ANALYTICAL INSTRUMENTS

A-96.210.481 / 031025

AMI-II pH/Redox

Operator's Manual

MADE IN SWITZERLAND

Customer Support

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This manual applies to firmware V1.00 and higher.
The information contained in this document is subject to change without notice.

Table of Contents

Operator's Manual

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

1. Safety Instructions

General

The instructions included in this section explain the potential risks associated with instrument operation and provide important safety practices designed to minimize these risks.
If you carefully follow the information contained in this section, you can protect yourself from hazards and create a safer work environment.
More safety instructions are given throughout this manual, at the respective locations where observation is most important. Strictly follow all safety instructions in this publication.

Target audience

Operator: Qualified person who uses the equipment for its intended purpose.
Instrument operation requires thorough knowledge of applications, instrument functions and software program as well as all applicable safety rules and regulations.

OM location

Keep the Operator's Manual in proximity of the instrument.

Qualification, training

To be qualified for instrument installation and operation, you must

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

1.1. Warning Notices

The symbols used for safety-related notices have the following meaning:

DANGER

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

- Follow the prevention instructions carefully.

WARNING

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

- Follow the prevention instructions carefully.

CAUTION

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

- Follow the prevention instructions carefully.

Mandatory signs

The mandatory signs in this manual have the following meaning:

Safety goggles

Safety gloves

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


Electrical shock hazard


Corrosive


Harmful to health


Flammable


General warning


Attention

1.2. General Safety Regulations

Legal requirements

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

Spare parts and disposables

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

Modifications

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

WARNING

Electrical shock hazard

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

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

WARNING

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

2. Product Description

2.1. Description of the System

Application range

pH and ORP are measured in many applications as for example potable water, high purity water or waste water. Each application requires different fittings, flow cells, and sensors.

Potable water

pH is measured at the inlet and at the outlet of the plant, ORP is hardly determined. In the raw water, a cleaning might be necessary in very special cases. Because potable water is normally very clean water, no problems are to be expected.

Swan offers a complete monitor including a transmitter, a suitable flow cell, a sensor, and a temperature sensor, mounted on a panel. This makes start-up and operation very easy, because you receive a completely tested unit.

High purity water

pH is a key parameter in the demineralization of water to produce high-purity water and, in general, in the use of high-purity water, e.g., in power plants. In demineralization plants, pH is used to monitor whether the plant is functioning correctly and consistently. In thermal power plants, correct pH adjustment is essential to minimize corrosion and save chemicals: pH is monitored continuously in feedwater, boiler-water, district heating water cycles and condensate to detect deviations immediately.

Since high-purity water has low conductivity, special sensors with liquid electrolyte are required in these applications. Swan offers a complete monitor including a transmitter, a suitable flow cell, a sensor for low-conductivity water and a temperature sensor, mounted on a panel.

Waste water

pH is mostly measured at the inlet (warning of extreme pH levels), of a biological tank (optimal conditions for bacteria), and at the outlet of sewage treatment (monitoring of environmental limits). ORP may be measured at the inlet, but is most frequently used in the biological tank to control nitrification/denitrification.

In most cases, the problematic sampling point is at the inlet of the plant. Here pollution with grease or oil may require an automatic cleaning function and a careful choice of the installation point. The sensor should be easily accessible for routine maintenance and cleaning.

Sample point in open channels

For this kind of installation, use submerge fittings, a sensor protected against pollution and a transmitter.

Available models

The instrument is available in three variants:

- AMI-II pH/Redox M-Flow: Monitor on PVC panel for applications in potable water, effluents and cooling water.
- AMI-II pH/Redox QV-Flow: Monitor on stainless steel panel for applications in water cycles of power and industrial plants, as well as in demineralization plants.
- Single components for various applications, including wastewater.

Options

The AMI-II pH/Redox M-Flow can be equipped with the following options:

- Spray nozzle for sensor cleaning
- U-Flow ultrasonic flow meter
- AMI-II Relay Box

Signal outputs

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

Current loop: 0/4–20 mA

Maximal burden: 510 Ω

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

Relays

Two potential-free contacts programmable as limit switches for measured values, controllers or timers with automatic hold function.
Maximum load: 100 mA/50 V resistive

AMI-II Relay Box (option)

The AMI-II Relay Box adds two additional relays to the AMI-II transmitter (displayed as relays 3 and 4 in the menu).
It is intended for the direct power supply (AC) and control of dosing devices, e.g. two solenoid valves, two dosing pumps or one motor valve.
Maximum load: 1.5 A/230 VAC

Alarm relay

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

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

Maximum load: 100 mA/50 V resistive

Input

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

Communication interface (optional)

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

Safety features

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

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.

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 millivolt (mV).

Temperature compensation

When measuring pH, two types of temperature dependence must be differentiated. On the one hand, the measuring chain is temperature-dependent, and on the other hand, the pH value of the sample is also temperature-dependent.

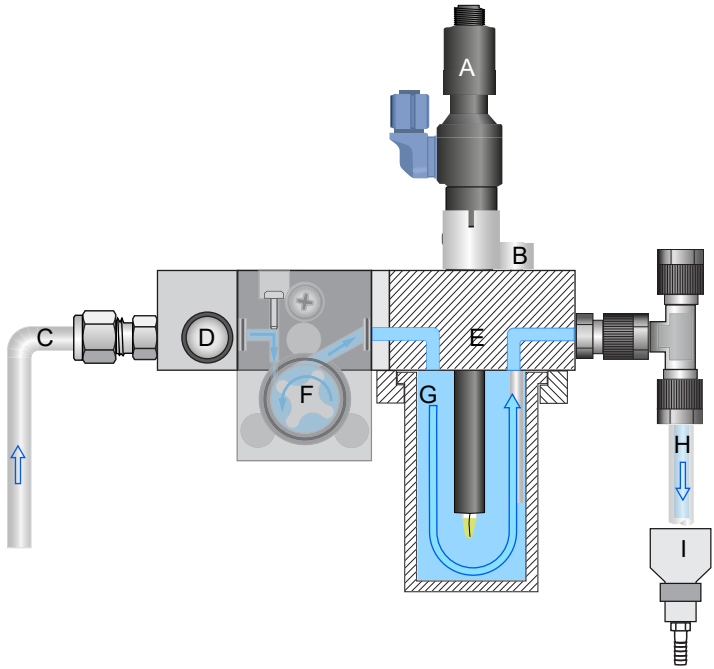
The temperature dependence of the measuring chain is mainly determined by the temperature-dependent slope of the glass electrode, which is described by the Nernst equation. At 25 °C, for example, the potential at the glass electrode changes by 59.16 mV per pH unit. The temperature of the sample is taken into account when converting the measured voltage into the pH value, which is generally described as "automatic temperature compensation according to Nernst". This temperature compensation is always applied when measuring pH.

The temperature dependence of the pH of the sample is usually unknown and therefore cannot be compensated for, which is why the temperature at which the measurement was taken should also be recorded for a pH measurement. Exceptions are solutions with a defined composition and high-purity water, for which the temperature dependence of the pH is known. For SWAN pH calibration solutions (pH 7 and 9), the temperature-dependent pH values are stored in tables in the firmware and are taken into account when calibrating a pH electrode. For high-purity water, two models are available for temperature compensation of the pH of the sample to 25 °C: nonlinear compensation according to ASTM 5128 and linear compensation with programmable temperature coefficient.

No temperature compensation is necessary when measuring redox potential (ORP).

Fluidics (QV-Flow)

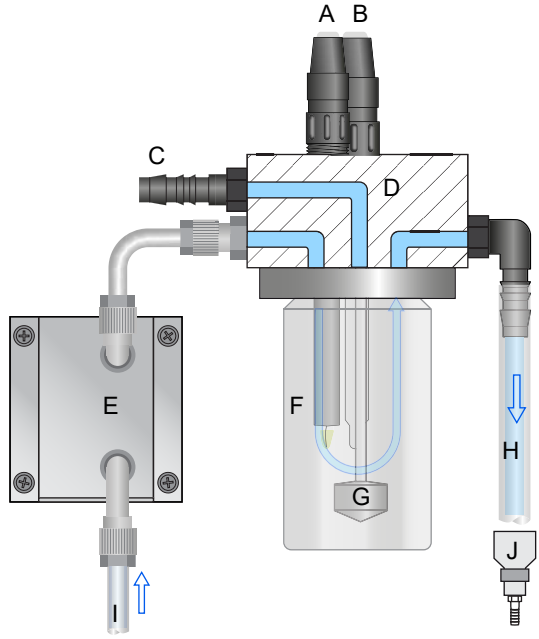
The QV-Flow flow cell consists of the flow regulating valve [D], the flow sensor [F], the flow cell block [E] and the calibration vessel [G].
The sample enters at the sample inlet [C] and flows through the flow control valve [D], where the flow rate can be adjusted. The sample then flows through the flow sensor [F] and the flow cell block [E] into the vessel [G], where the pH or redox value and the temperature of the sample is measured.
The sample leaves the vessel via the flow cell block through the sample outlet [H] and flows into the pressure-free drain [I].



A *pH/redox sensor*
B *Temperature sensor*
C *Sample inlet (stainless steel tube)*
D *Flow regulating valve*
E *Flow cell block*
F *Flow sensor*
G *Calibration vessel (stainless steel)*
H *Sample outlet*
I *Drain*

Fluidics (M-Flow)

The M-Flow 10-3PG flow cell consists of the flow cell block [D] and the calibration vessel [F].
The pH or redox sensor [A] and the temperature sensor [B] are screwed into the flow cell block [D].
A spray nozzle [G] can be installed as an option. The spray nozzle allows the sensor tips to be cleaned without having to remove the sensors. The supply tube for the spray nozzle is connected to the hose nozzle [C].
The sample enters the flow meter [E] via the sample inlet [I] and flows through the flow cell block into the calibration vessel [F], where the pH or redox value is measured.
The sample leaves the calibration vessel via the flow cell block through the sample outlet [H] and flows into the drain [J].



A *pH/redox sensor*
B *Temperature sensor*
C *Inlet to spray nozzle*
D *Flow cell block*
E *Swansensor U-Flow (option)*
F *Calibration vessel*
G *Spray nozzle*
H *Sample outlet*
I *Sample inlet*
J *Drain*

2.2. Instrument Specification

Power supply	AC variant:	100–240 VAC (±10%) 50/60 Hz (±5%)
	DC variant:	10–36 VDC
	Power consumption	max. 35 VA
Sample requirements	**QV-Flow:**	
	Flow rate:	3–10 l/h
	Temperature:	0 to 50 °C
	Inlet pressure:	max. 2 bar
	Outlet pressure:	pressure free
	M-Flow:	
	Flow rate:	3–15 l/h
	Temperature:	up to 50 °C
	Operating pressure:	up to 1 bar
On-site requirements	**QV-Flow:**	
	Sample inlet:	Swagelok ¼" tube adapter
	Sample outlet:	for flexible tube, 15 mm inner Ø
	M-Flow:	
	Without Swansensor U-Flow:	
	Sample inlet:	elbow hose nozzle for flexible tube, 10 mm inner Ø
	Sample outlet:	for flexible tube, 15 mm inner Ø
	With Swansensor U-Flow:	
	Sample inlet:	6 mm Serto tube adapter (PA)
	Sample outlet:	for flexible tube, 15 mm inner Ø

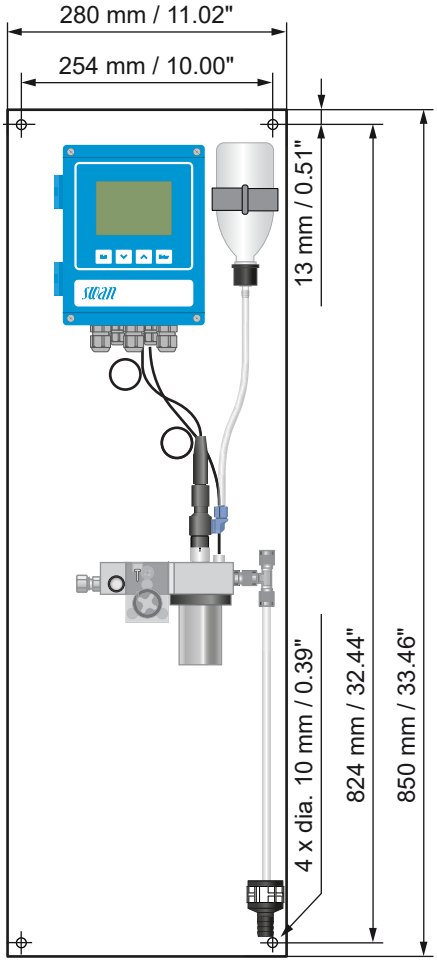
	Parameter	Range	Resolution
Measuring range	pH:	1.00–13.00 pH	0.01 pH
	Redox (ORP)	-1500–1500 mV	1 mV

Temperature sensor:	Pt1000 (DIN class A)
Range:	-30–250 °C
Accuracy (0–50 °C)	±0.25 °C
Resolution	0.1 °C

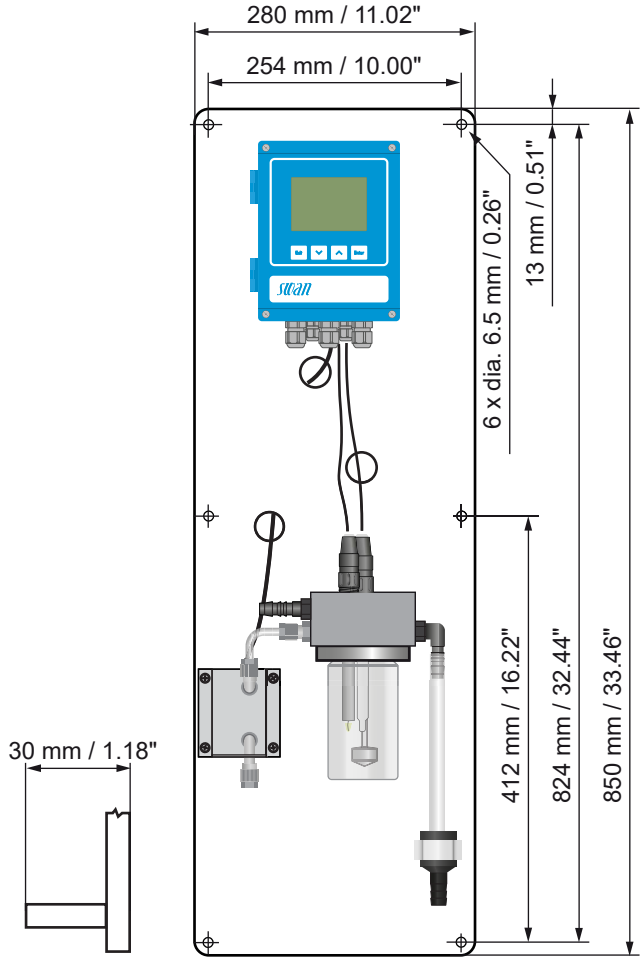
The operating temperature is limited by the flow cell and the sensor.

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

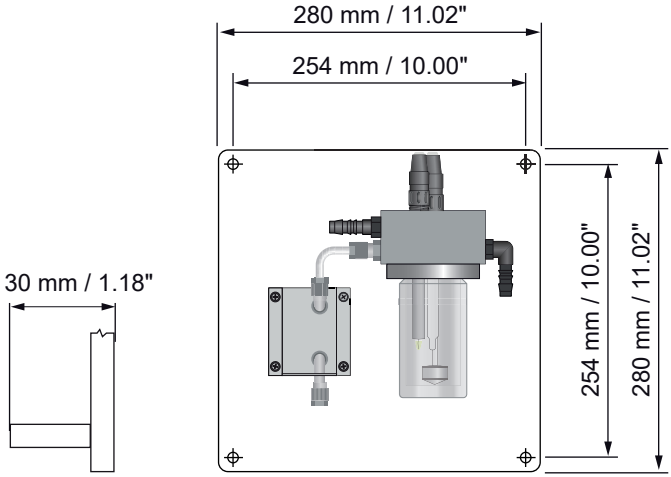
Dimensions (QV-Flow)	Panel:	stainless steel
	Dimensions:	280×850×180 mm
	Screws:	8 mm
	Weight:	8 kg



Dimensions (M-Flow)	Panel:	PVC
	Dimensions:	280×850×180 mm
	Screws:	8 mm
	Weight:	6 kg

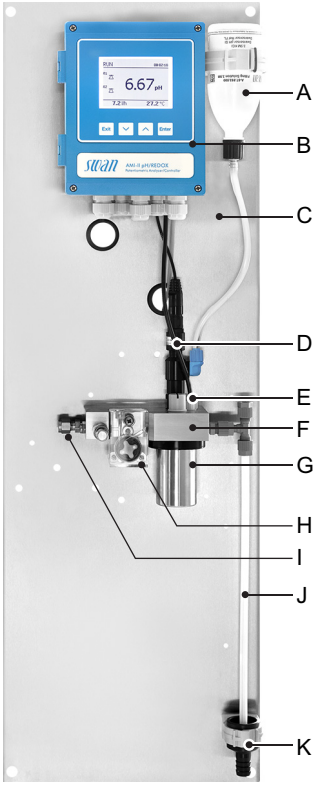


Dimensions (small panel)	Panel:	PVC
	Dimensions:	280×280×180 mm
	Screws:	8 mm



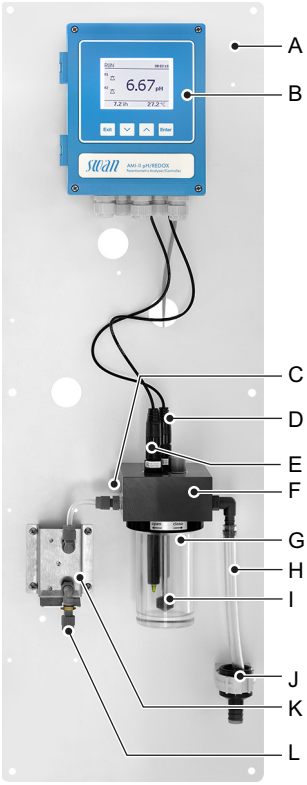
2.3. Instrument Overview

2.3.1 Monitor AMI-II pH/Redox QV-Flow



A *KCl bottle*
B *Transmitter*
C *Panel*
D *pH/redox sensor*
E *Temperature sensor*
F *Flow cell*
G *Calibration vessel*
H *Flow sensor*
I *Sample inlet*
J *Sample outlet*
K *Drain*

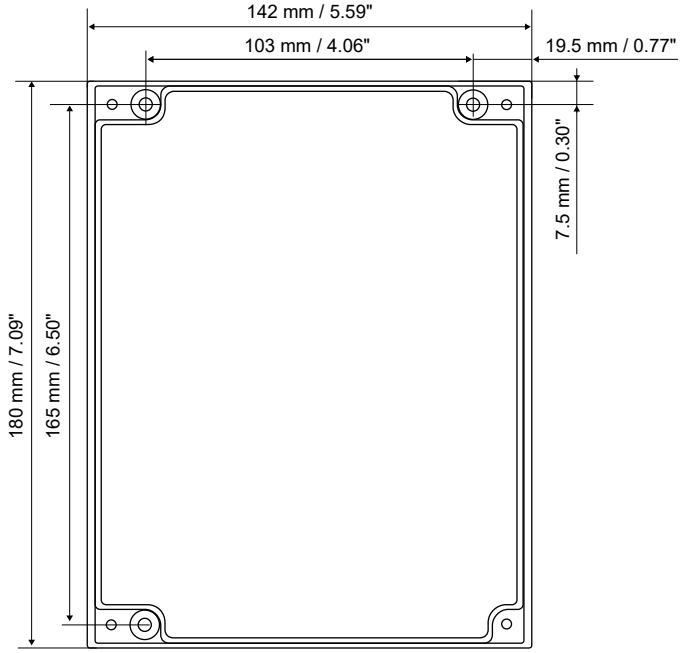
2.3.2 Monitor AMI-II pH/Redox M-Flow



A *Panel*
B *Transmitter*
C *Blind plug for spray nozzle inlet*
D *Temperature sensor*
E *pH/redox sensor*
F *Flow cell block*
G *Calibration vessel*
H *Sample outlet*
I *Spray nozzle (option)*
J *Drain*
K *Swansensor U-Flow (option)*
L *Sample inlet*

2.4. Single Components

2.4.1 AMI-II Transmitter



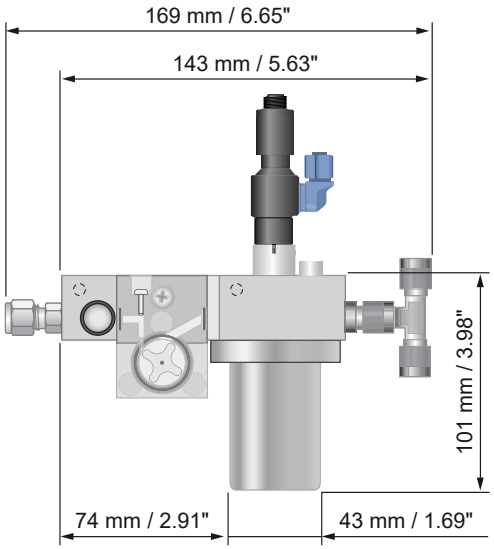
Specifications

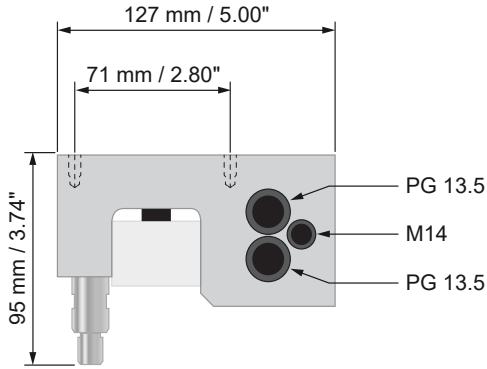
Electronics case:	Cast aluminum
Protection degree:	IP 66 / NEMA 4X
Display:	backlit LCD, 74 x 53 mm
Electrical connectors:	screw clamps

2.4.2 Flow Cell QV-Flow 2PG-T

Flow cell with integrated needle valve and flow meter for pH and redox potential (ORP) measurement in ultrapure water.

Dimensions



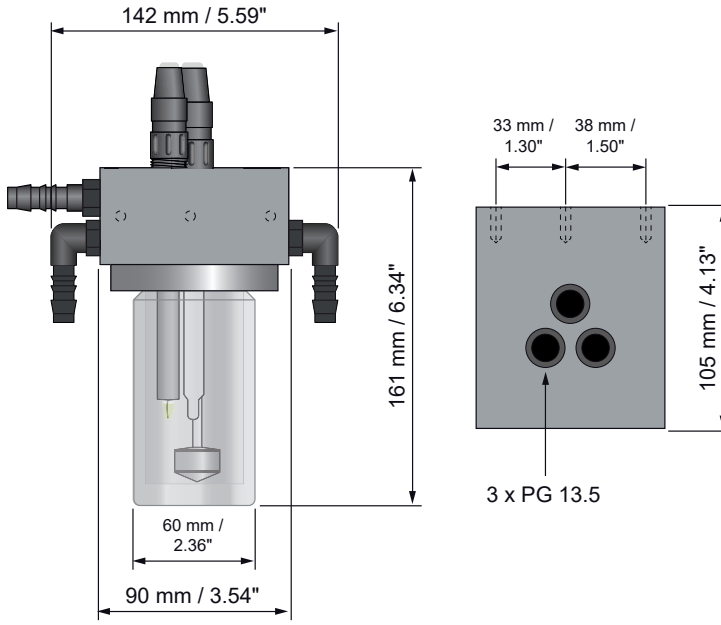


Sample conditions	Operating temperature:	max. 50 °C
	Inlet pressure:	max. 2 bar
	Outlet pressure:	pressure free
	Tube length at outlet:	max. 1.5 m
	Sample flow	3 to 10 l/h
Process connections	Inlet:	Swagelok fitting with R ⅛" (ISO 7-1) thread for ¼" tube OD
	Outlet:	8 mm Serto tube adapter (PA)
Sensor inserts	Threads:	PG13.5 (electrodes), M14 (temperature sensor)
	Insertion depth:	max. 75 mm
Material	Stainless steel 1.4404 (SS316L)	

2.4.3 Flow Cell M-Flow 10-3PG

General-purpose flow cell for measurements with pH and/or redox electrodes.

Dimensions



Sample conditions

Operating temperature:	max. 50 °C
Operating pressure:	max. 1 bar
Sample flow	3 to 15 l/h

Pressure and temperature specifications apply to the flow cell without sensors.

Process connections

Inlet and outlet:	Hose nozzle for 10 mm tube
Cleaning water:	Hose nozzle for 10 mm tube

Sensor inserts

Threads:	PG13.5 (electrodes and temperature sensor)
Insertion depth:	max. 120 mm

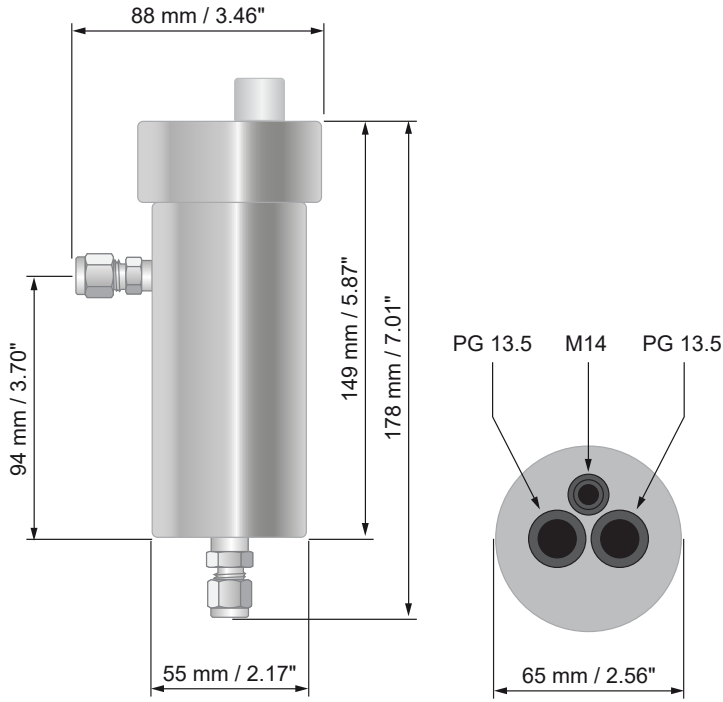
Materials

PVC and PMMA.

2.4.4 Flow Cell B-Flow 2PG-T

Flow cell for pH and redox potential (ORP) measurement in water at high pressure.

Dimensions



Sample conditions

Operating temperature:	max. 100 °C
Operating pressure:	max. 10 bar

Pressure and temperature specifications apply to the flow cell without sensors.

Process connections

Inlet and outlet:	NPT ¼" female thread
Cleaning water:	NPT ¼" female thread

Swagelok fittings must be ordered separately.

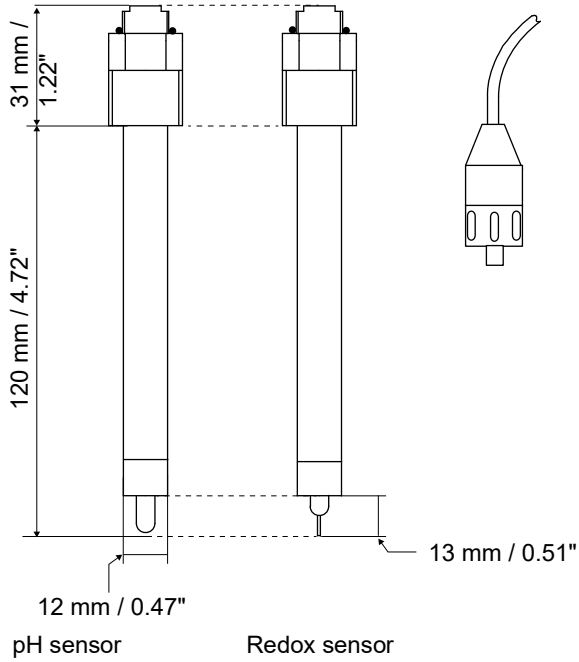
Sensor inserts

Threads:	PG13.5 (electrodes), M14 (temperature sensor)
Insertion depth:	max. 120 mm

Material Stainless steel 1.4404 (SS316L)

2.4.5 Swansensor pH and Redox Standard

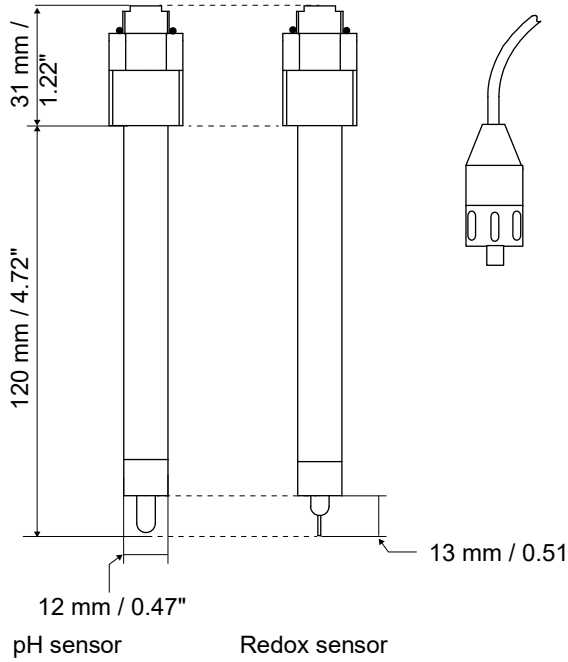
Combined electrode with gel electrolyte for application in drinking water and swimming pools.



Specifications pH sensor	Operative and measuring range:	1 to 13 pH
	Operating temperature:	0–50 °C
	Pressure:	<2 bar
	Conductivity:	>150 µS/cm
	Connection:	plug PG 13.5
Specifications ORP sensor	Operative and measuring range:	-1500 to 1500 mV
	Operating temperature:	0–50 °C
	Pressure:	<2 bar
	Conductivity:	>150 µS/cm
	Connection:	plug PG 13.5

2.4.6 Swansensor pH and Redox AY

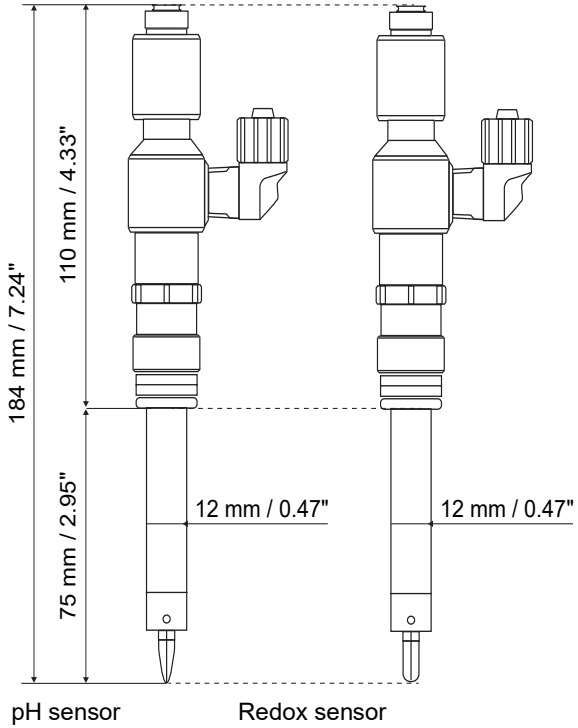
Combined electrode with solid polymer electrolyte and additional salt supplies for applications in waste water.



Specifications pH sensor	Operative and measuring range:	1 to 13 pH
	Operating temperature:	0–50 °C
	Pressure:	<2 bar
	Conductivity:	>100 µS/cm
	Connection:	plug PG 13.5
Specifications ORP sensor	Operative and measuring range:	-1500 to 1500 mV
	Operating temperature:	0–50 °C
	Pressure:	<2 bar
	Conductivity:	>100 µS/cm
	Connection:	plug PG 13.5

2.4.7 Swansensor pH and Redox SI

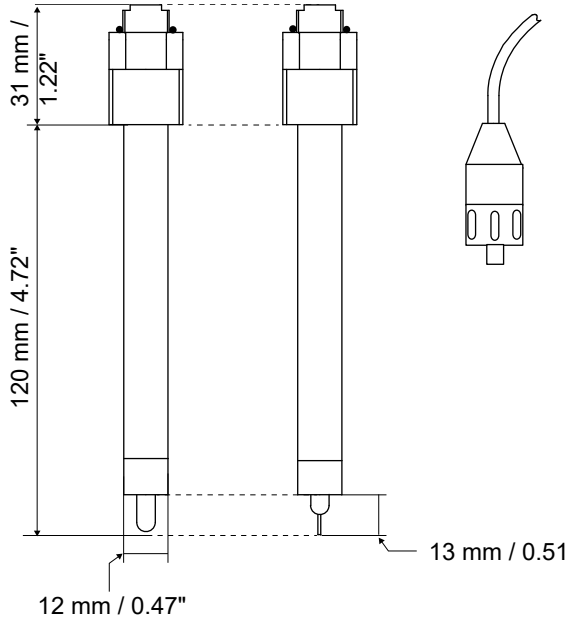
pH/redox electrode with reference electrode for the measurement of pH/redox value in power plants.



Specifications pH sensor	Operative and measuring range:	1 to 13 pH
	Operating temperature:	0–50 °C
	Electrolyte:	KCl, 3.5 M
	Pressure:	pressure free
	Conductivity:	>0.055 µS/cm
	Connection:	plug PG 13.5
Specifications ORP sensor	Operative and measuring range:	-1500 to 1500 mV
	Operating temperature:	0–50 °C
	Electrolyte:	KCl, 3.5 M
	Pressure:	pressure free
	Conductivity:	>0.055 µS/cm
	Connection:	plug PG 13.5

2.4.8 Swansensor pH and Redox FL

pH/Redox electrode for the measurement of pH value or redox potential in high purity water. Only in combination with Swansensor Reference FL.

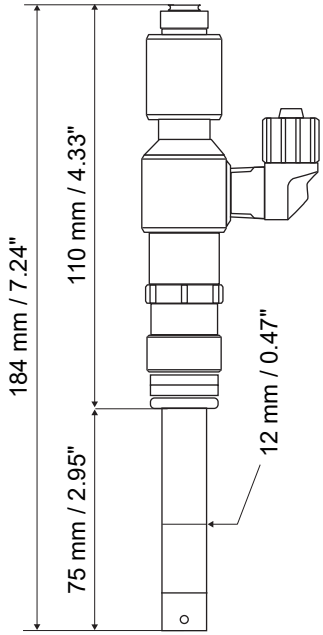


pH sensor Redox sensor

Specifications pH sensor	Operative and measuring range:	1 to 13 pH
	Reference electrode:	Reference FL
	Operating temperature:	0–50 °C
	Pressure:	pressure free
	Conductivity:	>0.055 µS/cm
	Connection:	plug PG 13.5
Specifications Redox sensor	Operative and measuring range:	-1500 to 1500 mV
	Reference electrode:	Reference FL
	Operating temperature:	0–50 °C
	Pressure:	pressure free
	Conductivity:	>0.055 µS/cm
	Connection:	plug PG 13.5

2.4.9 Swansensor Reference FL

Reference electrode for Swansensor pH FL or Swansensor Redox FL.



Specifications

Reference system:	Ag/AgCl
Electrolyte:	KCl, 3.5 M
Operating temperature:	0–50 °C
Pressure:	pressure free
Conductivity:	>0.055 µS/cm
Connection:	plug PG 13.5

3. Installation

3.1. Installation Checklist

On-site requirements	AC variant: 100–240 VAC (±10%), 50/60 Hz (±5%). DC variant: 10–36 VDC. Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see Instrument Specification, p. 14).
Installation	Mount the instrument in vertical position. Display should be at eye level.
Electrodes	Install the sensors and connect the sensor cables. Store the protective caps for later use.
Electrical wiring	Connect all external devices like limit switches and current loops according to the connection diagram. Connect power cord.
Power-up	Start sample flow and wait until the flow cell is completely filled. Switch on power.
Instrument setup	Adjust sample flow. Program all sensor parameters. Program all parameters for external devices (interface, recorders, etc.). Program all parameters for instrument operation (limits, alarms).
Run-in period	Let the instrument run continuously for 1 h.
Calibration	Calibrate the pH or redox electrode.

3.2. Mounting the Instrument

Mounting requirements

Mount the instrument in vertical position. The display should be at eye level to simplify operation and maintenance.
The instrument is intended for indoor installation or weather-protected installation in cabinets.
If a measurement is set up outdoors based on individual components, e.g. with immersion assemblies, the AMI-II transmitter must be protected from the effects of direct weathering and, in particular, direct sunlight e.g., by using a sun roof or weather protection cover.

Dimensions

For panel dimensions, see p. 16, p. 17 and p. 18.
For transmitter dimensions, see p. 21.

3.3. Connecting Sample Inlet and Outlet

3.3.1 QV-Flow

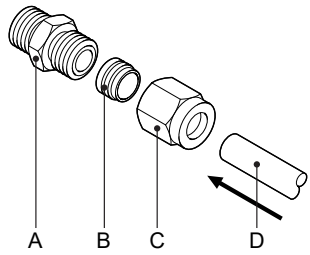
Preparation

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 ferrule).

Installation

1 Screw on the union nut by hand until finger tight. At the same time, push the tube against the body.

2 Tighten down the union nut 1¾ rotation using an open ended spanner. Hold body from turning with a second wrench.

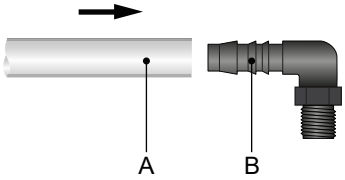


A *Body*
B *Compression ferrule*
C *Union nut*
D *Tube*

3.3.2 M-Flow

Without Swansensor U-Flow

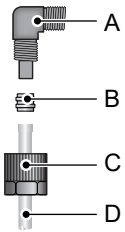
Use plastic tube (FEP, PA, or PE 10 x 12 mm) to connect the sample inlet and outlet.



A *Plastic tube 10 x 12*
B *Elbow hose nozzle*

With Swansensor U-Flow

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



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

3.4. Installing Electrodes

3.4.1 Flow Cell QV-Flow

The pH and ORP sensors are supplied separately and must be installed in the flow cell after the monitor has been installed.

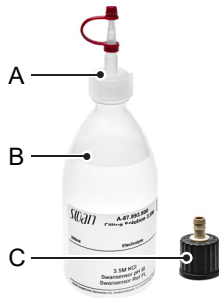
CAUTION

Fragile parts

pH and ORP sensors are fragile.

- Handle with care.

Prepare the KCl bottle

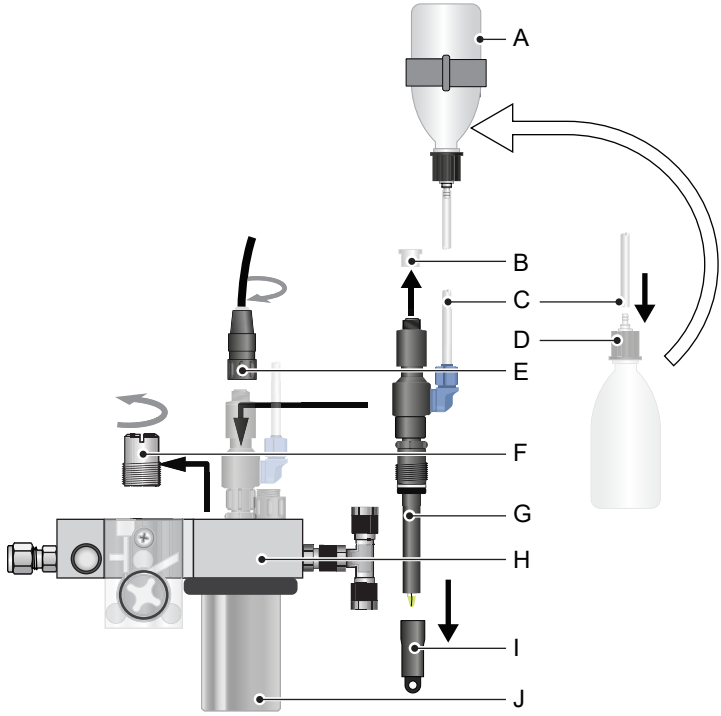


A *Seal cap with dosing tip*
B *KCl bottle*
C *Tube adapter*

1. Unscrew the seal cap with dosing tip [A] from the bottle.
2. Screw the tube adapter [C] onto the bottle.
3. Dispose of the seal cap [A].

Install the sensor

This instruction applies to both the pH and the ORP sensor.



A *KCl bottle*
B *Connector cap*
C *KCl supply tube*
D *Tube adapter*
E *Connector*
F *Blind plug*
G *Sensor*
H *Flow cell block QV-Flow*
I *Protection cap*
J *Calibration vessel*

Recommended personal protective equipment:

1 Unscrew and remove the blind plug [F] from the flow cell block.

2 Carefully remove the protection cap [I] from the sensor tip. Turn it clockwise only.

Be careful not to spill KCl when removing the protection cap.

3 Rinse the sensor tip with clean water.

4 Insert the sensor through the flow cell block [H] into the calibration vessel [J].

5 Tighten it hand-tight.

6 Remove the connector cap [B].

7 Screw the connector [E] onto the sensor.

8 Keep the protection caps in a safe place for later use.

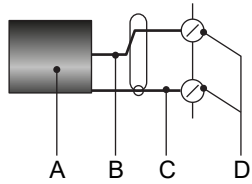
9 Attach the KCl supply tube to the tube adapter of the KCl bottle

10 Mount the KCl bottle to the bottle holder fixed on the panel.

11 Puncture the bottom of the KCl bottle.

Connection to transmitter

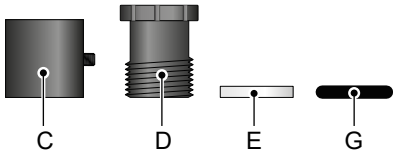
Connect the sensor cable to the transmitter according to the electrical connection scheme.
The coaxial cable of the sensor consists of an inner conductor [B] and a shield [C]. Do not interchange the conductors when connecting the cable to the terminals.



A *Coaxial cable*
B *Inner conductor (blue)*
C *Shield (white)*
D *Terminals*

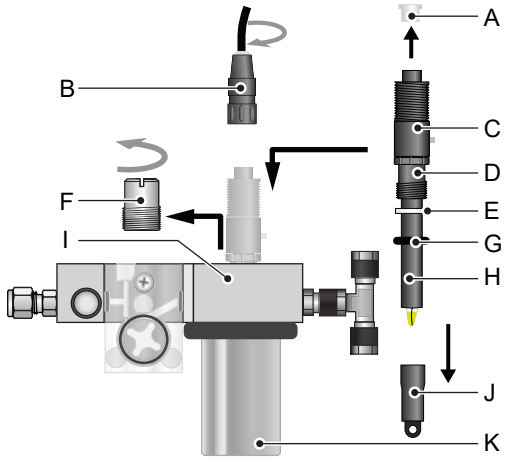
3.4.2 Adapter Set

An adapter set is available, which allows to install sensors with a shaft length of 120 mm. This adapter set guarantees the correct installation depth of these sensors. It contains the following parts:



C *Distance sleeve with fixing screw*
D *Union screw*
E *Washer*
G *O-ring*

Installation



A *Connector cap*
B *Connector*
C *Distance sleeve*
D *Union screw*
E *Washer*
F *Blind plug*
G *O-ring*
H *Sensor shaft*
I *Flow cell block*
J *Protection cap*
K *Calibration vessel*

Recommended personal protective equipment:

To install a sensor with a shaft length of 120 mm proceed as follows:

1. Unscrew and remove the blind plug [F] from the flow cell block.
2. Carefully remove the protection cap [J] from the sensor tip. Turn it clockwise only.
3. Rinse the sensor tip with clean water.
4. Slide the distance sleeve [C] over the sensor shaft and slightly tighten the fixing screw.
5. Slide the union screw [D], the washer [E] and the O-ring [G] over the sensor shaft [H].
6. Insert the sensor through the flow cell block [I] into the calibration vessel [K].
7. Tighten the union screw [D] hand-tight.
8. Remove the connector cap [A].
9. Screw the connector [B] onto the sensor.
10. Keep the protection caps in a safe place for later use.

3.4.3 Flow Cell M-Flow

The pH and ORP sensors are supplied separately and must be installed in the flow cell after the monitor has been installed.

CAUTION

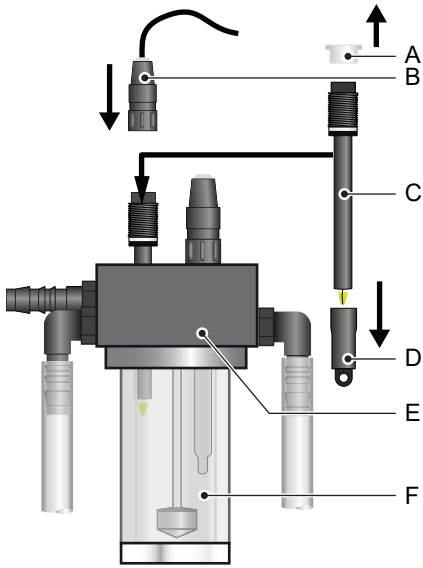
Fragile parts

The pH and the ORP sensors are fragile.

- Handle with care.

Sensors

This instruction applies to both the pH and the ORP sensor.



A *Connector cap*
B *Connector*
C *Sensor*
D *Protection cap*
E *Flow cell block*
F *Calibration vessel*

Recommended personal protective equipment:

1 Carefully remove the protection cap [D] from the sensor tip. Turn it clockwise only.

Be careful not to spill KCl when removing the protection cap.

2 Rinse the sensor tip with clean water.

3 Insert the sensor through a hole in the flow cell block [E] into the calibration vessel [F].

4 Tighten it hand-tight.

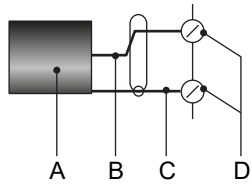
5 Remove the connector cap [A].

6 Screw the connector [B] onto the sensor.

7 Keep the protection caps in a safe place for later use.

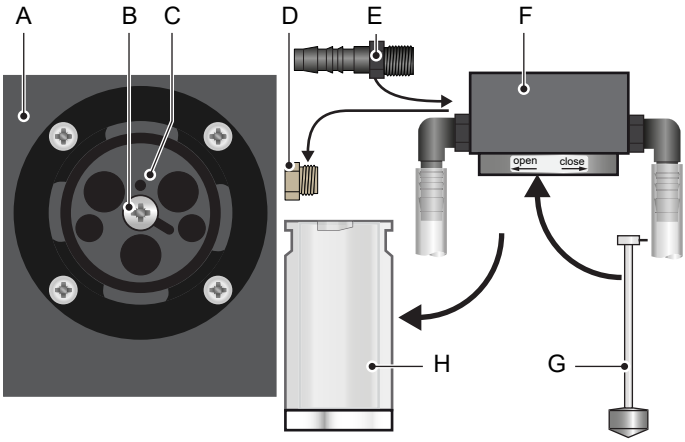
Connection to transmitter

Connect the sensor cable to the transmitter according to the electrical connection scheme.
The coaxial cable of the sensor consists of an inner conductor [B] and a shield [C]. Do not interchange the conductors when connecting the cable to the terminals.



A *Coaxial cable*
B *Inner conductor (blue)*
C *Shield (white)*
D *Terminals*

3.5. Installing Spray Nozzle (Option) into M-Flow

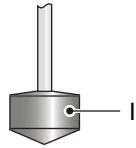


A *Flow cell block bottom view*
B *Cleaning solution inlet*
C *Threaded hole for fixing screw*
D *Blind plug*
E *Hose nozzle*
F *Flow cell block*
G *Spray nozzle*
H *Calibration vessel*

To install the optional spray nozzle proceed as follows:

1. Remove the sensors as described in Remove electrodes from flow cell, p. 62.
2. Remove the calibration vessel [H] from the flow cell block [F] and empty it.
3. Unscrew and remove the sealing screw from the cleaning solution inlet [B].
4. Insert the spray nozzle [G] so that its pin fits into the guiding slot of the cleaning solution inlet.
5. To fix the spray nozzle screw the enclosed M4 screw into the threaded hole [C] next to the cleaning solution inlet.
6. Install the sensors.

7 Make sure that the openings on the spray head [I] are aligned with the sensor tips. If necessary, rotate it slightly.



8 Fix the calibration vessel to the flow cell block.

9 Unscrew and remove the blind plug [D].

10 Install the hose nozzle [E].

3.6. Electrical Connections

WARNING

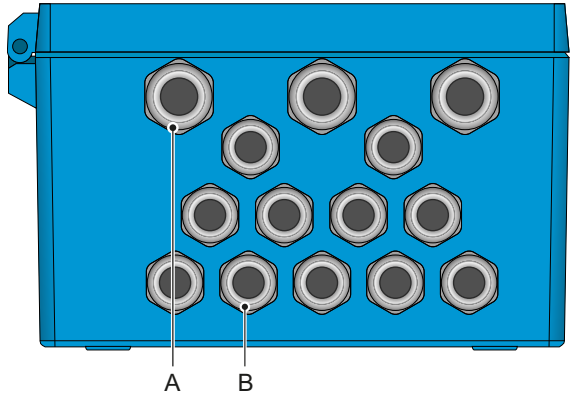
Risk of electrical shock

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

- Always turn off power before manipulating electric parts.
- Do not connect the instrument to power unless the ground wire (PE) is connected.
- Make sure the power specification of the instrument corresponds to the power on site.

Cable thicknesses

In order to comply with IP66, use the following cable thicknesses. Protect unused cable glands.

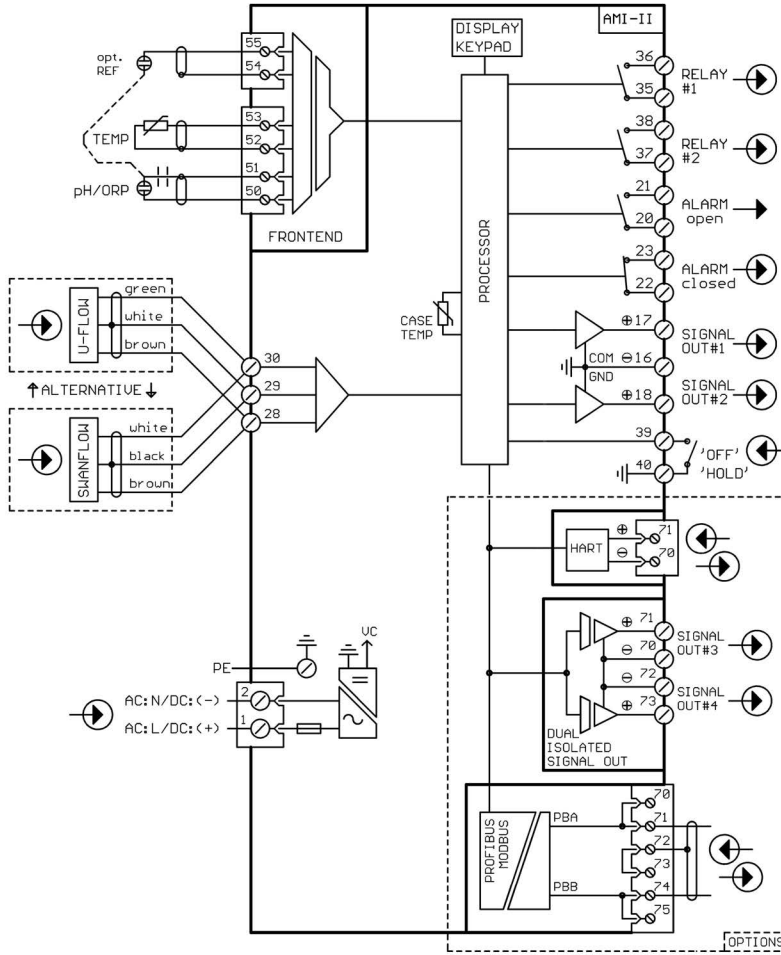


A *M16 cable glands (3x): cable* $Ø_{outer}$ *5–10 mm*
B *M12 cable glands (11x): cable* $Ø_{outer}$ *3–6 mm*

Wires

For power and relays: Use max. 1.5 mm^2 / AWG 14 stranded wire with end sleeves.
For signal outputs and input: Use 0.25 mm^2 / AWG 23 stranded wire with end sleeves.

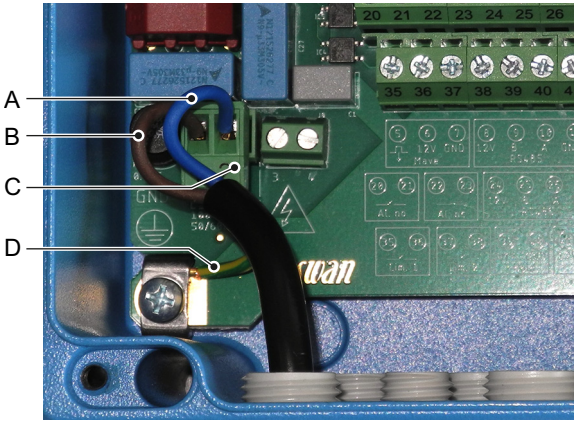
3.6.1 Connection Diagram



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.

3.6.2 Power Supply



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

Installation requirements

The installation must meet the following requirements.

- Mains cable 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-II pH/Redox

3.7. Relay Contacts

3.7.1 Input

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

3.7.2 Alarm Relay

Two alarm outputs for system errors.

- Normally closed contact (terminals: 22/23):
  Active (opened) when no error is present. Inactive (closed) on error and loss of power.
- Normally open contact (terminals: 20/21):
  Active (closed) when no error is present. Inactive (opened) on error and loss of power.

Max. load 100 mA/50 V resistive

3.7.3 Relay 1 and 2

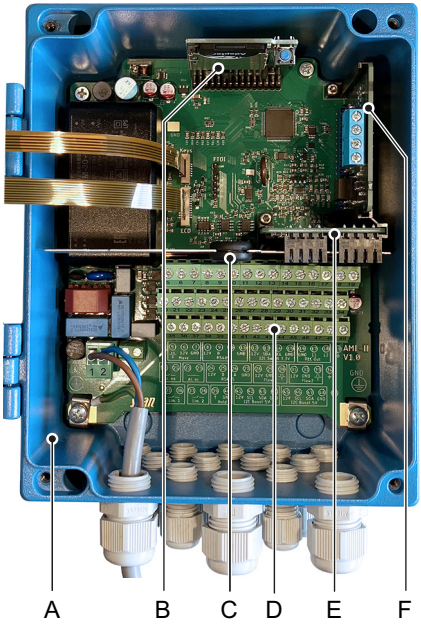
Max. load 100 mA/50 V resistive
Relay 1: terminals 35/36.
Relay 2: terminals 37/38.

3.8. Signal Outputs

3.8.1 Signal Output 1 and 2 (Current Outputs)

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

3.9. Interface Options



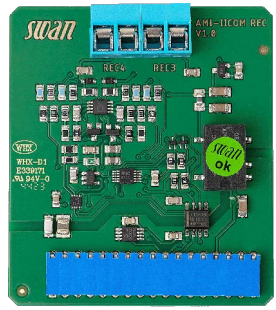
A *AMI-II transmitter*
B *SD card slot*
C *Cable grommet*
D *Screw terminals*
E *Frontend*
F *Communication option*

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

- Two additional signal outputs
- Profibus or Modbus
- HART

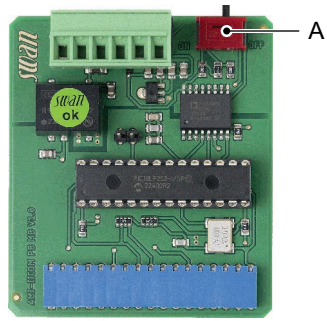
3.9.1 Signal Outputs 3 and 4

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



3.9.2 RS485 (Profibus or Modbus Protocol)

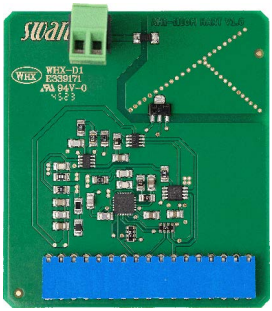
Terminal 74/75 PB, terminal 70/71 PA, terminal 72/73 shield
The switch [A] must be set to “ON” if only one instrument is installed or on the last instrument in the bus.



A *On/off switch*

3.9.3 HART

Terminals 71 (+) and 70 (-).



4. Instrument Setup

4.1. Establish Sample Flow

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

4.2. Programming

Sensors Menu 5.1.1
Select the parameter (pH or Redox) and the type of flow meter (none, QV-Flow, U-Flow).

External devices Menu 5.2 Signal Outputs
Menu 5.4 Interface

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

Calibration solutions Menu 5.1.4 Standards
If necessary, enter the values of the calibration solutions used. The temperature curves for the buffer solutions Standard 1 (pH7) and Standard 2 (pH9) available from Swan are preset in the transmitter firmware. To program the temperature curve for the buffer solution pH4 overwrite standard 2.

Please note that this table is only valid for Swan buffers. If you use different buffers, refer to the manufacturer's documentation.

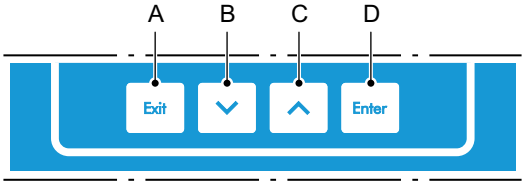
Temperature	Value pH7	Value pH9	Value pH4
Buffer value at 0 °C	7.13	9.24	3.99
Buffer value at 5 °C	7.07	9.19	3.99
Buffer value at 10 °C	7.05	9.14	3.99
Buffer value at 15 °C	7.03	9.08	3.99
Buffer value at 20 °C	7.01	9.05	3.99
Buffer value at 25 °C	7.00	9.00	4.00
Buffer value at 30 °C	6.99	8.96	4.01
Buffer value at 35 °C	6.98	8.93	4.01
Buffer value at 40 °C	6.98	8.90	4.03
Buffer value at 50 °C	6.98	8.84	4.05

4.3. Calibration of pH or Redox Electrode

Let the instrument run for at least one hour before calibrating the electrode.
See Process Calibration, p. 64 and Standard Calibration, p. 65.

5. Operation

5.1. Keys



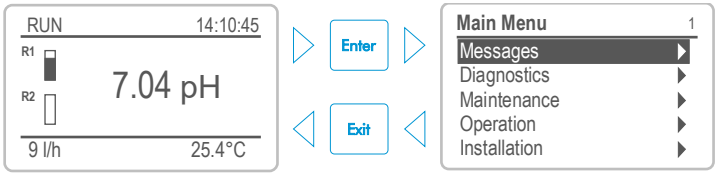
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

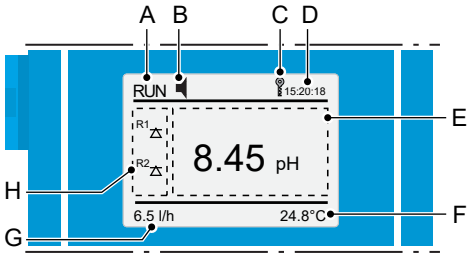
C to move up in a menu list and to increase digits

D to open a selected menu item
to accept an entry

Program access, exit



5.2. Display



A RUN — Normal operation

HOLD — Input active or cal delay: Instrument on hold (shows status of signal outputs)

OFF — Input active: Signal outputs go to 4 mA.

B Error — Non-fatal error — Fatal error

C Keys locked, transmitter control via Profibus

D Time

E Process values

F Sample temperature

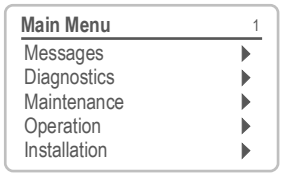
G Sample flow

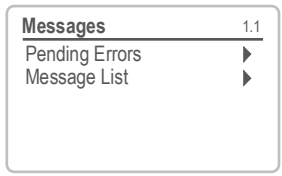
H Relay status
If the optional AMI-II Relay Box is installed, press the ⌄ key to display the status of relays 3 and 4.
Press the ⌄ key again to return to the status of relays 1 and 2.

Symbols used for relay status:

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

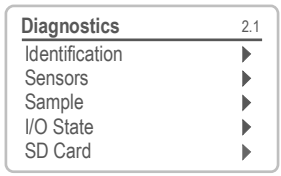
5.3. Software Structure





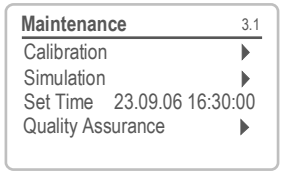
Menu Messages 1

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



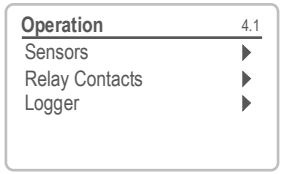
Menu Diagnostics 2

Provides user-relevant instrument and sample data.



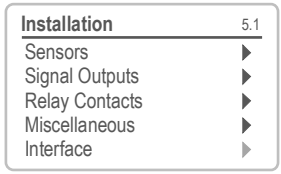
Menu Maintenance 3

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



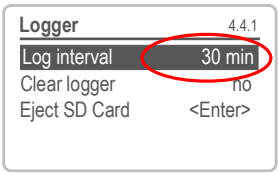
Menu Installation 5

For initial instrument set up by Swan authorized person. Can be protected by means of a password.

5.4. Changing Parameters and Values

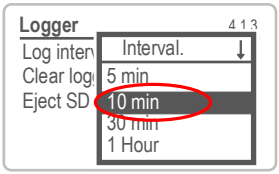
Changing parameters

The following example shows how to change the logger interval:



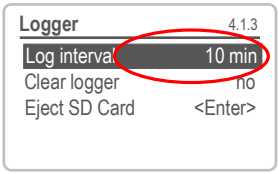
1 Select the parameter you want to change.

2 Press [Enter].



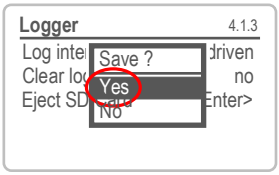
3 Press ^ or v to highlight the required parameter.

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



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

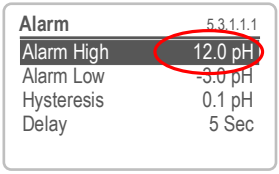
5 Press [Exit].



⇒ *Yes is highlighted.*

6 Press [Enter] to save the new parameter.

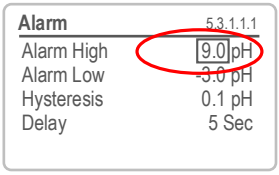
Changing values



1 Select the value you want to change.

2 Press [Enter].

3 Set required value with ^ or v.



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

6. Maintenance

6.1. Maintenance Schedule

Swansensor pH or Redox Standard:

Every three months	◆ If necessary, clean electrode. ◆ Check expiration date of calibration solution(s). ◆ Calibrate electrode.
Yearly	◆ Replace electrode.

Swansensor pH or Redox AY:

Twice per month	◆ Clean electrode.
Monthly	◆ If necessary, clean electrode. ◆ Check expiration date of calibration solution(s). ◆ Calibrate electrode.

Swansensor pH or Redox SI, Swansensor pH or Redox FL:

Weekly	◆ Check level in electrolyte bottle. ◆ If necessary, change electrolyte bottle.
Monthly	◆ Calibrate electrode.
Every three months	◆ Open the cap of the reference electrode slightly and allow a small amount (~5 ml) of electrolyte to flow out. ◆ Close the cap again hand-tight.

6.2. Stop of Operation for Maintenance

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

6.3. Cleaning Electrodes

6.3.1 Swansensor pH/Redox SI or FL

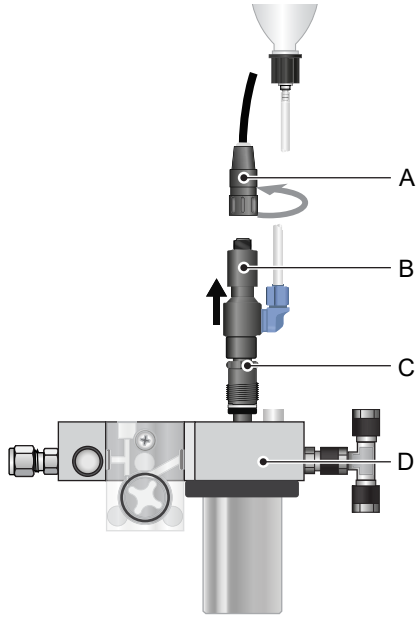
Do not remove the KCl bottle from its holder or the KCl supply tube from the KCl bottle when removing the electrode.
Do not put the electrodes into acids to clean them.

Removing electrodes from flow cell

To remove the electrodes 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*

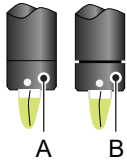
Cleaning the pH or Redox SI electrode

This instruction applies to Swansensor pH or Redox SI:

1 If necessary wipe the electrode shaft and the 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 the reference electrode and allow a small quantity of electrolyte (~ 5 ml) to flow out.



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

4 Tighten the sensor cap hand tight again.

5 Rinse the electrode tip thoroughly with clean water.

6 Install the electrode into the flow cell again.

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

Cleaning the pH or Redox FL electrode

This instruction applies to Swansensor pH or Redox FL:

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

2 Remove grease with a tissue moistened with alcohol.

3 Rinse the electrode tip thoroughly with clean water.

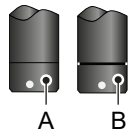
4 Install the electrode into the flow cell again.

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

Cleaning the Reference FL electrode

This instruction applies to Swansensor Reference FL:

1. If necessary, wipe off dirt 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 the reference electrode and allow a small quantity of electrolyte (~ 5 ml) to flow out.



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

4. Tighten the sensor cap hand tight again.
5. Rinse the electrode tip thoroughly with clean water.
6. Install the electrode into the flow cell again.
7. Let the electrode run in for 1 h before the first calibration.

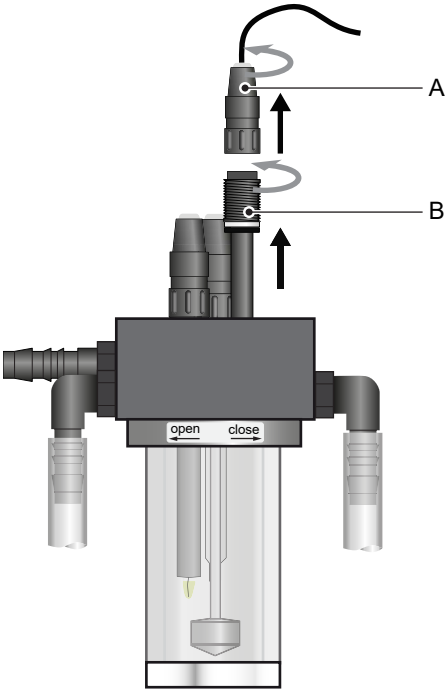
6.3.2 Swansensor pH/Redox Standard or AY

Remove electrodes from flow cell

To remove the electrodes 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.



A *Connector* ***B*** *Electrode*

Clean pH electrode

1 Wipe the electrode shaft and the tip cautiously with a soft, clean, and damp paper tissue.

2 Remove grease with a tissue moistened with alcohol.

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 into the flow cell again.

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

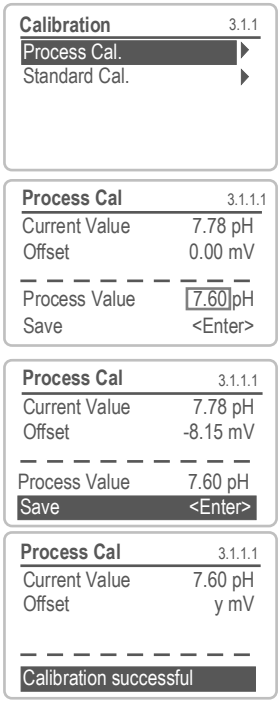
Clean ORP electrode

1. Wipe off dirt cautiously with a soft, clean and damp paper tissue.
2. Remove grease with a tissue moistened with alcohol.
   ⇒*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 into the flow cell again.
6. Let the electrode run-in for 1 h before the first calibration.

6.4. Process Calibration

The process calibration is based on a comparative measurement of the on-line instrument with a reference instrument.

Process pH or redox calibration



1 Navigate to **Maintenance** > **Process Cal**.

2 Press [Enter].

3 Enter the value of the comparative measurement using the arrow keys.

4 Press [Enter] to save.

⇒ *The process value is saved and the new offset in mV is displayed.*

Error messages

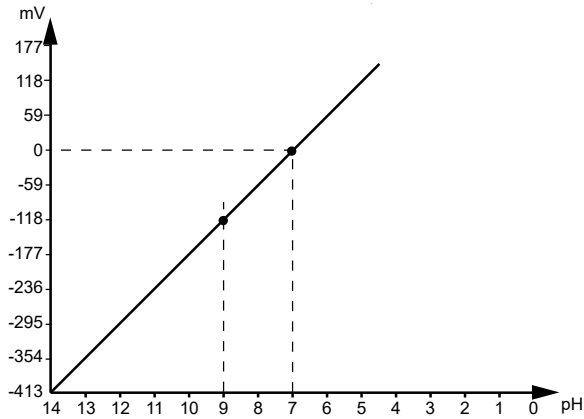
Possible reason for offset error:

Last calibration incorrect.
Electrode old or dirty.
Cable wet or broken.
Reference measurement incorrect.

6.5. Standard Calibration

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.



Standard ORP calibration

The reference electrode system used is Ag/AgCl. The measured 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 measured value is stable again.

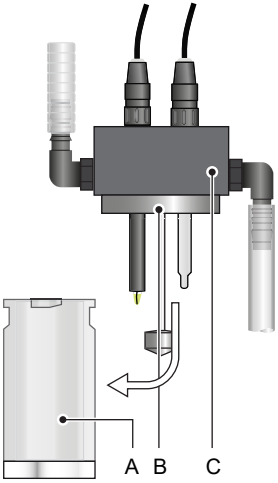
Procedure

To perform a standard calibration navigate to menu **Maintenance** > **Calibration** and select “Standard pH” or “Standard ORP”. Follow the dialog on the screen.

Note:

- *Calibration must be performed with a clean sensor (and a clean calibration vessel). If necessary apply the cleaning procedure described in* *Cleaning Electrodes, p. 59**.*
- *Calibration solutions have to be clean. Do not use if expired.*
- *Always rinse and dry electrodes before immersing them into the calibration solutions.*

If the sensors are clean, it is not necessary to remove them from the flow cell block. Simply unscrew the calibration vessel [A], clean it, fill it with the buffer solution and screw it back on.



A *Calibration vessel (measuring vessel)*
B *Bayonet socket*
C *Flow cell block*

Error messages

Possible reason for offset or slope error:
Old, dirty or wrong buffer solutions.
Electrode old or dirty.
Cable wet or broken.

6.6. Quality Assurance of the Instrument

Swan's online measuring instruments have integrated quality assurance functions that check the plausibility of each measurement. With the AMI-II pH/Redox, this includes continuous flow monitoring and monitoring of the temperature in the transmitter housing.
In addition, a menu-guided quality assurance procedure can be carried out with a certified reference instrument (AMI Inspector). By selecting a quality assurance level in the menu, the quality assurance procedure is activated and the instrument reminds the user at regular intervals to carry out the quality assurance procedure. The results are saved in a history.
The menu-guided quality assurance procedure is only available for pH measurement.

Quality assurance levels

There are three predefined levels and a user level. These define the test interval and the deviation limits for temperature and measurement result between the test equipment and the measuring instrument.

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

Additional level:

- Level 4 User: Inspection interval and maximum deviation of temperature and measuring result defined by user.

Limits and intervals:

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

6.6.1 Activate Swan Quality Assurance Procedure

Navigate to **Installation** > **Sensors** > **Quality Assurance** > **Level** and select the level from the list. The required submenus are automatically activated.

6.6.2 Preparations

- Reference instrument: AMI INSPECTOR pH:
  - Check certificate. The certificate of the reference instrument should not be older than one year.
  - Check that the battery is completely charged. The remaining operating time on display should be at least 20 hours.
- On-line instrument: AMI-II pH/Redox:
  - Check that the flow cell is free of particles and that the sensor surface is free of deposits.
  - In the message list, check that there are no frequent flow or other errors. If errors are present, eliminate their causes before proceeding with the quality assurance procedure.

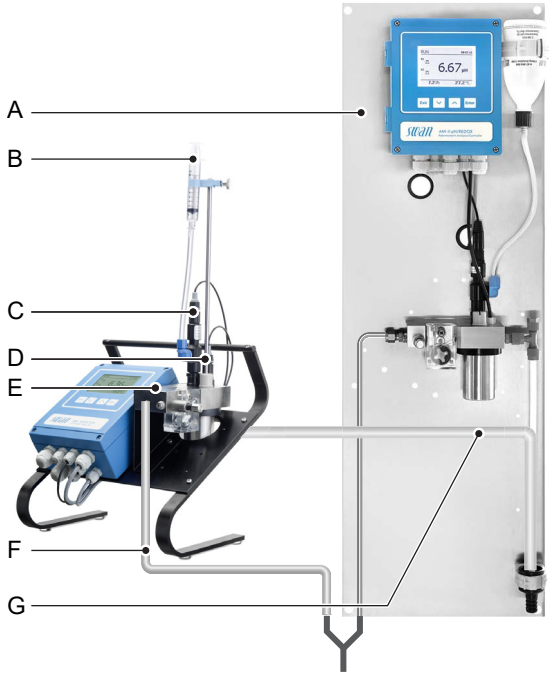
6.6.3 Connect Sample Lines

The choice of sampling depends strongly on local conditions on site. Possible sampling:

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

Note:

- *Take the sample as near as possible to the process monitor.*
- *While the measurement is running, wait approximately 10 minutes until the measured value and the temperature have stabilized.*



A *Monitor AMI-II 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-II pH/Redox.

2 Connect sample line of the monitor AMI-II pH/Redox with the sample inlet of the AMI INSPECTOR pH. Use the supplied tube made of FEP.

3 Connect sample outlet of the 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.

6.6.4 Carry Out Comparison Measurement

Navigate to menu **Maintenance** > **Quality Assurance** and follow the dialog on the display.
If the quality assurance procedure is not successful, it is recommended to clean the sensor. If the quality assurance procedure fails again, contact your local Swan representative for support.

6.6.5 Completion of the Measurement

1. Stop sample flow to the AMI INSPECTOR pH.
2. Proceed according to chapter “Longer Stop of Operation” in the manual of the AMI INSPECTOR pH.

6.7. 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. Place the caps on the sensor plugs.
5. Remove the electrodes from the flow cell.
6. If applicable remove the KCl bottle form the bottle holder.
7. Rinse the electrodes well with clean water.
8. If applicable remove the KCl supply tube from the KCl bottle and seal the tube with a plug.
9. If applicable dispose of the KCl according to your local regulations.
10. Fill 3.5 molar KCl (if not available: clean water) into the protection caps and put them on the tips of the electrodes.
11. Store the electrodes with the tips pointing downwards in a frost-protected room.
12. Empty and dry the calibration vessel.

7. Troubleshooting

This chapter provides some hints to make troubleshooting easier.
For information on how to handle/clean parts refer to Maintenance, p. 57.
For information on how to program the instrument refer to Program List and Explanations, p. 84.
If you need help please contact your local distributor. Note serial number of instrument and all diagnostic values before.

7.1. Error List

Two categories of messages are distinguished:

Non-fatal error

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

Fatal error (flashing symbol)

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

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

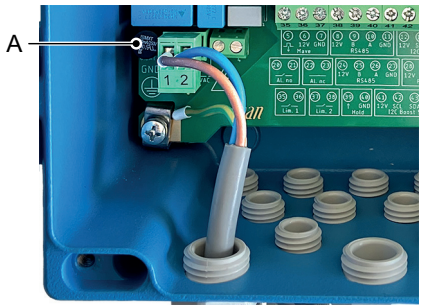
Error	Description	Corrective action
E001	Alarm high	– Check process. – Check programmed value.
E002	Alarm low	– Check process. – Check programmed value.
E007	Sample temp. high	– Check process. – Check programmed value.
E008	Sample temp. low	– Check process. – Check programmed value.
E009	Sample Flow high	– Check process. – Check programmed value.
E010	Sample Flow low	– Check process. – Check programmed value.
E011	Temp. shorted	– Check wiring of temperature sensor. – Check temperature sensor.
E012	Temp. disconnected	– Check wiring of temperature sensor. – Check temperature sensor.
E013	Case Temp. high	– Check case/environment temperature. – Check programmed value.
E014	Case Temp. low	– Check case/environment temperature. – Check programmed value.
E017	Control timeout	– Check control device or programming in menus **Installation** > **Relay contacts** > **Relay 1** and **Installation** > **Relay contacts** > **Relay 2**.
E018	Quality assurance	– Perform quality assurance procedure.
E024	Input active	– Message informing that the relay input has been actuated. – Can be deactivated in menu **Installation** > **Relay contacts** > **Input** > **Fault**.
E026	IC LM75	– Call support.

Error	Description	Corrective action
E030	I2C Frontend	– Call support.
E031	Calibration Recout	– Call support.
E032	Wrong Frontend	– Call support.
E049	Power-on	– None, normal status.
E050	Power-down	– None, normal status.

7.2. Replacing Fuses

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

AMI-II transmitter



A *0.8 AT/250V Instrument power supply*

8. Program Overview

Explanations of each parameter in the menus can be found in chapter Program List and Explanations, p. 84.

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

8.1. Messages (Main Menu 1)

Pending Errors 1.1*	*Pending Errors*	1.1.5*	* Menu numbers
Message List 1.3*	*Number*	1.3.1*	
	Date, Time		

8.2. Diagnostics (Main Menu 2)

Identification 2.1*	*Designation*			* Menu numbers
	Version			
	Bootloader			
	Factory Test 2.1.3*	*Motherboard*	2.1.3.1*	
		Front End		
	Operating Time 2.1.4*	*Years, days, hours, minutes, seconds*		2.1.5.1*
Sensors 2.2*	**Electrode** 2.2.1*	*Current Value*	2.2.1.1*	
		(Raw value) mV		
		Cal. History 2.2.1.5*	*Number*	2.2.1.5.1*
			Date, Time	
			Offset	
			Slope	
	Miscellaneous 2.2.2*	*Case Temp.*	2.2.3.1*	
	QA History 2.2.3*	(if quality assurance is activated)		
Sample 2.3*	*Sample ID*	2.3.1*		
	Temperature (PT1000)			
	Sample Flow (Raw value)			
I/O State 2.4*	**Relays** 2.4.1*	*Alarm Relay*	2.4.1.1*	
		Relay 1/2		
		Input		
	Signal Outputs 2.4.2*	*Signal Output 1/2*	2.4.2.1*	
SD Card 2.5*	*State*	2.5.1*		
Interface 2.6*	*Protocol*	2.6.1*		(only with RS485 interface)
	Baud rate			

8.3. Maintenance (Main Menu 3)

Calibration	*Process pH/Redox*		
3.1*	3.1.1*		
	Standard pH/Redox		
	3.1.2*		
Simulation	**Relays**	*Alarm Relay*	3.1.1.1*
3.1*	3.1.1*	*Relay 1*	3.1.1.2*
		Relay 2	3.1.1.3*
	Signal Outputs	*Signal Output 1*	3.1.2.1*
	3.1.2*	*Signal Output 2*	3.1.2.2*
Set Time	*(Date), (Time)*		
3.3*			

* Menu numbers

8.4. Operation (Main Menu 4)

Sensors	*Filter Time Const.*	4.1.1*		* Menu numbers
4.10*	*Hold after Cal*	4.1.2*		
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	4.2.1.1.1*
4.2*	4.2.1*	4.2.1.1*	*Alarm Low*	4.2.1.1.25*
			Hysteresis	4.2.1.1.35*
			Delay	4.2.1.1.45*
	Relay 1/2	*Setpoint*	4.2.x.200*	
	4.2.2*/4.2.3*	*Hysteresis*	4.2.x.300*	
		Delay	4.2.x.40*	
	Input	*Active*	4.2.4.1*	
	4.2.4*	*Signal Outputs*	4.2.4.2*	
		Output / Control	4.2.4.3*	
		Fault	4.2.4.4*	
		Delay	4.2.4.5*	
Logger	*Log Interval*	4.3.1*		
4.3*	*Clear Logger*	4.3.2*		
	Eject SD Card	4.3.3*		

8.5. Installation (Main Menu 5)

Sensors	**Flow**	*Flow measurement*		* Menu numbers
5.1*	5.1.1*	5.1.1.1*		
	Parameter	*Type of sensor*		
	5.1.2*	5.1.2.1*		
	Temperature	*Temp. Sensor*	5.1.3.1*	
	5.1.3*	*Temp. Corr*	5.1.3.2*	
		Temp. Compensation	*Comp.*	5.1.3.3.1*
		5.1.3.3*		
	Standards	**pH Standard 1**	@ 0 °C–50 °C	5.1.40.1.1–10*
	5.1.4*	5.1.40.1*		
		pH Standard 2	@ 0 °C–50 °C	5.1.40.2.1–10*
		5.1.40.2*		
	Quality Assurance	*Level*	5.1.5.1*	
	5.1.5*			
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1/5.2.2.1*	
5.2*	5.2.1/5.2.2*	*Current Loop*	5.2.1.2/5.2.2.2*	
		Function	5.2.1.3/5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.10/11*
		5.2.x.40	*Range High*	5.2.x.40.20/21*
Relay Contacts	**Alarm Relay**	**Alarm**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.25*
			Hysteresis	5.3.1.1.35*
			Delay	5.3.1.1.45*
		Sample flow	*Flow alarm*	5.3.1.2.1*
		5.3.1.2*	*Alarm High*	5.3.1.2.2*
			Alarm Low	5.3.1.2.34*
		Sample Temp.	*Alarm High*	5.3.1.3.1*
		5.3.1.3*	*Alarm Low*	5.3.1.3.25*
		Case Temp. high	5.3.1.4*	
		Case Temp. high	5.3.1.5*	
	Relay 1/2	*Function*	5.3.2.1/5.3.3.1*	
	5.3.2/5.3.3*	*Parameter*	5.3.2.20/5.3.3.20*	
		Setpoint	5.3.2.300/5.3.3.301*	
		Hysteresis	5.3.2.400*	
		Delay	5.3.2.50*	

	Input	*Active*	5.3.4.1*	* Menu numbers
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	
Miscellaneous	*Language*	5.4.1*		
5.4*	*Set defaults*	5.4.2*		
	Load Firmware	5.4.3*		
	Password	*Messages*	5.4.4.1*	
	5.4.4*	*Maintenance*	5.4.4.2*	
		Operation	5.4.4.3*	
		Installation	5.4.4.4*	
	Sample ID	5.4.5*		
Interface	*Protocol*	5.5.1*		(only with RS485
5.5*	*Device Address*	5.5.21*		interface)
	Baud Rate	5.5.31*		
	Parity	5.5.41*		

9. Program List and Explanations

1 Messages

1.1 Pending Errors

1.1.5 Provides the list of active errors with their status (active, acknowledged). When all active errors have been acknowledged, the alarm relay is active again. Cleared errors are moved to the message list.

1.2 Message List

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

2 Diagnostics

2.1 Identification

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

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

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

2.2 Sensors

2.2.1 **Electrode**

Current value: Shows the measured value (pH or redox potential).
Raw value: Shows the raw value in mV.

2.2.1.5 *Cal. History:* Shows previous calibrations of the pH or redox electrode. 64 data records are memorized.

2.2.2 **Miscellaneous**

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

2.2.3 *QA History:* Shows the QA values of the last quality assurance procedures. 64 data records are memorized.

2.3 Sample

2.3.1xx *Sample ID:* Shows the ID used to identify the location of the sample.
Temperature: Shows the current sample temperature in °C.
(Pt1000): Shows the current sample temperature in Ohm.

Depending on the configuration:
Sample Flow: Shows the current sample flow in l/h.
(Raw value) in Hz.

2.4 I/O State

2.4.1 Relays

2.4.1.1	*Alarm Relay:*	Active or inactive
	Relays 1 and 2:	Active or inactive
	Relays 3 and 4:	Active or inactive (if optional AMI-II Relay Box is installed)
	Input:	Open or closed

2.4.2 Signal Outputs

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

2.5 SD Card

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

2.6 Interface

Settings of the installed communication option (if any).

3 Maintenance

3.1 Calibration

3.1.1 *Process Cal.:* See Process Calibration, p. 64.

3.1.2 *Standard Cal.:* See Standard Calibration, p. 65.

3.2 Simulation

To simulate a value or a relay state, select

- alarm relay
- relay 1 or 2
- relay 3 or 4 (if optional AMI-II Relay Box is installed)
- signal outputs 1 or 2
- signal outputs 3 or 4 (if option is installed)

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

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

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

3.2.1 Relays

3.2.1.1	*Alarm relay:*	Active or inactive
3.2.1.2	*Relay 1:*	Active or inactive
3.2.1.3	*Relay 2:*	Active or inactive
3.2.1.4	*Relay 3:*	Active or inactive
3.2.1.5	*Relay 4:*	Active or inactive

3.2.2 Signal outputs

3.2.2.1	*Signal outputs 1:*	Current in mA
3.2.2.2	*Signal outputs 2:*	Current in mA
3.2.2.3	*Signal outputs 3:*	Current in mA
3.2.2.4	*Signal outputs 4:*	Current in mA

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 s

4.1.2 *Hold after Cal.:* Delay permitting the instrument to stabilize again after calibration. During calibration plus hold time, the signal outputs are frozen (held on last valid value), alarm values, limits are not active.
Range: 0–6000 s

4.2 Relay Contacts

See Relay Contacts, p. 93.

4.3 Logger

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

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

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

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

5 Installation

5.1 Sensors

5.1.1 Flow

5.1.1.1 *Flow measurement:* Select the installed flow meter type.

- None
- Q-Flow
- U-Flow
- deltaT

5.1.2 Parameters

5.1.2.1 *Type of Sensor:* Select the type of the installed sensor.

- pH
- Redox

5.1.3 Temperature

5.1.3.1 *Temp. sensor:* The pH measurement and the pH value of the sample are temperature dependent. Select “Yes” if a temperature sensor is

connected. If “No” is selected, the default temperature is used for temperature compensation.

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 measured value is then compensated with this value.

5.1.3.3 Temp. Compensation: In addition to automatic temperature compensation of the measurement according to Nernst, specific functions for solution temperature compensation can be selected that address the temperature dependence of the pH of high-purity water. These functions compensate to the reference temperature 25 °C.

5.1.3.3.1 *Comp.:* Choose the compensation model which fits best to your application.
Available compensation models:

- Nernst: general applications, e.g. potable water, waste water, swimming pools.
- Non-linear: for high-purity water according to ASTM D5128
- Coefficient: for high-purity water.
  Range: -0.100–0.100 pH units per °C.

5.1.4 Standards: If you want to use standard solutions different from the recommended Swan standard solutions, enter the values.

5.1.4.1 *pH Standard 1:* Range: pH 1 to pH 13.

5.1.4.2 *pH Standard 2:* Range: pH 1 to pH 13.

5.1.4.3 *Standard:* Range: 400 to 500 mV.

5.1.5 Quality Assurance: Switch quality assurance on or off.

5.1.5.1 *Level*: Select quality level:

- Level 0: Off
  Quality assurance procedure switched off. The additional QA menus are not available.
- Level 1: Trend
- Level 2: Standard
- Level 3: Crucial
- Level 4: User (edit user-specific limits in menus 5.1.5.2 to 5.1.5.4).

5.2 Signal Outputs

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

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

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

- Measured value
- Temperature
- Sample flow (if a flow meter is selected)

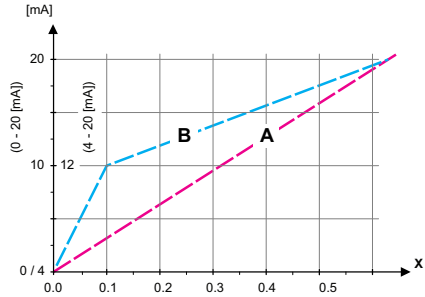
5.2.1.2 *Current Loop:* Select the current range of the signal output. Make sure the connected device works with the same current range. Available ranges: 0–20 mA or 4–20 mA

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:

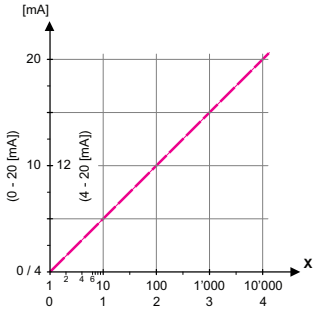
- Linear, bilinear or logarithmic for process values.
- Control upwards or control downwards.

As process values

The process value can be represented in three 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 and high) of the linear or logarithmic scale. In addition, the midpoint for the bilinear scale.

Parameter Meas. value (pH sensor):

5.2.1.40.10 *Range low:* -3 pH–15 pH

5.2.1.40.20 *Range high:* -3 pH–15 pH

Parameter Meas. value (ORP sensor):

5.2.1.40.10 *Range low*: -1500–1500 mV

5.2.1.40.20 *Range high*: -1500–1500 mV

Parameter Temperature:

5.2.1.40.11 *Range low*: -25–270 °C

5.2.1.40.21 *Range high*: -25–270 °C

Parameter Sample flow:

5.2.1.40.13 *Range low*: 0–200 l/h

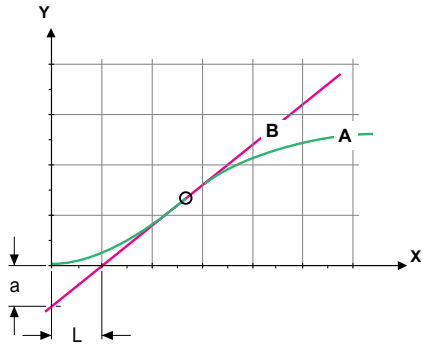
5.2.1.40.23 *Range high*: 0–200 l/h

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.

Control upwards or downwards

Setpoint: User-defined process value for the selected parameter.
P band: Range below (upwards control) or above (downwards control) the setpoint, within the dosing intensity is reduced from 100 % to 0 % to reach the setpoint without overshooting.

5.2.1.43 **Control Parameters:** if Parameters = Meas. Value (pH sensor)
5.2.1.43.10 Setpoint: -3.00 pH to +15.00 pH
5.2.1.43.20 P-Band: 0.00 pH to +2.00 pH

5.2.1.43 **Control Parameters:** if Parameters = Meas. Value (ORP sensor)
5.2.1.43.10 Setpoint: -1500 mV to +1500 mV
5.2.1.43.20 P-Band: 0 mV to 200 mV

5.2.1.43 **Control Parameters:** if Parameters = Temperature
5.2.1.43.11 Setpoint: -30 °C to +120 °C
5.2.1.43.21 P-Band: 0 °C to +100 °C

5.2.1.43 **Control Parameters:** if Parameters = Sample flow
5.2.1.43.12 Setpoint: 0.0 l/h–200 l/h
5.2.1.43.22 P-Band: 0.0 l/h–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: 0–9000 s

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: 0–9000 s

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:

- Measured value
- Temperature
- Sample flow (if a flow sensor is installed)
- 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 becomes inactive and E001 is displayed in the message list.
Range: -3 to 15 pH or -1500 mV to 1500 mV

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E002 is displayed in the message list.
Range: -3 to 15 pH or -1500 mV to 1500 mV

5.3.1.1.35 *Hysteresis:* Within the hysteresis range, the relay does not switch. This prevents damage to the relay contacts when the measured value fluctuates around the limit.
Range: 0 to 2.00 pH or 0 mV to 200 mV

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

5.3.1.3 Sample Flow

5.3.1.3.1 *Flow Alarm:* Program if the alarm relay should become inactive if there is a flow alarm. The flow alarm will always be indicated on the display, in the pending error list, saved in the message list and the logger.
Range: yes or no

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

5.3.1.3.2 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E009 is displayed in the message list.
Range: 0–200 l/h

5.3.1.3.35 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E010 is displayed in the message list.
Range: 0–200 l/h

5.3.1.4 Sample Temp.

5.3.1.1.2 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay becomes inactive and E007 is displayed in the message list.
Range: -25–270 °C

5.3.1.1.35 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay becomes inactive and E008 is displayed in the message list.
Range: -25–270 °C

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

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

5.3.x Relay 1 and 2: The function of relay contacts 1 or 2 is defined by the user.

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

1 First select the functions as:

- Limit upper/lower,
- Control upwards/downwards,
- Timer
- Fieldbus

2 Then enter the necessary data depending on the selected function. The same values can also be entered in menu 4.2.

5.3.5.3.2.1 Function = Limit upper/lower

If the relays are used as upper or lower limit switches, program the following:

5.3.2.20 *Parameter:* select a process value.

5.3.2.300 *Setpoint:* If the measured value rises above respectively falls below the setpoint, the relay is activated.

Parameter	Range
Meas. value	-3.00 to 15.00 pH or -1500 to 1500 mV
Temperature	-25–270 °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 limit.

Parameter	Range
Meas. value	0.00 to 2.00 pH or 0 to 200 mV
Temperature	0–100 °C
Sample Flow	0–200 l/h

5.3.2.50 *Delay:* Time by which the switching of the relay is delayed after the measured value has risen above or fallen below the programmed setpoint.
Range. 0–600 s

5.3.2.1 Function = Control upwards/downwards

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

5.3.2.22 *Parameter:* Choose one of the following process values.
- 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

Dosing is controlled by the operating time.

5.3.2.32.20 *Cycle time:* Duration of one control cycle (on/off change).
Range: 0–600 s.

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

5.3.2.32.4 Control Parameters
Range for each parameter same as 5.2.1.43.

5.3.2.32.1	Actuator = Frequency
	Dosing is controlled by the repetition speed of dosing shots.
5.3.2.32.21	*Pulse frequency:* Max. pulses per minute the device is able to respond to. Range: 20–300/min.
5.3.2.32.31	**Control Parameters** Range for each parameter same as 5.2.1.43.
5.3.2.32.1	Actuator = Motor valve
	Note: *This function is only available with optional AMI-II Relay Box.*
	Dosing is controlled by the position of a motor-driven mixing valve using two relays (i.e. two relays are needed to control one motor valve).
5.3.2.32.22	*Run time:* Time needed to open a completely closed valve. Range: 5–300 s.
5.3.2.32.32	*Neutral zone:* Minimal response time in percent 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.
5.3.2.1	Function = Timer
	The relay will be activated repetitively depending on the programmed time scheme.
5.3.2.24	*Mode:* Operating mode (interval, daily, weekly).
5.3.2.24	Interval
5.3.2.340	*Interval:* The interval can be programmed within a range of 1–1440 min.
5.3.2.44	*Run Time:* Enter the time the relay stays active. Range: 5–32400 s.
5.3.2.54	*Delay:* During run time plus the delay time the signal and control outputs are held in the operating mode programmed below. Range: 0–6000 s.
5.3.2.6	*Signal Outputs:* Select operating mode of the signal output:
	Cont.: Signal outputs continue to issue the measured value.
	Hold: Signal outputs hold the last valid measured value. Errors, except fatal errors, are not issued.
	Off: Signal outputs are switched off (set to 0 or 4 mA). Errors, except fatal errors, are not issued.

5.3.2.7 *Output/Control:* Select operating mode of the controller output:

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

5.3.2.24 daily

The relay contact can be activated daily, at any time of a day.

5.3.2.341 *Start time:* Time of day at which the relay is activated.
Range: 00:00:00–23:59:59

5.3.2.44 *Run Time:* see Interval.

5.3.2.54 *Delay:* see Interval.

5.3.2.6 *Signal Outputs:* see Interval.

5.3.2.7 *Output/Control:* see Interval.

5.3.2.24 weekly

The relay contact can be activated on one or several days of a week.

5.3.2.342 Calendar

5.3.2.342.1 *Start time:* The programmed start time is valid for each of the programmed days.
Range: 00:00:00–23:59:59

5.3.2.342.2 *Monday:* Possible settings, on or off.
to

5.3.2.342.8 *Sunday:* Possible settings, on or off.

5.3.2.44 *Run Time:* see Interval.

5.3.2.54 *Delay:* see Interval.

5.3.2.6 *Signal Outputs:* see Interval.

5.3.2.7 *Output/Control:* see Interval.

5.3.2.1 Function = Fieldbus

The relay is switched via Profibus or Modbus. 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 when the input relay is closed
When open:	Input is active when the input relay is open

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

Continuous:	Signal outputs continue to issue the measured value.
Hold:	Signal outputs hold the last valid measured value. Errors, except fatal errors, are not issued.
Off:	Sets the signal outputs to 0 or 4 mA. Errors, except fatal errors, are not issued.

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

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

5.3.4.4 *Fault:*

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

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

5.4 Miscellaneous

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

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

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

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

5.4.4 **Password:** Select a password different from 0000 to prevent unauthorized access to the menus “Messages”, “Maintenance”, “Operation” and “Installation”.
Each menu can be protected by a different password.
If you forgot the passwords, contact the closest Swan representative.

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

5.5 Interface

Select one of the following communication protocols. 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 no.:	Range: Analyzer; Manufacturer; Multivariable
5.5.40	Local operation:	Range: Enabled, Disabled

5.5.1 *Protocol:* **Modbus RTU**

5.5.21	Device address:	Range: 0–126
5.5.31	Baud rate:	Range: 1 200–115 200 Baud
5.5.41	Parity:	Range: none, even, odd

5.5.1 *Protocol:* **HART**

	Device address:	Range: 0–63

10. Material Safety Data Sheets

Download MSDS

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

Catalogue no.:	A-85.112.300
Product name:	Calibration solution pH4
Catalogue no.:	A-85.113.300, A-85.113.500, A-85.113.700
Product name:	Calibration solution pH7
Catalogue no.:	A-85.114.300, A-85.114.500, A-85.114.700
Product name:	Calibration solution pH9
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
Relay Contacts	Alarm Relay	same as in Installation
	Relay 1/2	same as in Installation
	Input	same as in Installation
Logger:	Logger Interval:	30 min
	Clear Logger:	no

Installation

Sensors	Flow: Flow measurement	None
	Parameter: Type of sensor	pH
	Temperature: Temp. Sensor	Yes
	Temp. Corr.	0.00 °C
	Temp. Compensation	Nernst
	Standards: pH Standard 1	see Calibration solutions, p. 51
	Standards: pH Standard 2	see Calibration solutions, p. 51
	Standards: Redox	475 mV
	Quality Assurance: Level	0: Off
Signal Output 1	Parameter:	Meas. Value
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0.00 pH/0 mV
	Scaling: Range high:	14.00 pH/1000 mV
Signal Output 2	Parameter:	Temperature
	Current loop:	4 –20 mA
	Function:	linear
	Scaling: Range low:	0 °C
	Scaling: Range high:	50 °C
Alarm Relay	Alarm: Alarm high:	15.00 pH/1500 mV
	Alarm: Alarm low:	-3.00 pH/-1500 mV
	Alarm: Hysteresis:	0.10 pH/10 mV
	Alarm: Delay:	5 s
	Sample Temp: Alarm high:	55 °C
	Sample Temp: 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 s
	If Function = Control upw. or dnw:
	Settings: Actuator: ..... Frequency
	Settings: Pulse Frequency: 120/min
	Settings: Control Parameters: Setpoint: ..... 14.00 pH/1500 mV
	Settings: Control Parameters: P-band: ..... 0.10 pH/10 mV
	Settings: Control Parameters: Reset time: ..... 0 s
	Settings: Control Parameters: Derivative Time: ..... 0 s
	Settings: Control Parameters: Control Timeout: ..... 0 min
	Settings: Actuator: ..... Time proportional
	Cycle time: ..... 60 s
	Response time: ..... 10 s
	If Function = Timer:
	Mode: ..... Interval
	Interval: ..... 1 min
	Mode: ..... daily
	Start time: 00.00.00
	Mode: ..... weekly
	Calendar; Start time: 00.00.00
	Calendar; Monday to Sunday: ..... Off
	Run time: ..... 10 s
	Delay: ..... 5 s
	Signal output: ..... cont
	Output/Control: ..... cont
Input	Active ..... when closed
	Signal Outputs ..... hold
	Output/Control ..... off
	Fault ..... no
	Delay ..... 10 s
Miscellaneous	Language: ..... English
	Set default: ..... no
	Load firmware: ..... no
	Password: ..... for all modes 0000
	Sample ID: ..... - - - - - - - -

ANALYTICAL INSTRUMENTS

A-96.210.481 / 031025

Swan Products - Analytical Instruments for:

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

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MADE IN SWITZERLAND

AMI-II pH/Redox