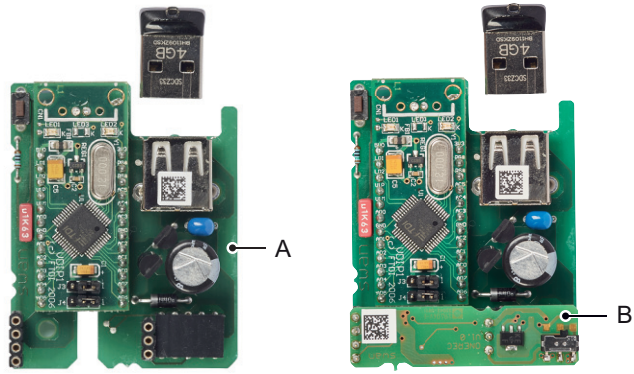


HART Interface PCB

3.9.4 USB Interface

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

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



USB Interface

A *USB interface PCB*

B *Third signal output 0/4 - 20 mA PCB*

4. Instrument Setup

4.1. Establish Sample Flow

Open sample flow and wait until the flow cell is completely filled.
Switch on power.

4.2. Programming

Programming

Check the following settings in menu 5.1 Installation/Sensors and correct it if necessary, for further information see 5.1 Sensors, p. 57:

- Electrodes: set electrodes to pH - mV,
- Flow measurement: Set to Level Switch
- Temperature: Set to 1 sensor.
- Standard solution(s): Program the buffer values (pH buffer table) or the ORP calibration solution if you do not use the SWAN standards.

Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms). See Program Overview, p. 48, for explanations, see Program List and Explanations, p. 53.

Calibration of pH electrode

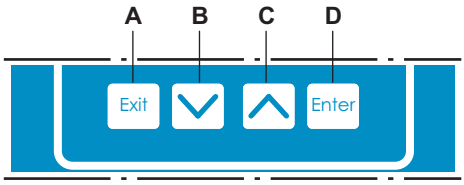
The instrument should be operating for 1 h before performing a pH calibration.
Calibrate the pH electrode with two buffers, e.g. pH 7.00 and pH 9.00. See Calibration, p. 40, for details.

Calibration of ORP electrode

The instrument should be operating for 1 h before performing an ORP calibration. See Calibration, p. 40, for details.

5. Operation

5.1. Keys



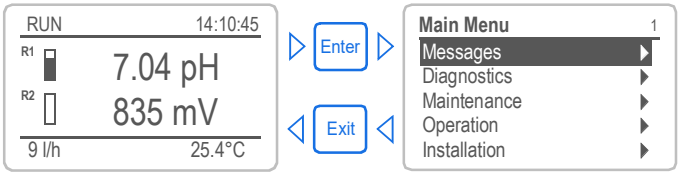
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

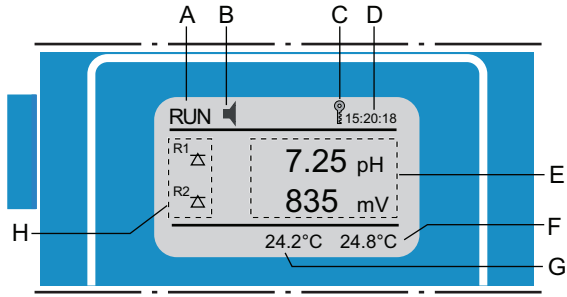
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Display



A RUN — normal operation

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

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

B ERROR — Error — Fatal Error

C Keys locked, transmitter control via Profibus

D Time

E Process values

F Sample temperature 2

G Sample temperature 1

H Relay status

Relay status, symbols

upper/lower limit not yet reached

upper/lower limit reached

control upw./downw. no action

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

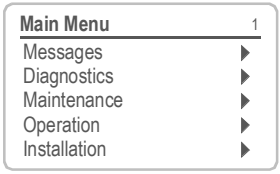
motor valve closed

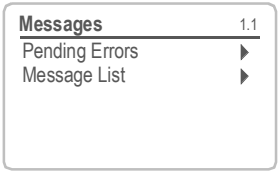
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

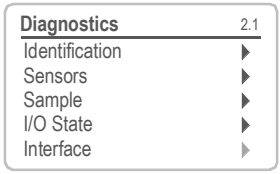
5.3. Software Structure





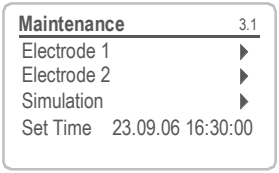
Menu **Messages 1**

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



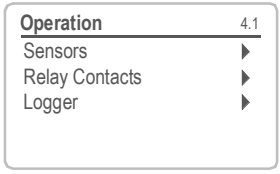
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



Menu **Maintenance 3**

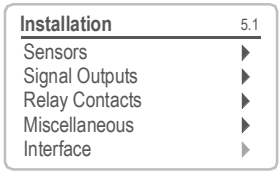
For instrument calibration, relay and signal output simulation, and to set the instrument time.
It is used by the service personnel.



Menu **Operation 4**

User relevant parameters that might need to be modified during daily routine. Normally password protected and used by the process-operator.

Subset of menu 5 - Installation, but process-related.



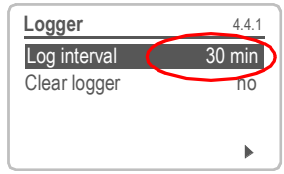
Menu **Installation 5**

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

5.4. Changing Parameters and values

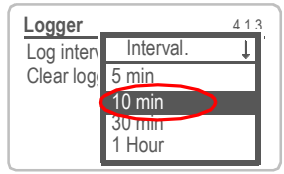
Changing parameters

The following example shows how to change the logger interval:



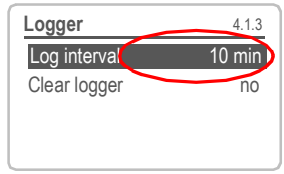
1 Select the parameter you want to change.

2 Press [Enter]



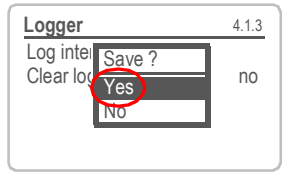
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

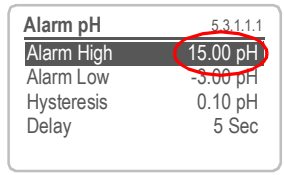
5 Press [Exit].



⇒ *Yes is highlighted.*

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

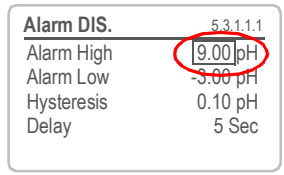
Changing values



1 Select the value you want to change.

2 Press [Enter].

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



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

6. Maintenance

6.1. Maintenance Table

Swansensor pH / Swansensor Redox (ORP)

Four times per year	Calibrate electrode. Ensure buffers are not expired. If necessary, replace electrode.
Yearly	If necessary, clean electrode.

6.2. Stop of Operation for Maintenance

- Stop sample flow.
- Shut off power of the instrument.

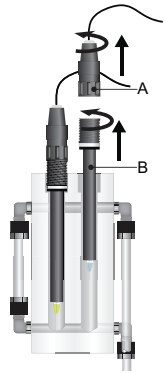
6.3. Maintenance of Electrodes

WARNING

Chemicals can be toxic, caustic, flammable and explosive.

- 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 Electrodes



pH Electrode

1. Unscrew and remove the connector [A] from the electrode [B].
2. Unscrew and remove the electrode [B] from the flow cell.
3. If necessary wipe the electrode shaft and the green tip cautiously with a soft, clean, and damp paper tissue.
4. Remove grease with a tissue moistened with alcohol.
5. If the electrode is very dirty, put its tip into 1% diluted hydrochloric acid for roughly 1 min.
6. Afterwards rinse the electrode tip thoroughly with clean water.
7. Install the electrode in the flow cell again.
8. Let the electrode run-in for 1 h before the first calibration.

ORP Electrode

1. Take the electrode out of the flow cell.
2. If necessary, wipe off dirt cautiously with a soft, clean, and damp paper tissue.
   ⇒ *Dull platinum surfaces indicate a contamination.*
3. If the electrode is very dirty, put its tip into 1% diluted hydrochloric acid for roughly 1 min.
4. Afterwards rinse the electrode tip thoroughly with clean water.
5. Install the electrode in the flow cell again.
6. Let the electrode run-in for 1 h before the first calibration.

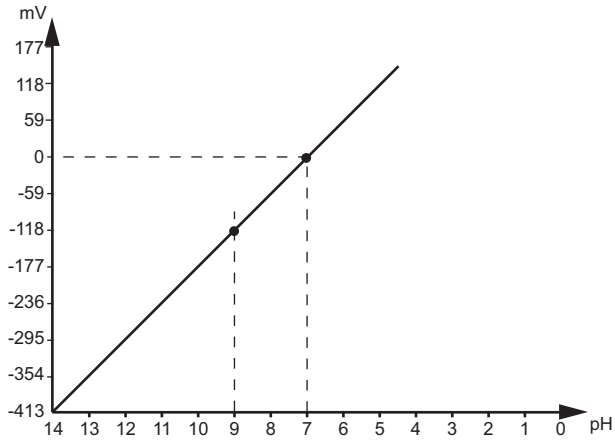
6.4. Calibration

Process pH Calibration

For correction, a valid manual measurement has to be performed. Compare the measuring value with the on-line instrument and if necessary, enter the correct measuring value in the menu <Maintenance/Electrode 1 or 2/Process Cal.> of the on-line instrument.

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 ORP Calibration

For correction, a valid manual measurement has to be performed. Compare the measuring value with the on-line instrument and if necessary, enter the correct measuring value in the menu <Maintenance/Electrode 1 or 2/Process Cal.> of the on-line instrument.

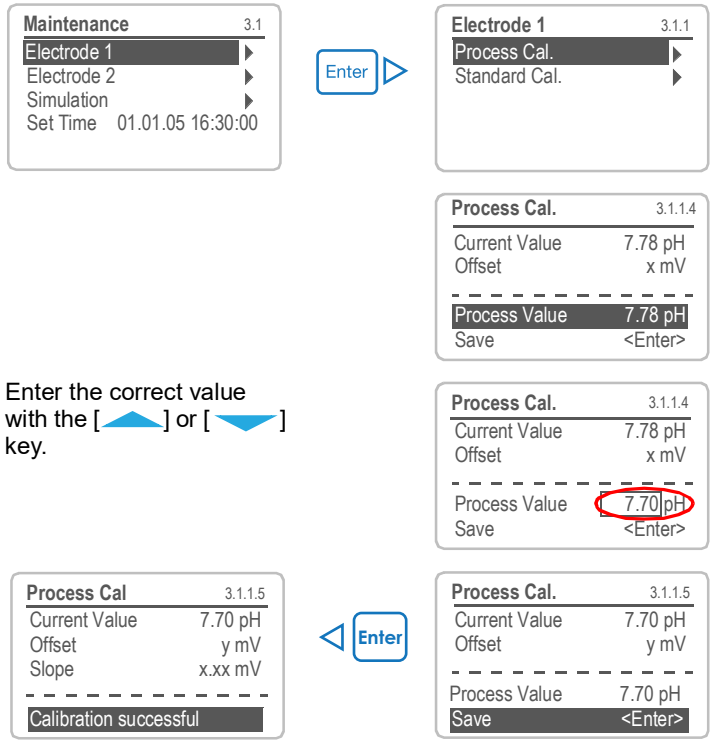
Standard ORP Calibration

Our reference electrode system is Ag/AgCl. The measuring value is roughly 50 mV higher than the calomel reference system.

The slope of the ORP electrode is not defined. To compensate the offset of gel electrodes, a calibration can be done with one buffer solution. Because ORP electrodes are slow, it can take some time after calibration until the measuring value is stable again.

Process pH or ORP Calibration

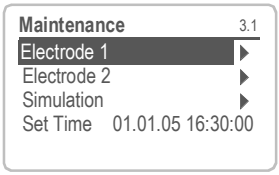
Use a Chematest (or equivalent) to determine the sample pH value. Make sure your reference instrument is calibrated correctly!

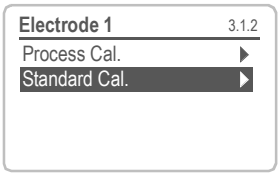


Possible error message

Offset error:
Last calibration wrong.
Electrode old or dirty.
Cable wet or brocken.

Standard pH or ORP Calibration





1 Navigate to menu <Maintenance>/ <Calibration>.

2 Press [Enter].

3 Remove the pH sensor from the flow cell.

4 Follow the instructions on the display.

Calibration solutions have to be clean. Do not use if expired. Always rinse electrode before dipping it into the solution.

Display instructions

1 Rinse and dry the pH sensor and put it into standard 1.
⇒*The progress of the measurement and the current value of Standard 1 is shown.*

2 Rinse and dry the pH sensor and put it in standard 2.
⇒*The progress of the measurement and the current value of Standard 2 is shown.*

3 Rinse and dry the pH sensor and put it into the flow cell.

Possible error message

Offset error or Slope error:
Old, dirty or wrong buffer solutions.
Electrode old or dirty.
Cable wet or brocken.

6.5. Longer Stop of Operation

1 Stop sample flow.
2 Shut off power of the instrument.
3 Unscrew and remove the connectors from the electrodes.
4 Put the connector caps on it (see Electrodes, p. 22).
5 Remove the electrodes from the flow cell and rinse them well with clean water.
6 Fill 3.5 molar KCl (if not available: clear water) into the protective caps and put them on the tips of the electrodes.
7 Store the electrodes with the tips pointing downwards in a frost-protected room.

CAUTION

Damage of pH sensor

Wrong storage will damage the pH sensor.

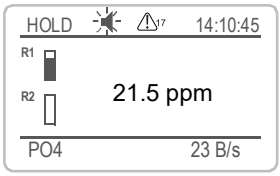
- Never store the pH sensor dry.
- Store the pH sensor with tip pointing downwards in a frost-protected room.

7. Troubleshooting

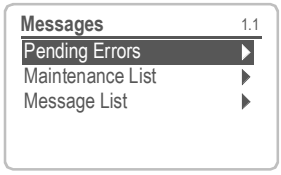
7.1. Error List

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:

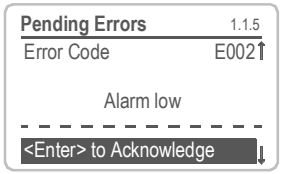
- Errors which disappear if correct measuring conditions are recovered (i.e. Sample Flow low).
  Such Errors are marked **E0xx** (bold and orange)
- Errors which indicate a hardware failure of the instrument.
  Such Errors are marked **E0xx** (bold and red)



Error or fatal Error
Error not yet acknowledged.
Check **Pending Errors 1.1.5 *** and take corrective action.
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 1 high	– check process – check programmed value
E002	Alarm 1 low	– check process – check programmed value
E003	Alarm 2 high	– check process – check programmed value
E004	Alarm 2 low	– check process – check programmed value
E005	Temp. 1 high	– check process – check programmed value
E006	Temp. 1 low	– check process – check programmed value
E007	Temp. 2 high	– check process – check programmed value
E008	Temp. 2 low	– check process – check programmed value
E009	Sample Flow high	– check sample flow – check programmed value
E010	Sample Flow low	– establish sample flow – clean instrument – check programmed value
E011	Temp. 1 shorted	– Check wiring of temperature sensor – Check temperature sensor
E012	Temp. 1 disconnected	– Check wiring of temperature sensor – Check temperature sensor
E013	Case Temp. high	– check case/environment temperature – check programmed value
E014	Case Temp. low	– check case/environment temperature – check programmed value
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 see 5.3.2 and 5.3.3, p. 65

Error	Description	Corrective action
E019	Temp. 1 shorted	– Check wiring of temperature sensor – Check temperature sensor
E020	Temp. 1 disconnected	– Check wiring of temperature sensor – Check temperature sensor
E024	Input active	– See If Fault Yes is programmed in Menu see 5.3.4, p. 69
E026	IC LM75	– call service
E028	Signal output open	– check wiring on signal outputs 1 and 2
E030	EEProm Frontend	– call service
E031	Cal. Recout	– call service
E032	Wrong Frontend	– call service
E033	Power-on	– none, normal status
E034	Power-down	– none, normal status

7.2. Replacing Fuses

WARNING

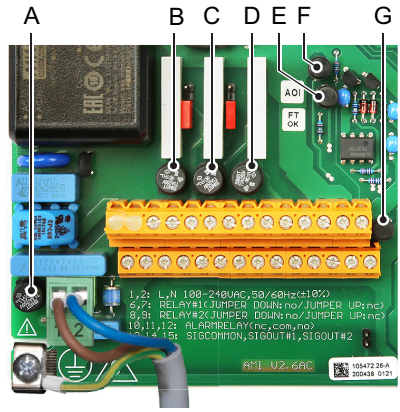
External Voltage.

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

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

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

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



A *AC variant: 1.6 AT/250 V Instrument power supply*
DC variant: 3.15 AT/250 V Instrument power supply
B *1.0 AT/250V Relay 1*
C *1.0 AT/250V Relay 2*
D *1.0 AT/250V Alarm relay*
E *1.0 AF/125V Signal output 2*
F *1.0 AF/125V Signal output 1*
G *1.0 AF/125V Signal output 3*

8. Program Overview

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

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

8.1. Messages (Main Menu 1)

Pending Errors	*Pending Errors*	1.2.5*	* Menu numbers
1.2*			
Message List	*Number*	1.4.1*	
1.4*	*Date, Time*		

8.2. Diagnostics (Main Menu 2)

Identification	Designation	AMI pH/mV:pH/mV		* Menu numbers
2.1*	Version	V6.20-08/16		
	Factory Test	*Instrument*	2.1.3.1*	
	2.1.3*	*Motherboard*		
		Frontend		
	Operating Time	*Years / Days / Hours / Minutes / Seconds*		2.1.5.1*
	2.1.5*			
Sensors	Electrode 1	*Current Value pH*		
2.2*	2.2.1*	*(Raw value) mV*		
		Cal. History	*Number*	
		2.2.1.5*	*Date, Time*	
			Offset	
			Slope	
	Electrode 2	*Current Value mV*		
	2.2.2*	*(Raw value) mV*		
		Cal. History	*Number*	
		2.2.2.5*	*Date, Time*	
			Offset	
	Miscellaneous	*Case Temp.*	2.2.3.1*	
	2.2.3*			
Sample	*Sample ID*	2.3.1*		
2.3*	Temperature	*Temperature 1*		
	2.3.2.1	*(NTK5)*		
		Temperature 2		
		(NTK5)		
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1/2*	2.4.2*		
	Input			
	Signal Output 1/2			
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Electrode 1	Process Cal.		* Menu numbers
3.1*	3.1.1*		
	Standard Cal.		
	3.1.2*		
Electrode 2	Process Cal.		
3.2*	3.2.1*		
	Standard Cal.		
	3.2.2*		
Simulation	*Alarm Relay*	3.3.1*	
3.3*	*Relay 1*	3.3.2*	
	Relay 2	3.3.3*	
	Signal Output 1	3.3.4*	
	Signal Output 2	3.3.5*	
Set Time	*(Date), (Time)*		
3.4*			

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**	**Meas. Value 1/2**	*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.25*
			Hysteresis	4.2.1.x.35*
			Delay	4.2.1.x.45*
	Relay 1/2	*Setpoint*	4.2.x.100*	
	4.2.2* - 4.2.3*	*Hysteresis*	4.2.x.200*	
		Delay	4.2.x.30*	
	Input	*Active*	4.2.4.1*	
	4.2.4*	*Signal Outputs*	4.2.4.2*	
		Output / Control	4.2.4.3*	
		Fault	4.2.4.4*	
		Delay	4.2.4.5*	
Logger	*Log Interval*	4.3.1*		
4.3*	*Clear Logger*	4.3.2*		* Menu numbers

8.5. Installation (Main Menu 5)

Sensors	*Electrodes*	*5.1.1**		* Menu numbers
5.1*	*Temp. Sensor*	5.1.2		
	Default Temp.	*5.1.3*		
	Flow	*Sensor*	5.1.4.1*	
	5.1.4			
	Standards	**pH Standard 1**	*@ 0 °C–50 °C*	5.1.5.1.1–10*
	5.1.5	5.1.5.1*		
		pH Standard 2	*@ 0 °C–50 °C*	5.1.5.1.1–10*
		5.1.5.2*		
		Redox Standard	*5.1.5.3*	
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1 - 5.2.2.1*	
5.2*	5.2.1* - 5.2.2*	*Current Loop*	5.2.1.2 - 5.2.2.2*	
		Function	5.2.1.3 - 5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.10/10*
		5.2.x.40	*Range High*	5.2.x.40.20/20*
Relay Contacts	**Alarm Relay**	**Meas. Value 1/2**	*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.25
			Hysteresis	5.3.1.x.35
			Delay	5.3.1.x.45
		Temperature 1	*Alarm High*	5.3.1.3.1*
		5.3.1.3	*Alarm Low*	5.3.1.3.25*
		Temperature 2	*Alarm High*	5.3.1.4.1*
		5.3.1.4	*Alarm Low*	5.3.1.4.25*
		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*	

Miscellaneous	*Language*	5.4.1*		
5.4*	*Set defaults*	5.4.2*		
	Load Firmware	5.4.3*		
	Password	*Messages*	5.4.4.1*	
	5.4.4*	*Maintenance*	5.4.4.2*	
		Operation	5.4.4.3*	
		Installation	5.4.4.4*	
	Sample ID	5.4.5*		
	Line break detection	5.4.6*		
Interface	*Protocol*	5.5.1*		(only with RS485
5.5*	*Device Address*	5.5.21*		interface)
	Baud Rate	5.5.31*		
	Parity	5.5.41*		* 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

Designation: Designation of the instrument.
Version: Firmware of instrument (e.g. V6.20-08/16)

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 1**

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

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

2.2.2 **Electrode 2**

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

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

2.2.3 Miscellaneous:

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

2.3 Sample

2.3.1 *Sample ID***:** Review the programmed code. The code is defined by the user to identify the sample point in the plant.

Temperature: Shows the
actual temperature 1 in °C and NT5K in Ohm.
actual temperature 2 in °C and NT5K in Ohm.

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.

2.4.1/2.4.2

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

3.1.1 **Process Cal.:** Performs a Process calibration. Follow the instruction on the screen. See Calibration, p. 40

3.1.1 **Standard Cal.:** Performs a standard calibration. Follow the instruction on the screen. See Calibration, p. 40

3.2 Electrode 2

3.2.1 **Process Cal.:** Performs a Process calibration. Follow the instruction on the screen. See Calibration, p. 40

3.2.1 **Standard Cal.:** Performs a standard calibration. Follow the instruction on the screen. See Calibration, p. 40

3.3 Simulation

o simulate a value or a relay state, select the

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

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

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

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

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

3.4 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, verification or grab sample 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. 27

4.3 Logger

The instrument is equipped with an internal logger. The logger data can be copied to a PC with an USB stick if option USB interface is installed.
The logger can save approx. 1500 data records. The Records consists of: Date, time, alarms, measured value, measured value uncompensated, temperature, flow.
Range: 1 Second to 1 hour

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

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

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

5 Installation

5.1 Sensors

5.1.1 *Electrodes:* Set the measuring mode according to your application. The following measuring modes are available:

pH - pH, pH - mV, mV - pH or mV- mV

5.1.2 *Temp. Sensor:* The pH measurement is temperature-dependent therefore it is possible to install one or two temperature sensors. Depending on your configuration program:
None, 1 or 2 temperature sensors

If None is programmed the measuring value is compensated with the default temperature.

5.1.3 *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.

5.1.4 **Flow**: Select the type of flow sensor if a flow sensor is installed. The following sensor types are available:

None, Q-Flow, deltaT, Level Switch.

5.1.5 **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 *Redox Standard*: Enter the mV value of the redox standard.

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.

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

5.2.1.1 *Parameter:* Assign one of the process values to the signal output.
Available values: Meas. Value 1, Meas. Value 2, Temperature 1, Temperature 2, Sample Flow

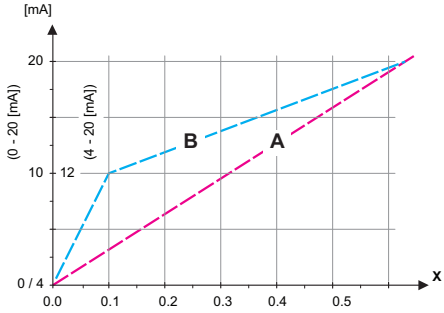
5.2.1.2 *Current Loop:* Select the current range of the signal output.
Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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:

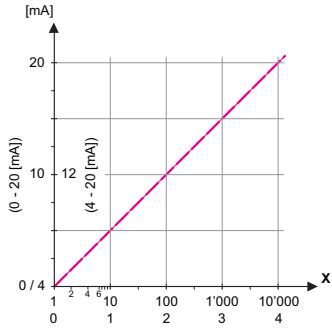
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 58
- Control upwards or control downwards for controllers.
  See As control output, p. 60

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 1

5.2.1.40.10 Range low: -3 pH to +15 pH

5.2.1.40.20 Range high: -3 pH to +15 pH

Parameter Meas. value 2

5.2.1.40.11 Range low: -500 mV to +1500 mV

5.2.1.40.21 Range high: -500 mV to +1500 mV

Parameter Temperature 1

5.2.1.40.12 Range low: -30 °C to +120 °C

5.2.1.40.22 Range high: -30 °C to +120 °C

Parameter Temperature 2

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

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

Parameter Sample flow

5.2.1.40.14 Range low: 0 l/h – 200 l/h

5.2.1.40.24 Range high: 0 l/h – 200 l/h

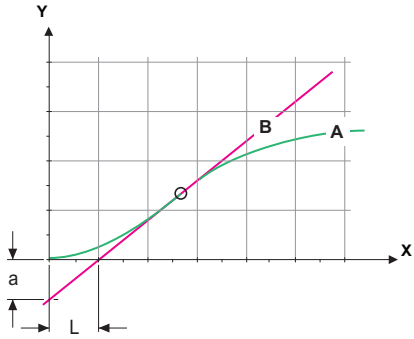
As control output

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.

Control upwards or 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 Parameter = Meas. value 1

5.2.1.43.10 Setpiont
Range: -3 pH to +15 pH

5.2.1.43.20 P-Band
Range: 0 pH to +2 pH

5.2.1.43 **Control Parameters** if Parameter = Meas. value 2

5.2.1.43.11 Setpiont
Range: -500 mV to + 1500 mV

5.2.1.43.21 P-Band
Range: 0 mV to + 200 mV

5.2.1.43 **Control Parameters** if Parameter = Temperature 1

5.2.1.43.12 Setpoint
Range: -30 °C to + 120 °C

5.2.1.43.22 P-Band
Range: 0 °C to + 100 °C

5.2.1.43 **Control Parameters** if Parameter = Temperature 2

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

5.2.1.43.23 P-Band
Range: 0 °C to + 100 °C

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

5.2.1.43.14 Setpoint
Range: 0 l/h – 200 l/h

5.2.1.43.24 P-Band
Range: 0 l/h – 200 l/h

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

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

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 1, Meas. Value 2, Temperature 1, Temperature 2, Sample Flow, Case Temperature

5.3.1.1 Meas. Value 1

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

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E002 is displayed in the message list.
Range: -3.00 pH – 15.00 pH

5.3.1.1.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0.00 pH – 2.00 pH

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

5.3.1.2 Meas. Value 2

5.3.1.2.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E003, is displayed in the message list.
Range: -500 mV – 1500 mV

5.3.1.2.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E004 is displayed in the message list.
Range: -500 mV – 1500 mV

5.3.1.2.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0 mV – 200 mV

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

5.3.1.3 & 5.3.1.4 Temperature 1 and 2: Define at which sample temperature an alarm should be issued.

5.3.1.x.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated
Range: -25 to + 270 °C

5.3.1.x.25 *Alarm Low:* If the measured value rises above the alarm high value, the alarm relay is activated.
Range: -25 to + 270 °C

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

5.3.1.51.1 *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.*

5.3.1.51.2 *Alarm High:* If the measuring values rises above the programmed value E009 will be issued.
Range: 0–100 l/h

5.3.1.51.35 *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 0–100 l/h

5.3.1.61 *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 1and 2:** The contacts can be set as normally open or normally closed with a jumper. See Relay 1 and 2, p. 28. The function of relay contacts 1 or 2 are defined by the user

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 switch
- controller
- timer
- fieldbus driven

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
Meas. Value 1	-3.00 pH–15.00 pH
Meas. Value 2	-500 mV–1500 mV
Temperature 1/2	-30 °C to + 120 °C
Sample flow	0–200 l/h

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
Meas. Value 1	0.00 pH–2.00 pH
Meas. Value 2	0 mV–200 mV
Temperature 1/2	0 °C–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/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 1
- Meas. Value 2
- Temperature 1
- Temperature 2
- Sample Flow

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 5.2.1.40, p. 59

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 5.2.1.40, p. 59

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 5.2.1.40, p. 59

5.3.2.1 Function = Timer:

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

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

5.3.2.24 *Interval*

5.3.2.340 *Interval:* The interval can be programmed within a range of 1–1440 min.

5.3.2.44 *Run Time*: Enter the time the relay stays active.
Range: 5–32400 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. 68.
Range: 00:00:00–23:59:59

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

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

5.3.2.1 Function = Fieldbus:

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

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

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

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

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

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

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

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

5.3.4.4 *Fault:*

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

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

5.4 Miscellaneous

5.4.1 *Language:* Set the desired language.
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.

5.4.6 *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: 1200–115200 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

Download MSDS

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

Catalogue No.:	A-85.112.300, A-85.112.500, A-85.112.700
Product name:	Calibration Solution pH 4
Catalogue No.:	A-85.113.300, A-85.113.500, A-85.113.700
Product name:	Calibration Solution pH 7
Catalogue No.:	A-85.114.300, A-85.114.500, A-85.114.700
Product name:	Calibration Solution pH 9
Catalogue No.:	A-85.121.300
Product name:	Redox calibration solution

11. Default Values

Operation:

Sensors:	Filter Time Const.:	30 s
	Hold after Cal.:	300 s
Alarm Relay		same as in Installation
Signal Output		same as in Installation
Relay 1 / 2		same as in Installation
Input		same as in Installation
Logger:	Logger Interval:	30 min
	Clear Logger:	no

Installation:

Sensors	Electrodes:	pH–mV
	Temp. Sensor:	None
	Default Temp.	25 °C
	Flow: Sensor	none
	Standards: pH Standard 1	@ 0 °C; 7.13 pH
		@ 5 °C; 7.07 pH
		@ 10 °C; 7.05 pH
		@ 15 °C; 7.02 pH
		@ 20 °C; 7.00 pH
		@ 25 °C; 6.98 pH
		@ 30 °C; 6.97 pH
		@ 35 °C; 6.96 pH
		@ 40 °C; 6.95 pH
		@ 50 °C; 6.95 pH
	Standards: pH Standard 2	@ 0 °C; 9.24 pH
		@ 5 °C; 9.16 pH
		@ 10 °C; 9.11 pH
		@ 15 °C; 9.05 pH
		@ 20 °C; 9.00 pH
		@ 25 °C; 8.95 pH
		@ 30 °C; 8.91 pH
		@ 35 °C; 8.88 pH
		@ 40 °C; 8.85 pH
		@ 50 °C; 8.79 pH
	Standards: Redox Standard	475 mV

Signal Output 1	Parameter: ..... Meas. Value 1
	Current loop: ..... 4 –20 mA
	Function: ..... linear
	Scaling: Range low: ..... 0.00 pH
	Scaling: Range high: ..... 14.00 pH
Signal Output 2	Parameter: ..... Meas. Value 2
	Current loop: ..... 4 –20 mA
	Function: ..... linear
	Scaling: Range low: ..... 0 mV
	Scaling: Range high: ..... 1400 mV
Alarm Relay:	Meas. Value 1:
	Alarm high: ..... 5.00 pH
	Alarm low: ..... -3.00 pH
	Hysteresis: ..... 0.1 pH
	Delay: ..... 5 s
	Meas. Value 2:
	Alarm high: ..... 1500 mV
	Alarm low: ..... -500 mV
	Hysteresis: ..... 10 mV
	Delay: ..... 5 s
	Temperature 1/2: Alarm High: ..... 55 °C
	Temperature 1/2: Alarm Low: ..... 5 °C
	Case temp. high: ..... 65 °C
	Case temp. low: ..... 0 °C
Relay 1	Function: ..... limit upper
	Parameter: ..... Meas. Value 1
	Setpoint: ..... 14.00 pH
	Hysteresis: ..... 0.1 pH
	Delay: ..... 30 s
	If Function = Control upw. or dnw:
	Parameter: ..... Meas. Value 1
	Settings: Actuator: ..... Frequency
	Settings: Pulse Frequency: 120/min
	Settings: Control Parameters: Setpoint: ..... 14.00 pH
	Settings: Control Parameters: P-band: ..... 0.1 pH
	Settings: Control Parameters: Reset time: ..... 0 s
	Settings: Control Parameters: Derivative Time: ..... 0 s
	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: ..... 1 min
Mode: daily/weekly: ..... Starting time: 00.00.00
Run time: ..... 10 s
Delay: ..... 5 s
Signal output: ..... cont.
Output/Control: ..... cont.

Relay 2

Function: ..... limit upper
Parameter: ..... Meas. Value 2
Setpoint: ..... 1400 mV
Hysteresis: ..... 10 mV
Delay: ..... 30 s

If Function = Control upw. or dnw:

Parameter: ..... Meas. Value 2
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 1400 mV
Settings: Control Parameters: P-band: ..... 10 mV
Settings: Control Parameters: Reset time: ..... 0 s
Settings: Control Parameters: Derivative Time: ..... 0 s
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 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

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Analytical Instruments for:

- High Purity Water
- Feedwater, Steam and Condensate
- Potable Water
- Pool and Sanitary Water
- Cooling Water
- Waste Water and Effluents

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