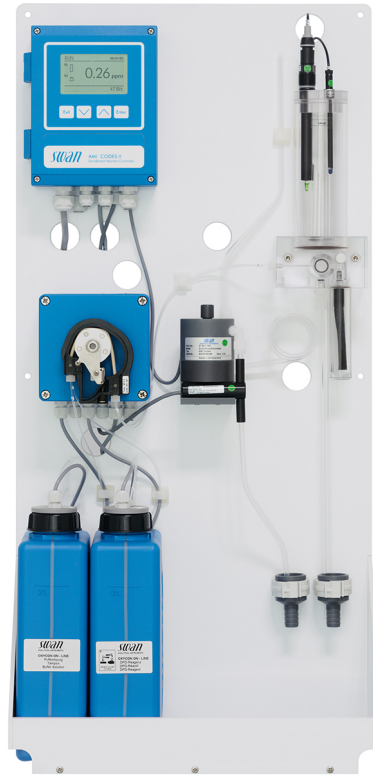
ANALYTICAL INSTRUMENTS

A-96.250.571 / 070622

Operator’s Manual

Firmware V6.20 and higher



SWISS MADE

AMI Codes-II

Customer Support

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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 AMI Operator's Manual in proximity of the instrument.

Qualification, Training

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

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

1.1. Warning Notices

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

DANGER

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

- Follow the prevention instructions carefully.

WARNING

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

- Follow the prevention instructions carefully.

CAUTION

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

- Follow the prevention instructions carefully.

Mandatory Signs

The mandatory signs in this manual have the following meaning:

Safety goggles

Safety gloves

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


Electrical shock hazard


Corrosive


Harmful to health


Flammable


Warning general


Attention general

1.2. General Safety Regulations

Legal Requirements

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

Spare Parts and Disposables

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

Modifications

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

WARNING

Electrical Shock Hazard

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

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

WARNING

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

WARNING

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

1.3. Restrictions for use

The sample must not contain any particles, which may block the flow cell. Sufficient sample flow is coercive for the correct function of the instrument.
If the sample contains only little disinfectant concentrations, or there is the danger of biological growth, we recommend to use the optional Cleaning module from Swan.

WARNING

Health hazard

Some reagents are etching and can cause severe burns or eye damage.

- For safe handling of the reagents you must read and understand the instructions in this manual, as well as the Material Safety Data Sheets (MSDS)

Download MSDS

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

- OXYCON ON-LINE DPD
- OXYCON ON-LINE Buffer
- OXYCON ON-LINE KI
- Buffer solution pH 4
- Buffer solution pH 7
- Buffer solution pH 9

2. Product Description

Application range

The AMI Codes-II analyzer is a complete monitoring system for the automatic, continuous measurement and dosing control of chlorine and other disinfectants based on the DPD colorimetric method AWWA 4500 Cl-G and on EN ISO 7393-2.
It can be used for measuring disinfectants in:

- Potable water
- Swimming pools
- Cooling water
- Effluent
- Seawater

It is also applicable for water containing additives like corrosion inhibitors, cyanuric acids and antiscalants.
For the determination of free chlorine, chlorine dioxide, bromine and iodine the reagents:

- Oxycon on-line DPD
- Oxycon on-line Buffer

are needed.
The measurement of monochloramine or ozone requires an additional reagent:

- Oxycon on-line KI; which is added to Oxycon on-line Buffer

Disinfectant measurement

Disinfectant	Measuring range	Accuracy
Ozone	0.05–1.00 ppm	±0.01 ppm
HOCl / free chlorine / Monochloramine	0.00–1.00 ppm 1.00–3.00 ppm 3.00–5.00 ppm	±0.01 ppm ±0.06 ppm ±0.20 ppm
Chlorine dioxide / Iodine / Bromine	0.00–2.00 ppm 2.00–6.00 ppm	±0.02 ppm ±0.12 ppm

Signal outputs

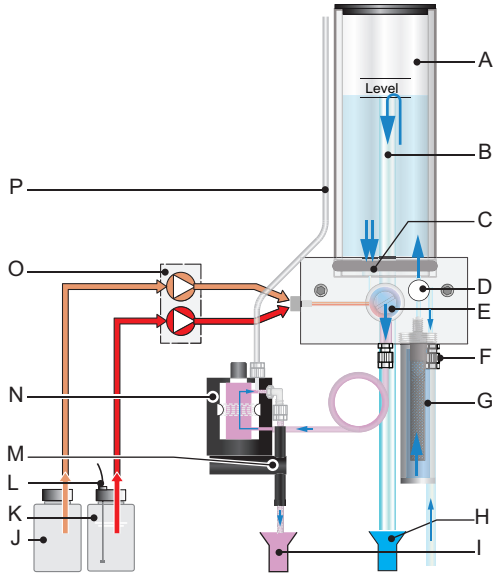
Two signal outputs programmable for measured values (freely scaleable, linear or bilinear) or as continuous control output (control parameters programmable).
Current loop: 0/4–20 mA
Maximal burden: 510 Ω
Third signal output available as an option. The third signal output can be operated as a current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

Relay	Two potential-free contacts programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function. Both contacts can be set as normally open or normally closed with a jumper. Maximum load: 1 A/250 VAC
Alarm relay	One potential free contact. Alternatively: ◆ Open during normal operation, closed on error and loss of power. ◆ Closed during normal operation, open on error and loss of power. Summary alarm indication for programmable alarm values and instrument faults.
Input	For potential-free contact to freeze the measuring value or to interrupt control in automated installations (hold function or remote-off)
Special feature	Possibility to interrupt the measurement by activating the input. See Program List and Explanation, 5.3.4, p. 93.
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.
Communication interface (optional)	◆ USB Interface for logger download ◆ Third signal output (can be used in parallel to the USB interface) ◆ RS485 with Fieldbus protocol Modbus or Profibus DP ◆ HART interface
pH	Optional pH measurement is possible (pH correction or calibration).
Relay box	The AMI Relay Box is designed for the direct power supply and activation of dosing devices which are controlled with an AMI transmitter, e. g. to connect two solenoid valves or one motor valve for disinfectant addition.
Cleaning module	Optional module for automatic chemical cleaning.

Fluidics

The sample flows through the sample inlet [F] and the filter vessel [G] into the constant head [A]. Adjust the flow regulating valve [D] so that always a small part of the sample flows through the overflow tube [B] into the drain [H]. A part of the sample flows through the photometer inlet [C] into the mixing chamber [E], where the reagents [J] and [K] are added by the peristaltic pump [O] and mixed with the sample. The mixed sample flows through the photometer [N] and disinfectant is measured. If KI and buffer are mixed in the reagent canister [K] monochloramine is measured.

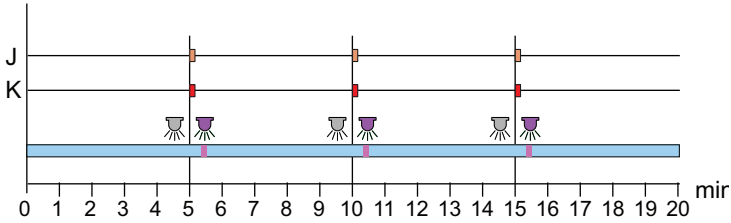
After the measurement the sample flows through the outlet of the photometer where it will be aerated through air inlet [P] to generate bubbles. Then the sample flows through the bubble detector [M] into the photometer drain [I].



A *Constant head*
B *Overflow tube*
C *Photometer inlet*
D *Flow regulating valve*
E *Mixing chamber*
F *Sample inlet*
G *Inlet Filter*
H *Constant head drain*
I *Photometer drain*
J *Reagent Oxycon on-line DPD*
K *Reagent Oxycon on-line Buffer*
L *Reagent level detector*
M *Air bubble detector*
N *Photometer*
O *Peristaltic pump*
P *Photometer air inlet*

Time interval of a measurement

The measuring interval can be set between 1 and 12 minutes. The time sequence of a measurement with a measuring interval of 5 min is shown in the diagram below.
The blue bar represents the sample which flows continuously through the photometer. A short time before the measurement starts, a zero point measurement is performed. Then the peristaltic pump starts and a small portion of the reagents [J] and [K] is pumped into the mixing chamber. Shortly after, when the mixture is in the photometer, the sample is measured.



J *OXYCON ON-LINE DPD*
K *OXYCON ON-LINE Buffer Solution*
Zero point measurement
Sample measurement

2.1. Instrument Specification

Power supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant:	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Sample requirements	Flow rate:	min. 10 l/h
	Temperature:	5–50 °C
	Inlet pressure:	0.15–2 bar
	Outlet pressure:	pressure-free

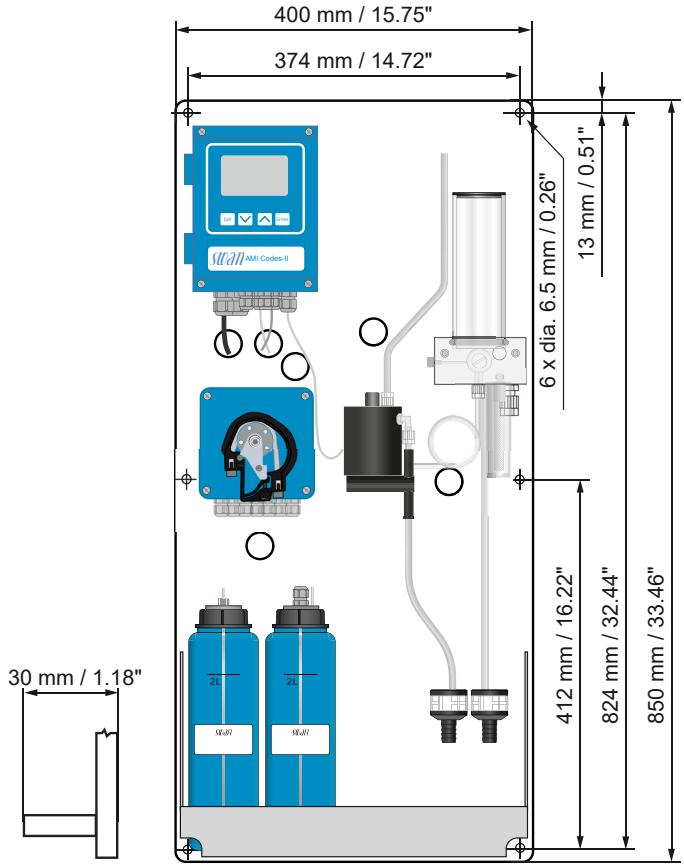
Note: *No oil, no grease, no sand.*

On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Tube 6 x 8 mm
	Sample outlet:	1/2” hose nozzle for flexible tube diam. 20x15 mm

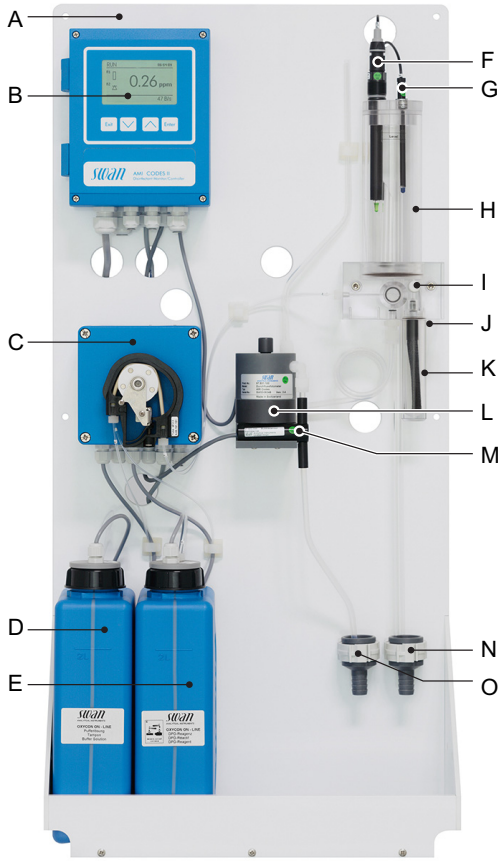
Measuring range	Ozone	Accuracy
	0.05–1.00 ppm	± 0.01 ppm
	HOCl, free chlorine, monochloramine	
	0.00–1.00 ppm	± 0.01 ppm
	1.00–3.00 ppm	± 0.06 ppm
	3.00–5.00 ppm	± 0.20 ppm
	Chlorine dioxide, iodine, bromine	
	0.00–2.00 ppm	± 0.02 ppm
	2.00–6.00 ppm	± 0.12 ppm

Dimensions

Panel:	PVC
Dimensions:	280x850x400 mm
Screws:	5 mm or 6 mm diameter
Weight:	12.0 kg without reagents and sample water 17.0 kg with reagents and sample water



2.2. Instrument Overview



A *Panel*
B *Transmitter*
C *Peristaltic pump*
D *Reagent Oxycon on-line DPD*
E *Reagent Oxycon on-line Buffer*
F *pH sensor*
G *Temperature sensor*
H *Constant head*
I *Flow regulating valve*
J *Sample inlet*
K *Inlet filter*
L *Photometer*
M *Air bubble detector*
N *Constant head drain*
O *Photometer drain*

3. Installation

3.1. Installation Check List

On site requirements	AC variant: 100–240 VAC (± 10%), 50/60 Hz (± 5%). DC variant: 10–36 VDC. Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see Instrument Specification, p. 15).
Installation	Mount the instrument in vertical position. Display should be at eye-level. Mount the filter, filter vessel, and constant head cover. Connect the sample and waste line. See Connecting Sample and Waste, p. 19.
Electrical wiring	Do not switch on the Instrument until all electrical connections have been completed. Connect all external devices like limit switches, current loops and pumps. Connect power cord. See Electrical Connections, p. 26.
If ordered: pH option	See Install the pH Option, p. 22.
Reagents	Prepare reagents. See Refill or Replace Reagents, p. 46. Insert the suction lances.
Power-up	Lock pump tubes. Turn on the sample flow and wait until the flow cell is completely filled. Switch on power. Start <Fill system>.
Instrument setup	Program all parameters for external devices (interface, recorders, etc.) and for instrument operation (limits, alarms, measuring interval).
pH sensor calibration	If ordered: Calibrate pH sensor. See Process pH, p. 51.

Process calibration	Make 3 manual measurements. Use a high quality photometer, e.g. Chematest from Swan. Calculate average value and compare this value to the value indicated by the AMI. If necessary, correct the value. The zero point is done automatically before each measurement.

3.2. Mounting of Instrument Panel

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

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

Mounting requirements

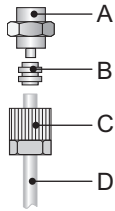
The instrument is only intended for indoor installation.
For dimensions see 16.

3.3. Connecting Sample and Waste

3.3.1 FEP Tube at Sample Inlet

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

Mounting of SERTO fitting



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

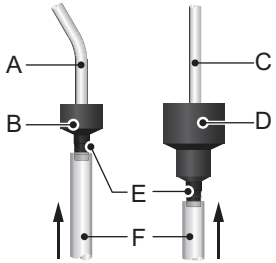
3.3.2 FEP Tube at Sample Outlet

WARNING

Risk of water pollution

The drain of the photometer outlet contains DPD.

- At no means recirculate it into the water system.



A *Tube from photometer*
B *Drain Photometer*
C *Tube from constant head*
D *Drain constant head*
E *Hose nozzles*
F *1/2” tubes*

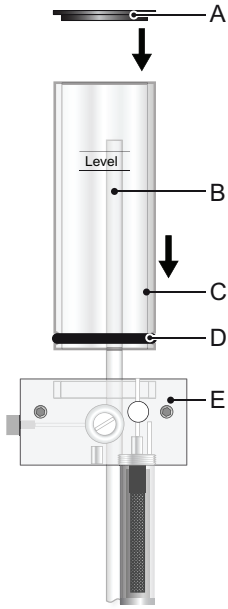
Connect the 1/2” tubes [F] to the hose nozzles [E] and place them into a pressure free drain with sufficient capacity.

3.4. Installation of Flow Cell

CAUTION

Fragile Part
Handle the constant head tube with care.

To avoid damage during the transport, the constant head tube [C] of the AMI Codes-II is not installed.



A *Constant head cover*
B *Overflow tube*
C *Constant head tube*
D *Gasket*
E *Flow cell block*

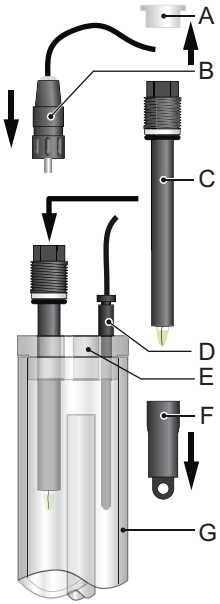
To install the constant head tube proceed as follows:

1. Unpack the constant head tube [C].
2. Push the constant head tube into the flow cell block [E].
3. Put the constant head cover [A] onto the constant head tube.
4. Check if the overflow tube [B] is aligned with the upper Level mark.

3.5. Install the pH Option

3.5.1 pH as Option ex works

If the pH option was ordered with the AMI Codes-II, the pH sensor cable as well as the temperature sensor are already connected to the AMI transmitter.



A *Connector cap*
B *Connector*
C *pH sensor*
D *Temperature sensor*
E *Constant head cover*
F *Protective cap*
G *Constant head*

1 Carefully pull off the protective cap [F] from the pH sensor [C] by turning it clockwise.

2 Store the protective cap in safe place.

3 Rinse the pH sensor tip with clean water.

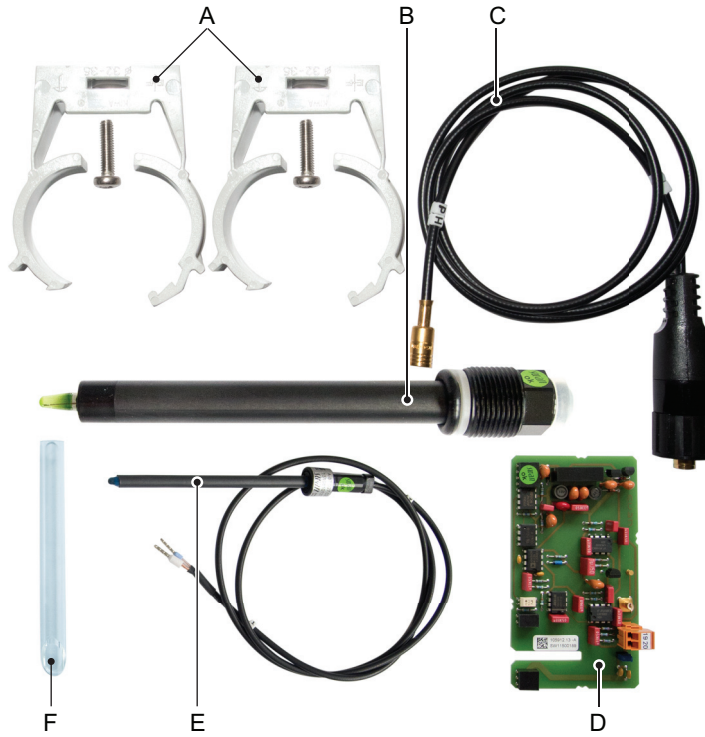
4 Insert the pH sensor into one of the holes in the constant head cover [E].

5 Insert temperature sensor [D] into the small hole.

6 Remove the connector cap from the connector of the pH sensor. Store it in safe place.

7 Screw the connector [B] onto the pH sensor.

3.5.2 pH Option as Retrofit Kit

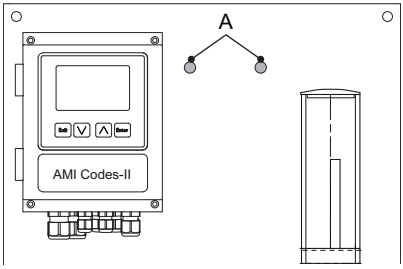


A *2 Clamps with screws*
B *pH sensor*
C *Sensor cable*
D *Front end PCB*
E *Temperature sensor*
F *Short overflow tube*

WARNING

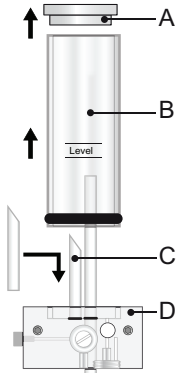
Risk of electrical shock.
Do not perform any work on electrical components if the transmitter is switched on. Failure to follow safety instructions can result in serious injury or death.

1 Screw the clamps for calibration solution onto the panel. Use the already drilled holes [A].



2 Stop sample flow. Wait until flow cell is empty.

3 Switch off the AMI transmitter (disconnect power).

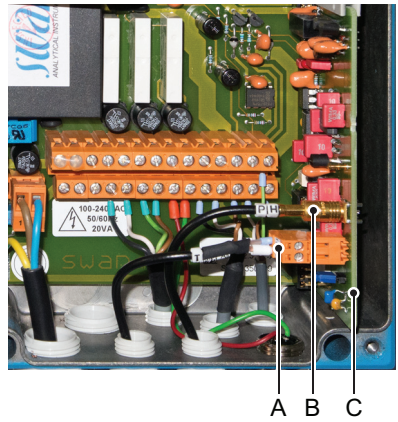


A *Constant head cover*
B *Constant head tube*
C *Short overflow tube*
D *Flow cell block*

4 Remove the constant head cover [A] and the constant head tube [B] from the flow cell block [D].

5 Insert the short overflow tube [C] into the outlet hole leading to the photometer.

6 Install the constant head tube and the constant head cover.



A *Temperature sensor plug*
B *pH sensor plug*
C *Frontend PCB*

7 Open the cover of the AMI transmitter housing.

8 Install the frontend PCB.

9 Feed the cable of the pH sensor through one of the cable glands (see Cable thicknesses, p. 26) into the AMI transmitter housing.

10 Connect it to the BNC socket.

11 Feed the cable of the Temperature sensor through one of the cable glands into the AMI transmitter housing.

12 Connect the temperature sensor cable to the plug as follows: Terminal 19: line, Terminal 20: shield.

13 Close the cover of the AMI transmitter housing.

14 Carefully pull off the protective cap [F] from the pH sensor [C].

15 Insert the pH sensor into one of the holes in the constant head cover [E].

16 Insert temperature sensor [D] into the small hole.

17 Remove the connector cap from the connector of the pH sensor. Store cap in safe place.

18 Screw the connector [B] onto the pH sensor.

19 Turn on sample flow and wait until flow cell has been filled completely.

20 Switch power ON. The instrument automatically detects the front end PCB during start-up.

3.6. Electrical Connections

WARNING

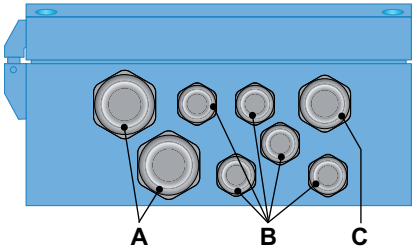
Risk of electrical shock

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

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

Cable thicknesses

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



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

Note: *Protect unused cable glands*

Wire

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

WARNING

External voltage

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

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

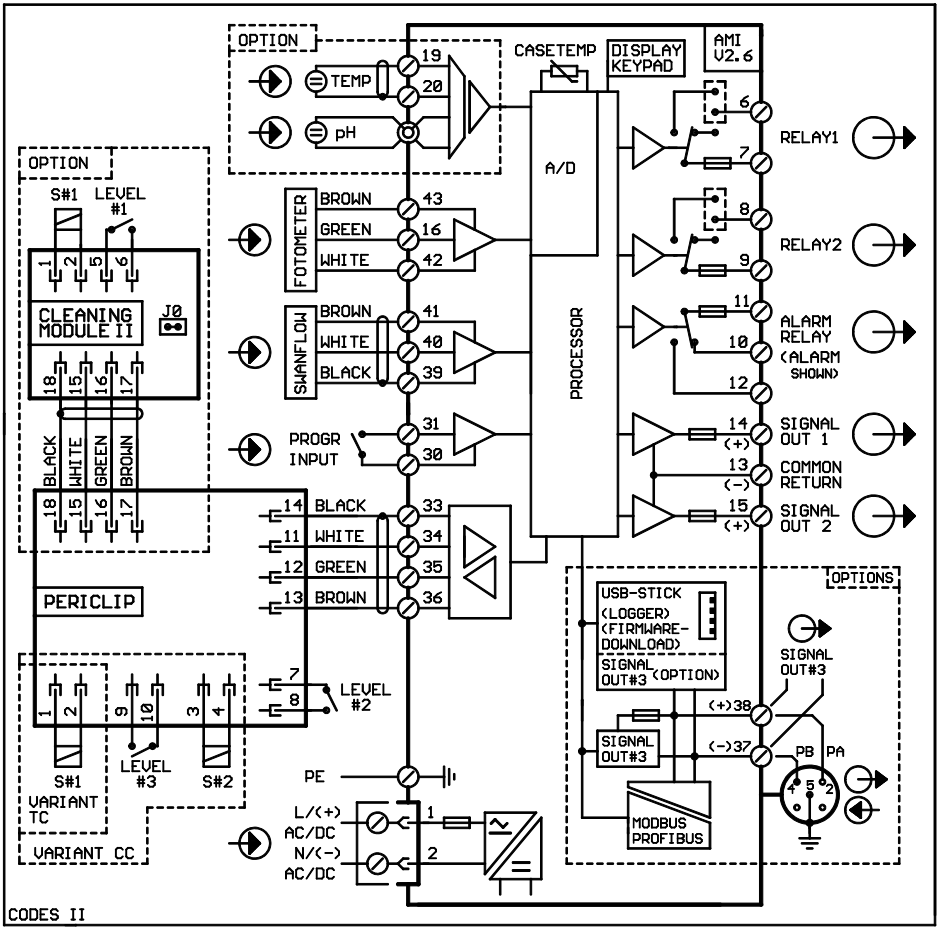
WARNING

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

WARNING

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

3.6.1 Connection Diagram



CAUTION

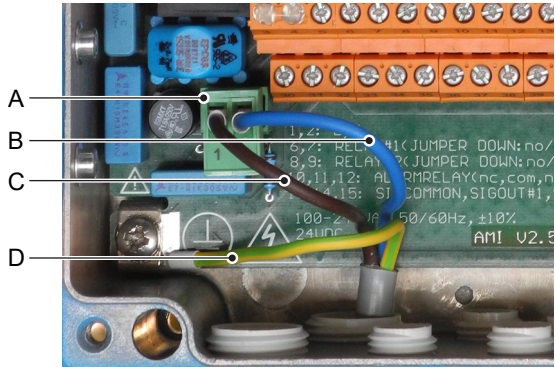
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.6.2 Power Supply

WARNING

Electrical shock hazard

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



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

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

Installation requirements

The installation must meet the following requirements.

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

3.7. Input

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

Terminals 30 and 31
If the signal output is set to hold, the measurement is interrupted if input is active.
For programming see menu Installation 5.3.4, p. 93.

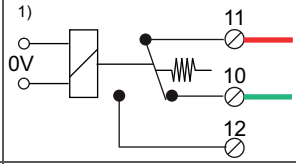
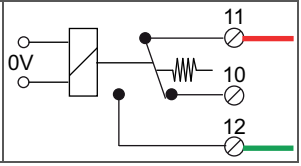
3.8. Relay Contacts

3.8.1 Alarm Relay

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

Alarm output for system errors.
Error codes see Troubleshooting, p. 63.

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

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

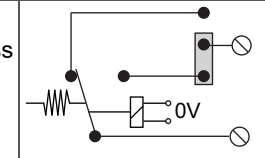
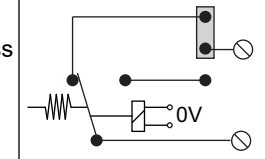
1) *usual use*

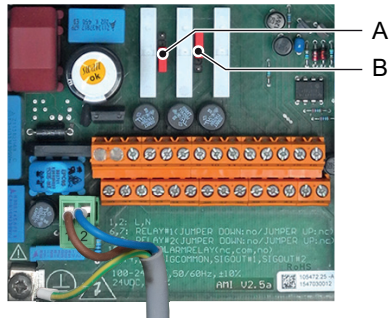
3.8.2 Relay 1 and 2

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

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

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

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



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

For programming see menu Installation 5.3.2 and 5.3.3, p. 89.

CAUTION

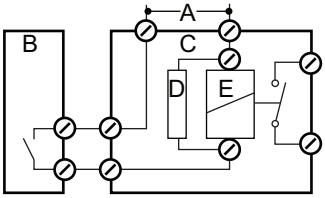
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

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

Inductive load

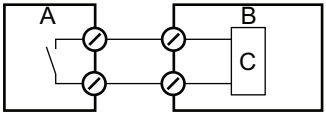
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load.
A snubber circuit is not necessary if an AMI relay box is used.



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

Resistive load

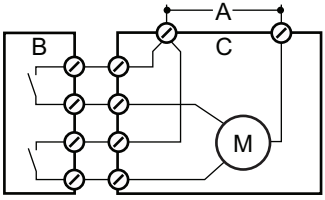
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures.



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

Actuators

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



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

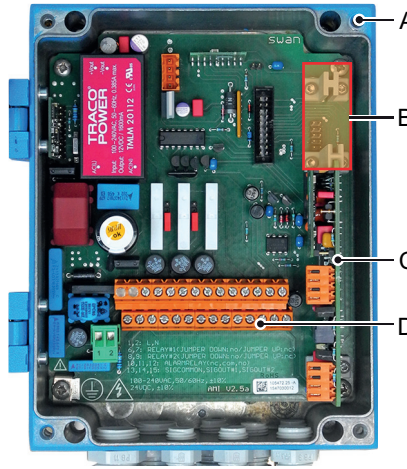
3.9. Signal Outputs

3.9.1 Signal Output 1 and 2 (current outputs)

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

Signal output 1: Terminals 14 (+) and 13 (-)
Signal output 2: Terminals 15 (+) and 13 (-)
For programming see Program List and Explanations, p. 77, Menu Installation.

3.10 Interface Options



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

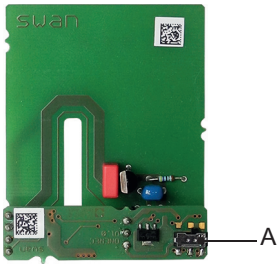
The slot for interfaces can be used to expand the functionality of the AMI instrument with either:

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

3.10.1 Signal Output 3

Terminals 38 (+) and 37 (-).
Requires the additional board for the third signal output 0/4–20 mA. The third signal output can be operated as a current source or as a current sink (switchable via switch [A]). For detailed information see the corresponding installation instruction.

Note: *Max. burden 510 Ω.*



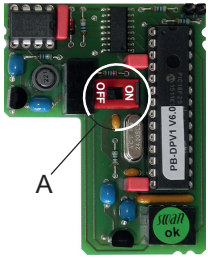
Third signal output 0/4 - 20 mA PCB

A *Operating mode selector switch*

3.10.2 Profibus, Modbus Interface

Terminal 37 PB, Terminal 38 PA
To connect several instruments by means of a network or to configure a PROFIBUS DP connection, consult the PROFIBUS manual. Use appropriate network cable.

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

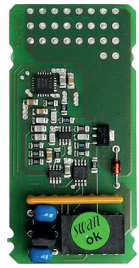


Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.10.3 HART Interface

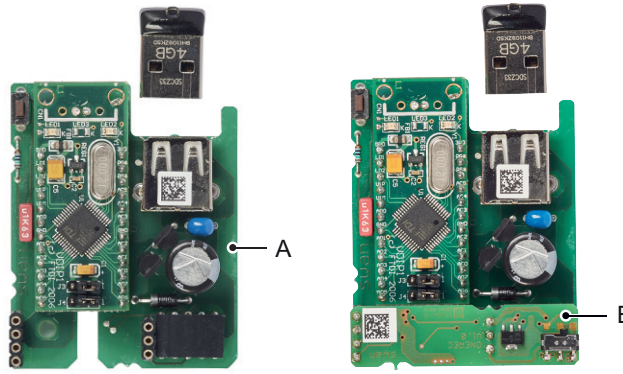
Terminals 38 (+) and 37 (-).
The HART interface PCB allows for communication via the HART protocol. For detailed information, consult the HART manual.



HART Interface PCB

3.10.4 USB Interface

The USB Interface is used to store Logger data and for Firmware upload. For detailed information see the corresponding installation instruction.
The optional third signal output 0/4–20 mA PCB [B] can be plugged onto the USB interface and used in parallel.



USB Interface

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

4. Instrument Setup

After installation according to checklist proceed as following:

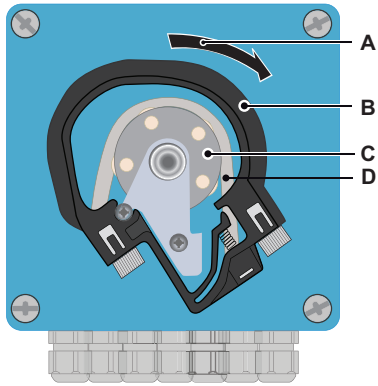
4.1. Prepare Reagents

1 Prepare reagents. See Refill or Replace Reagents, p. 46.
2 Insert the suction lances into the canisters.

4.2. Peristaltic Pump

The instrument is delivered with opened occlusion frames.

1 Activate the peristaltic pump tubes by closing the occlusion frames [B].



A *Turn to lock*
B *Occlusion frame*
C *Rotor*
D *Pump tube*

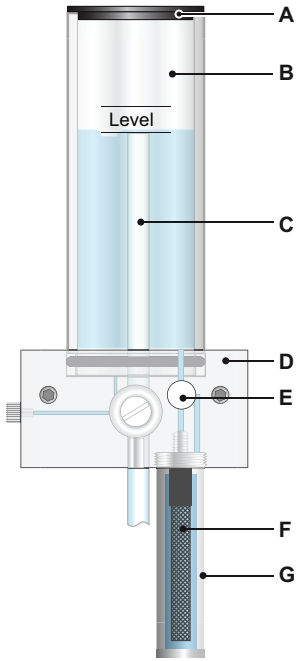
4.3. Establish Sample Flow

WARNING

Water pollution

The drain of the photometer outlet contains DPD.

- At no means recirculate it into the water system.



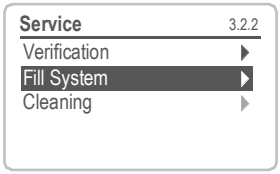
A *Cover*
B *Constant head tube*
C *Overflow tube*
D *Flow cell block*
E *Flow regulating valve*
F *Filter*
G *Filter vessel*

1. Open the flow regulating valve [E] and wait until the flow cell is completely filled.
2. Switch on power.
3. Adjust the sample flow so that always a small part of the sample drains off through the overflow tube.
4. Start <Fill system>, see Fill or Flush Reagent System, p. 38.

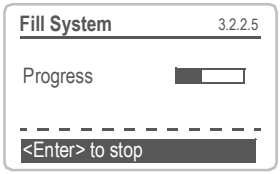
4.4. Fill or Flush Reagent System

Fill or flush the reagent tubing:

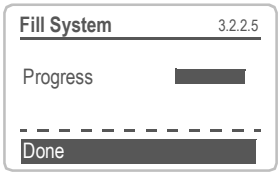
- upon the initial instrument setup,
- after refilling the reagent canisters,
- before a system shut-down to flush the system with demineralized water until no more reagent is left in the system.



Navigate to menu< Maintenance / Service/Fill system>.
Press [Enter].



The peristaltic pump is activated for 1.5 minutes.



Press [Exit] 4 x to go back to the operating mode.

1 Check tubing and flow cell for leaks and repair if necessary.

2 Let the instrument run continuously for 1 hour.

4.5. Programming

Programming

Program all parameters for external devices (interface, recorders, etc.)
Program all parameters for instrument operation (disinfectant, limits, alarms).
Program the DPD value of the Verikit in menu <Installation/Sensors/Ref. Verification>.
If pH option is installed, program the two buffers you want to use for calibration in menu <Installation/Sensors/Standards>.
See Program List and Explanations, p. 77.

4.6. Calibration

1 Calibrate pH sensor (if pH option is installed).
See Standard pH, p. 53.

2 Perform process calibration.
See Process Calibration of DIS, p. 51

If ordered: Calibration of pH sensor

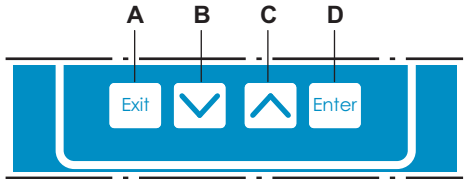
The instrument should be operating for 1 h before performing a pH calibration.
Program the two buffers you want to use for calibration (Installation/ Sensors/Standards). Calibrate the pH sensor with two buffers, e.g. pH 7.00 and pH 9.00. See chapter Calibration, p. 51 for details.

Process DIS

Use Chematest (or equivalent photometer) to determine the sample disinfectant concentration. Take the sample directly from the flow cell. Determine the sample disinfectant value by 3 manual DPD measurements and calculating the average value. Compare this value to the value indicated by the AMI Codes-II.
Take into account the accuracy of your manual measurement. Only correct the instrument if the difference is significant. Perform process DIS if necessary. See chapter Calibration, p. 51 for details.

5. Operation

5.1. Keys



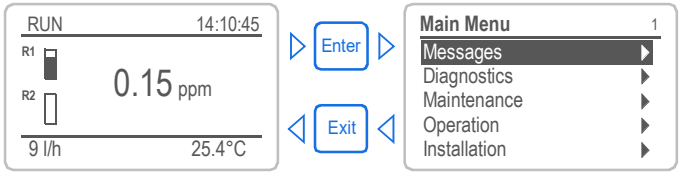
A to exit a menu or command (rejecting any changes)
to move back to the previous menu level

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

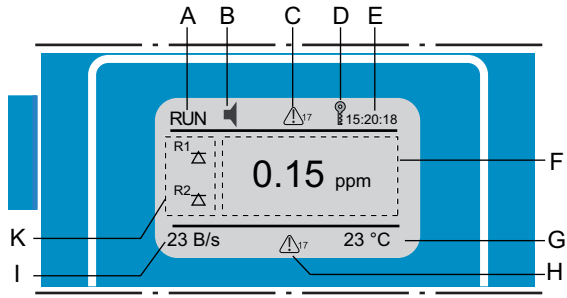
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Display



A RUN — normal operation

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

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

B ERROR — Error — Fatal Error

C Reagent low, indicates remaining reagents in % (17 % = 340 ml)

D Keys locked, transmitter control via Profibus

E Time

F Process values

G Sample Temperature

H Cleaning solution low, indicates remaining cleaning solution in %

I Sample flow in B/s

K Relay status

Relay status, symbols

upper/lower limit not yet reached

upper/lower limit reached

control upw./downw. no action

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

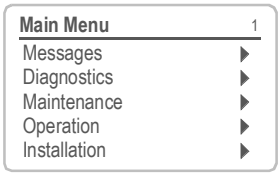
motor valve closed

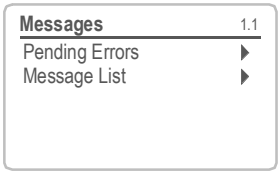
motor valve: open, dark bar indicates approx. position

timer

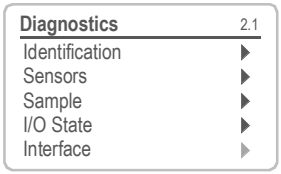
timer: timing active (hand rotating)

5.3. Software Structure

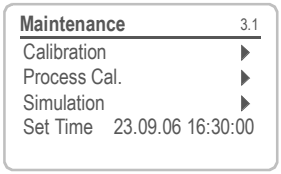




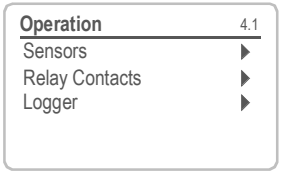
Menu **Messages 1**
Reveals pending errors as well as an event history (time and state of events that have occurred at an earlier point of time).
Contains user-relevant data.



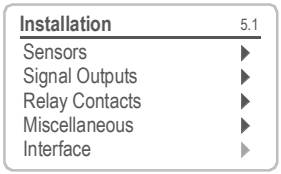
Menu **Diagnostics 2**
Provides user-relevant instrument and sample data.



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.

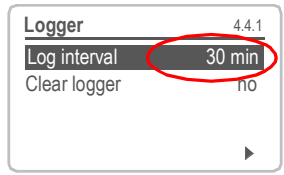


Menu **Installation 5**
For initial instrument set up by SWAN authorized person, to set all instrument parameters. Can be protected by means of password.

5.4. Changing Parameters and values

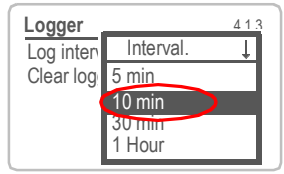
Changing parameters

The following example shows how to change the logger interval:



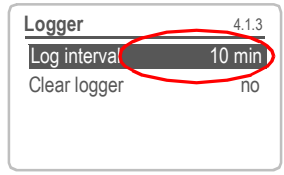
1 Select the parameter you want to change.

2 Press [Enter]



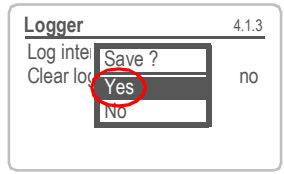
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

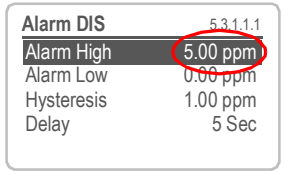
5 Press [Exit].



⇒ *Yes is highlighted.*

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

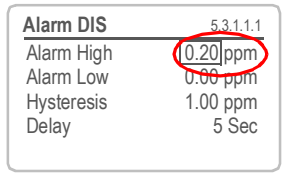
Changing values



1 Select the value you want to change.

2 Press [Enter].

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



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

6. Maintenance

6.1. Maintenance Schedule

Daily (dirty water) up to every 2 weeks (clean water)	Check sample supply for dirt. Clean all filters and strainers, if necessary. Clean AMI Codes protection filter, if necessary. Check sample flow (see also Troubleshooting, p. 63).
Every 2–4 weeks	Clean reagent canisters and prepare new reagents. Let instrument run for 1 h. Make 3 manual measurements. Compare average value to displayed value. If necessary, perform process calibration.
Monthly	Recommendation: Check photometer with verification kit Verification, p. 50
Yearly	Exchange reagent pump tubes, see Tube Replacement, p. 59.
By occurrence	E020, FOME dirty: Cleaning the Photometer, p. 55 E022, Reagent empty: Refill or Replace Reagents, p. 46 E065, Reagents low: Refill or Replace Reagents, p. 46

If pH option is installed:

Weekly	Perform a process calibration, see Process pH, p. 51.
Every 2 months	Perform a standard calibration, see Standard pH, p. 53.

6.2. Stop of Operation for Maintenance

1 Put the suction lances into a bucket with clean water.

2 Start <Fill system>.
⇒ *The reagent tubes are flushed with water.*

3 Remove the suction lances from the water.

4 Start <Fill system> again.
⇒ *The water will be pumped out of the reagent tubes.*

5 Stop sample flow.

6 Wait until level in flow cell is empty.

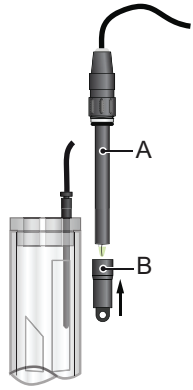
7 Shut off power of the instrument.

If pH option is installed:

8 Remove the pH sensor [A] from the flow cell.

9 Fill the protective cap [B] with water.

10 Put the protective cap onto the sensor tip.



A *pH sensor*
B *Protective cap*

6.3. Refill or Replace Reagents

The liquid level in canister 2 is monitored. The following messages are displayed:

Canister almost empty	Maintenance E065 - Reagents low and the remaining reagent volume in % (starting at 17 % = 340 ml).
Canister empty	Error E022 - Reagent empty

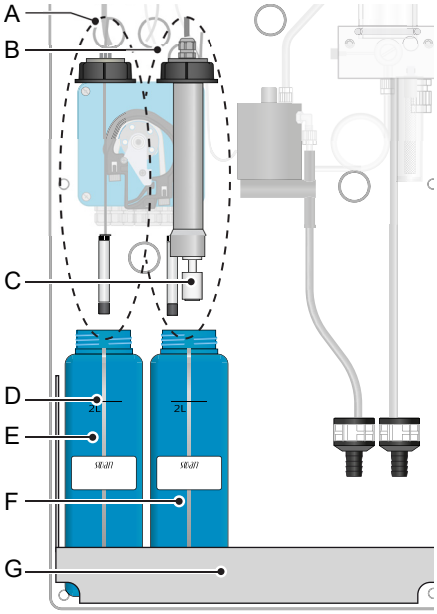
Note: *Before refilling the reagents, rinse the canisters with demineralized water.*

CAUTION

Chemical exposure hazard

- Observe the necessary security measures when manipulating dangerous chemicals.
- Read the Material Safety Data Sheets carefully!

Canister set up



A *Suction lance without level detector (canister 1)*
B *Suction lance with level detector (canister 2)*
C *Level detector*
D *2 L mark*
E *Canister 1: Oxycon on-line DPD*
F *Canister 2: Oxycon on-line Buffer*
G *Holder*

Reagent consumption

The 2 liter reagent canister will last for 15 days of operation (with measurement interval of 2 minutes). The provided reagent set (for 8 canisters) therefore lasts for 4 months of operation.
As the reagent consumption is not linear find further examples below:

Measuring interval	Duration per canister	Duration per reagent set
1 minute	~ 7 days	2 months
2 minutes	~ 15 days	4 months
4 minutes	~ 22 days	5 months
6 minutes	~ 33 days	8 months

Contents of the reagent sets

A-85.410.120 Reagent set for the measurement of free chlorine, chlorine dioxide, bromine or iodine:
- Oxycon On-Line DPD (8 bottles)
- Oxycon On-Line Buffer (8 bags)

A-85.419.200 Additional reagent for measurement of monochloramine, ozone or total chlorine:
- Oxycon On-Line KI (8 bags)

Personal protective equipment:

Oxycon On-Line DPD:
H314: Causes severe skin burns and eye damage.
H318: Causes serious eye damage.

Oxycon On-Line KI:
H372: Causes damage to organs through prolonged or repeated exposure.

6.3.1 Reagents for Free Chlorine, Chlorine Dioxide, Bromine and Iodine

To prepare 2 l of reagents the following chemicals are necessary:

- 1 x 50 ml of Oxycon On-line DPD
- 1 x 240 g of Oxycon On-line Buffer
- 4 liters of demineralized water

Prepare Oxycon On-line DPD

1. Rinse the canister [E] labelled “OXYCON ON LINE DPD Reagent” with demineralized water.
2. Fill the canister up to the 2 liter mark [D] with demineralized water.
3. Slowly pour the content of one bottle of Oxycon On-line DPD (50 ml) into the canister.
   ⚠ *Avoid splashing!*
4. Close the canister with the screw cover and tighten it well.
5. Mix the demineralized water and the reagents well.
6. Put the canister [E] into the holder [G].
7. Remove the screw cover, insert the suction lance [A] and tighten the screw cover.

Prepare Oxycon On-line Buffer

1. Rinse the canister [F] labelled “OXYCON ON LINE Buffer” solution with demineralized water.
2. Fill the canister up to the 2 liter mark [D] with demineralized water.
3. Slowly pour the content of one bag of buffer Oxycon On-line (240 gr) into the canister.
   ⚠ *Avoid splashing!*
4. Close the canister with the screw cover and tighten it well.
5. Mix the demineralized water and the reagents well.
6. Put canister [F] into holder [G].
7. Remove the screw cover and insert the suction lance [B] and tighten the screw cover.

Start-up

Fill reagent system. See Fill or Flush Reagent System, p. 38.

6.3.2 Reagents for Measuring Monochloramine and Ozone

To prepare 2 l of reagents the following chemicals are necessary:

- 1 x 50 ml of Oxycon On-line DPD
- 1 x 240 g of Oxycon On-line Buffer
- 1 x 60 g of Oxycon On-line KI
- 4 liters of demineralized water

Prepare Oxycon On-line DPD

1. Rinse the canister [E] labelled OXYCON ON LINE DPD Reagent with demineralized water.
2. Fill the canister up to the 2 liter mark with demineralized water.
3. Slowly pour the content of a bottle of Oxycon On-line DPD into the canister.
   ⚠ *Avoid splashing!*
4. Close the canister with the screw cover and tighten it well.
5. Mix the demineralized water and the reagents well.
6. Put the canister [E] into the holder [G].
7. Remove the screw cover, insert the suction lance [A] and tighten the screw cover.

Prepare Oxycon On-line Buffer & KI

1. Rinse the canister [F] labelled “OXYCON ON LINE Buffer” solution with demineralized water.
2. Fill the canister up to the 2 liter mark with demineralized water.
3. Slowly pour the content of one bag of Oxycon On-line Buffer into the canister.
   ⚠ *Avoid splashing!*
4. Add the content of one bag Oxycon On-line KI to the same canister.
5. Close the canister with the screw cover and tighten it well.
6. Mix the demineralized water and the reagents well.
7. Put the canister [F] into the holder [G].
8. Remove the screw cover, insert the suction lance [B] and tighten the screw cover.

Start-up

Fill reagent system. See Fill or Flush Reagent System, p. 38.

6.4. Verification

The “Verification kit for AMI Photometer” is available as an accessory. An optical window with a precisely determined absorbance value is placed into the light beam of the photometer. The actual measured absorbance will be compared to the reference value labeled on each kit.

Set reference value

Prior to performing the verification the DPD reference value, e.g. 0.255, needs to be set in menu 5.1.4 <Installation>/<Sensors>/<Ref. Verification>.

Verification procedure

Follow the dialog in menu 3.2.1 <Maintenance>/<Service>/<Verification>.

Note: *Start any time, if a measuring cycle is in progress wait for next prompt.*

1. Stop sample flow by closing regulating valve. Wait for next prompt: Constant head will be drained and an automatic zero will be defined.
2. Open cuvette of the photometer and insert the verification filter. [Enter] to continue.
3. Align the triangle shape either to the front– or backside and adjust for minimal absorbance (see AMI Display).
4. Press [Enter] to save the verification measurement. The verification is successful if the difference is within the limits. [Enter] to continue.
5. Remove filter, close cuvette and open regulating valve. [Enter] to finish and [Exit] to the main display.

Verification history

Can be reviewed in menu 2.2.1.5 <Diagnostics>/<Sensors>/<Photometer>/<Ver. History>

6.5. Calibration

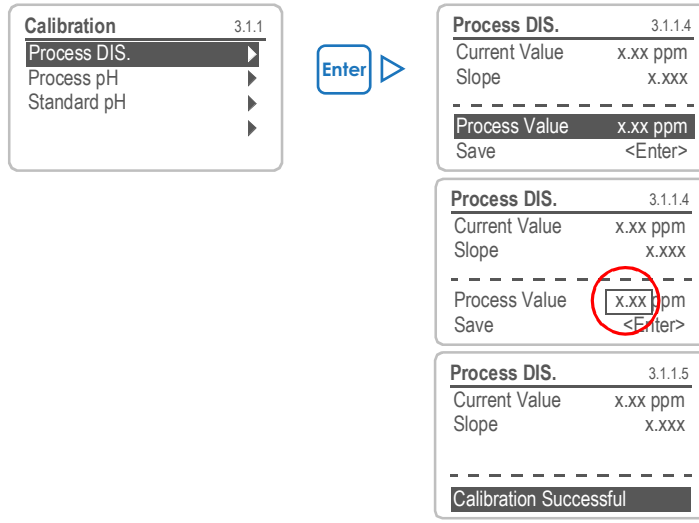
Process Calibration of DIS

Note: *Perform process calibration for free chlorine / total residual chlorine only if:*

- *the sample concentration is close to the desired process value (stable value)*
- *you are sure that the reagents are mixed completely and correctly*
- *if the difference to the manual measurement is significant.*
- *Keep in mind the accuracy of your manual measurement.*

Use Chematest (or equivalent photometer) to determine the sample disinfectant concentration. Determine the sample disinfectant value by performing 3 manual DPD measurements and calculating the average value. Compare this value to the value indicated by the AMI Codes-II.

Enter process value (mg/l = ppm) under menu 3.1.1, p. 79 for Process DIS



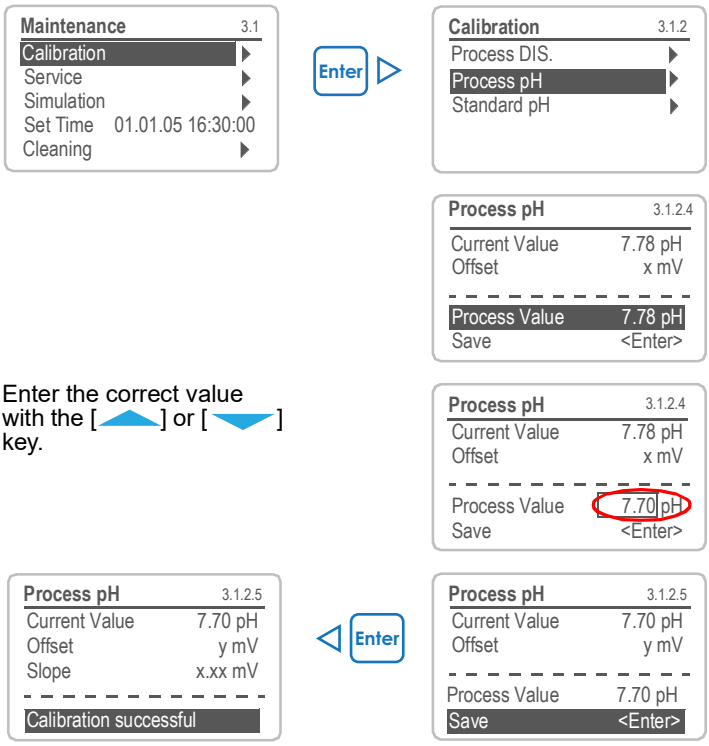
Press 3 x [Exit]

Possible error message see Calibration Errors, p. 64.

Zero A zero is automatically done before each measurement.

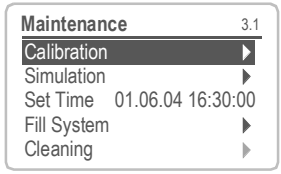
Process pH Use a Chematest photometer (or equivalent) to determine the sample pH value.

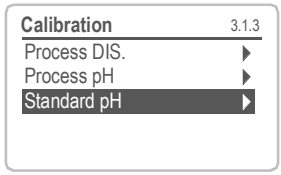
Note: *Make sure that your reference instrument is correctly calibrated!*



Possible error message see Calibration Errors, p. 64.

Standard pH





1 Navigate to menu <Maintenance>/ <Calibration>.
2 Press [Enter].
3 Remove the pH sensor from the flow cell.
4 Follow the instructions on the display.

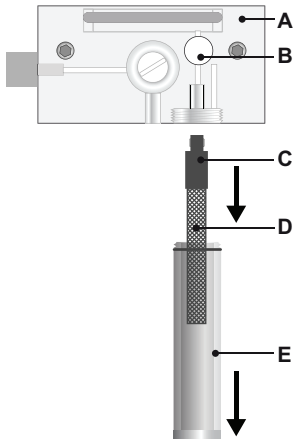
Display instructions

1 Rinse and dry the pH sensor and put it into standard 1
2 Standard 1, current value (Progress is shown).
3 Rinse and dry the pH sensor and put it in standard 2
4 Standard 2, current value (Progress is shown)
5 Rinse and dry the pH sensor and put it into the flow cell

Possible error message see Calibration Errors, p. 64.

6.6. Cleaning the protective Filter

Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 45.



A *Flow cell block*
B *Flow regulating valve*
C *Filter shaft*
D *Filter*
E *Filter vessel*

Normally the filter in your sample supply line will retain most debris. If the filter shows deposits, proceed as follows:

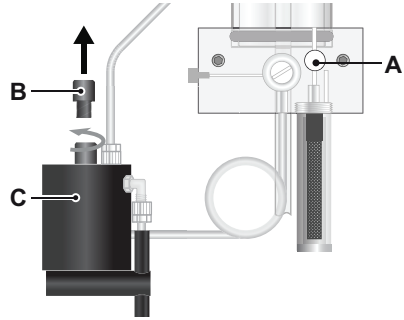
1. Close the main tap of the sample inlet.
2. Close flow regulating valve [B].
3. Unscrew and remove the filter vessel [E] from the flow cell block [A].
4. Hold the filter [D] on the shaft [C] and unscrew and remove it.
5. Backwash the filter under pressure of tap water.
6. Clean the outside of the filter.
7. Install the filter and the filter vessel again.
8. Establish the sample flow.
9. Adjust sample flow with the regulating valve.

6.7. Cleaning the Photometer

Clean the photometer after indication by alarm (E020, FOME dirty). Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 45.

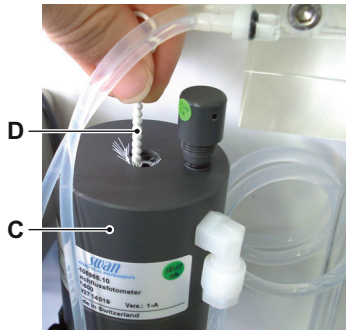
Material Small brush.

Procedure



A Flow regulating valve
B Photometer cover
C Photometer
D Brush

1. Close the flow regulating valve [A].
2. Wait until the sample flow through the photometer has stopped
3. Unscrew the cover [B] from the photometer [C].



4. Clean the Photometer with a small brush [D].
5. Screw the cover to the photometer.
6. Open the flow regulating valve.

Clean the photometer after indication by alarm (E020, FOME dirty).

6.8. Cleaning the Flow Cell

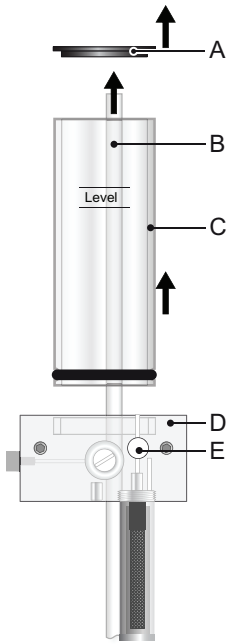
CAUTION

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

- Never use organic solvents or scrubbing materials to clean acrylic glass parts.
- Use soft detergent and rinse well. Eliminate lime deposits with a common household deliming agent in standard concentration.
- Do not drop the constant head tube

6.8.1 Disassemble the Flow Cell

The flow cell can be disassembled easily. Before disassembling the flow cell, switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 45.

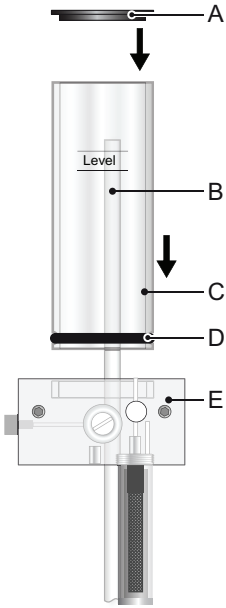


A *Constant head cover*
B *Overflow tube*
C *Constant head tube*
D *Flow cell block*
E *Flow regulating valve*

Cleaning

1. Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 45
2. If installed remove the pH sensor and the temperature sensor.
3. Remove the constant head cover [A].
4. Remove the constant head tube [C] from the flow cell block.
5. Pull the overflow tube [B] out of the flow cell block [D].
6. Clean all acrylic parts with a soft brush (bottle cleaner) and soapy water.
7. Remove lime deposits with a common household deliming agent with standard concentrations.

6.8.2 Assemble the Flow Cell



A *Constant head cover*
B *Overflow tube*
C *Constant head tube*
D *Gasket*
E *Flow cell block*

1. Replace the gasket [D] before reassembling the flow cell.

   Note: *A film of teflon paste (e.g. Fomblin from Solvay Solexis) on the gaskets improves tightness and life time.*

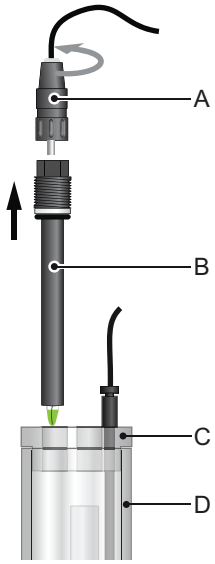
2 Push the overflow tube [B] through the flow cell block as far as it reaches the drain.

3 Install the constant head tube [C] onto the flow cell block.

4 Put the cover onto the constant head tube.

5 Align the overflow tube with the upper level mark.

6.9. Maintenance of pH sensor



A *Connector*
B *pH sensor shaft*
C *Flow cell cover*
D *Flow cell*

Clean pH sensor

1 Remove the pH sensor [B] from the flow cell.

2 Unscrew and remove the connector [A] from the pH sensor.

⚠ *Prevent the connectors from getting wet*

3 If necessary wipe the pH sensor shaft and the green tip cautiously with a soft, clean, and damp paper tissue.

4 Remove grease with a tissue moistened with alcohol.

5 If the sensor is very dirty put it into 1% diluted hydrochloric acid for 1 min.

⚠ *CAUTION! hydrochloric acid is corrosive!*

6 Rinse the pH sensor with clean water.

6.10. Tube Replacement

6.10.1 Replace the Pump Tubes

The pump tube [D] of the peristaltic pump is exposed to a minimal wear. It is therefore recommended to exchange the pump tube annually.

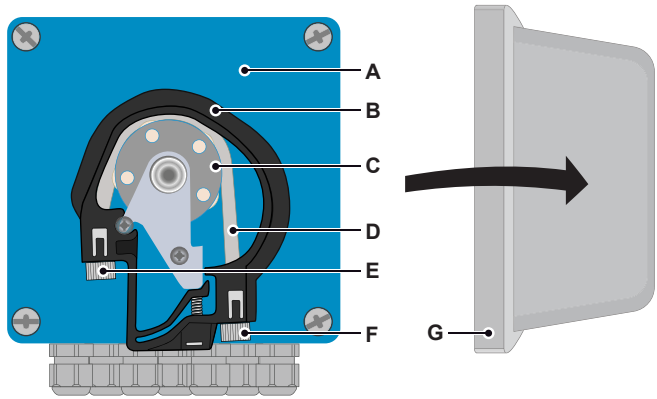
CAUTION

Pollution of reagents possible.

If the occlusion frames are opened during operation, already mixed reagents will flow back into the reagent canisters and pollute the reagents.

- Never open the occlusion frames if the instrument is in operation.
- Proceed according to Stop of Operation for Maintenance, p. 45 before opening the occlusion frames.

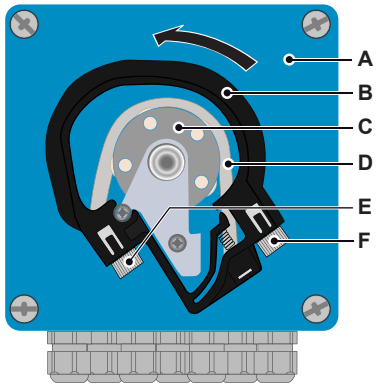
Overview



A *Pump housing*
B *Occlusion frame closed*
C *Rotor*
D *Pump tube*
E *Pump inlet*
F *Pump outlet*
G *Protection cap*

Dismount pump tubes

The pump tube can easily be dismounted and mounted. Proceed as follows:

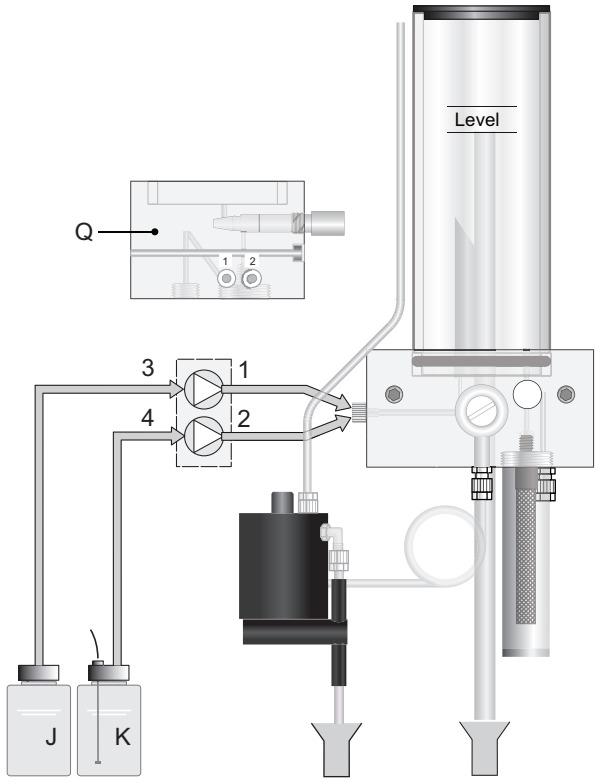


A *Pump housing*
B *Occlusion frame open*
C *Rotor*
D *Pump tube*
E *Pump inlet*
F *Pump outlet*

1. Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 45.
2. Remove the protection cap.
3. Open the occlusion frames [B] by turning them counter-clockwise.
4. Remove the pump tubes [D] from the rotor [C] by pulling the complete occlusion frames [B] out of the holder.
5. Disconnect the reagent tubes from the old pump tubes and connect them to the new pump tubes
6. Install the new pump tubes by pushing the occlusion frames onto the holder.
7. Lock the occlusion frames. Check that the occlusion frames and the tubes are aligned perpendicular to the axis of the rotor.
8. Insert the suction lances into the corresponding containers.
9. Start the <Fill system> function.

6.10.2 Replace the Reagent Tubes

Tube numbering



Nr.	from	to
1	Pump outlet: rear frame	Flow cell block: connection 1 *see Flow cell block side view Q*
2	Pump outlet: front frame	Flow cell block: connection 2 *see Flow cell block side view Q*
3	Reagent canister (J) Oxycon on-line DPD	Pump inlet: rear frame
4	Reagent canister (K) Oxycon on-line Buffer / KI	Pump inlet: front frame

6.11. Longer Stop of Operation

1 Put the suction lances into bucket with clean water.

2 Start <Fill system>.
⇒ *The reagent tubes are flushed with water.*

3 Remove the suction lance from the water.

4 Start <Fill system> again.
⇒ *The water will be pumped out of the reagent tubes.*

5 Stop sample flow.

6 Wait until level in flow cell has fallen to the shorter tube inside the cell.

7 Shut off power of the instrument.

8 Empty the flow cell completely.

9 Open the occlusion frames of the peristaltic pump, see Replace the Pump Tubes, p. 59.

If pH option is installed

10 Unscrew and remove the connector from the pH sensor.

11 Put the connector cap onto the sensor connector.

12 Fill 3.5 molar KCl (if not available: water) into the rubber cap.

13 Remove the pH sensor from the flow cell and place the rubber cap on the tip of the sensor

CAUTION

Damage of pH sensor

Wrong storage will damage the pH sensor.

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

7. Troubleshooting

This chapter provides some hints to make trouble shooting easier. For any detailed information how to handle or clean parts please see Maintenance, p. 44. For any detailed information how to program the instrument please see Program List and Explanations, p. 77.

7.1. General Instructions

Note: *The sample for the manual measurement (with DPD) must be taken directly from the flow cell.*
If you need further help please contact your dealer. Note serial number of instrument and all diagnostic values before doing so.

Diagnostic values

Zero photometry: 10'000–16'000 Hz (mostly near 16 000 Hz)
Slope photometry: 0.8–1.2
pH offset: New pH sensor: near 0, old pH sensor ± 50 mV
pH slope: typically: 55–62 mV/pH unit.

Frequently asked questions

Problem	Possible Reasons
Unstable values	◆ Sample taken too close to feeding line ◆ Sample flow too irregular or too low
Codes display higher or lower than manual measurement	◆ Wrong manual measurement or old chemicals have been used. Repeat the verification. ◆ Reagents of AMI Codes mixed wrongly or not completely
Sample flow alarm, but there is sample	◆ Check sample flow at photometer outlet. It must be at least 100 ml/min. For that place the photometer outlet tube into a measuring cup for 1 minute. ◆ Check sample line for pressure fluctuation. ◆ Check for regular air bubble pattern. ◆ Check flow alarm values in menu 5.3.1.3, p. 88)

7.2. Calibration Errors

7.2.1 Process calibration DIS

Possible error message

Slope error:

Possible cause	Corrective Action
Wrong manual measure-ment.	Repeat the manual measurement. Use fresh reagents.
◆ Wrong reagent mixture ◆ Reagents not completely solved in water.	◆ Make a correct mixture. ◆ Mix long and intensively.

7.2.2 Process pH

Possible error message

Offset error:

Possible cause	Corrective Action
Manual measurement wrong.	Repeat the manual measurement.
Slope of last calibration wrong.	Set default calibration values, see 5.4.2, p. 94. Repeat the calibration
pH sensor dirty, old or defect.	Clean or replace pH sensor, see Maintenance of pH sensor, p. 58.
Cable connector corroded.	Replace cable and sensor.

7.2.3 Standard pH

Possible error message

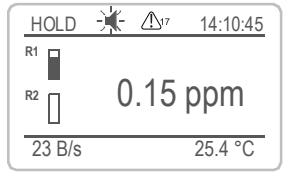
Offset error or Slope error:

Possible cause	Corrective Action
Old, dirty or wrong buffer solutions.	Check buffers expiration date if necessary order new buffer.
Verify programmed buffer values with the values of the buffer solution used.	Change programmed buffer values or use correct buffer solution.
pH sensor dirty, old or defect.	Clean or replace pH sensor, see Maintenance of pH sensor, p. 58.
Cable connector corroded.	Replace cable and sensor.

7.3. Error List

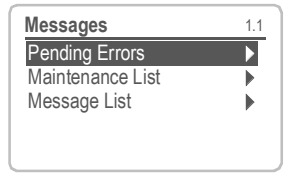
Error
Non-fatal Error. Indicates an alarm if a programmed value is exceeded.
Such Errors are marked **E0xx** (bold and black).
Fatal Error (blinking symbol)
Control of dosing devices is interrupted.
The indicated measured values are possibly incorrect.
Fatal Errors are divided in the following two categories:

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

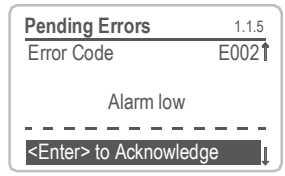


Error or fatal Error
Error not yet acknowledged.
Check **Pending Errors 1.1.5** and take corrective action.

Reagent level low
Indicates the remaining reagent in percent



Navigate to <Messages>/ <Pending Errors>



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

Error	Description	Corrective action
E001	DIS. Alarm high	– check process – check programmed value in menu 5.3.1.1.1, p. 87
E002	DIS. Alarm Low	– check process – check programmed value in menu 5.3.1.1.25, p. 87
E003	pH Alarm high	– check process – correct/calibrate pH sensor, see Calibration, p. 51 – check programmed value in menu, see 5.3.1.2.1, p. 88
E004	pH Alarm low	– check process – correct/calibrate pH sensor, see Calibration, p. 51 – check programmed value in menu, see 5.3.1.2.21, p. 88
E005	DIS. too high	– check process
E007	Sample Temp. high	– check sample temperature – check programmed value in menu 5.3.1.4.1, p. 88
E008	Sample Temp. low	– check sample temperature – check programmed value in menu 5.3.1.4.2, p. 89
E009	Sample Flow high	– check sample input pressure – readjust sample flow – check programmed value in menu 5.3.1.3.x, p. 88
E010	Sample Flow low	– check sample input pressure – readjust sample flow – clean instrument, see Cleaning the protective Filter, p. 54 – check programmed value in menu 5.3.1.3.x, p. 88

Error	Description	Corrective action
E011	Temp. shorted	– check wiring of temperature sensor, see Connection Diagram, p. 28 – check temperature sensor
E012	Temp. disconnected	– check wiring of temperature sensor, see Connection Diagram, p. 28 – check temperature sensor
E013	Case Temp. high	– check case/environment temperature – check programmed value in menu 5.3.1.5, p. 89
E014	Case Temp. low	– check case/environment temperature – check programmed value in menu 5.3.1.6, p. 89
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 5.3.2 and 5.3.3, p. 89
E018	Reagent Pump	– shut off power – check wiring, see Connection Diagram, p. 28
E019	Photometer not connected	– shut off power – check wiring of photometer, see Connection Diagram, p. 28
E020	Photometer dirty	– check process, – clean photometer, see Cleaning the Photometer, p. 55
E021	DIS. invalid	– This error appears after start-up and will disappear after the first valid measurement is finished.
E022	Reagent empty	– refill reagents, see Refill or Replace Reagents, p. 46
E023	Cleaning solution	– refill cleaning solution
E024	Input active	– See If Fault Yes is programmed in Menu 5.3.4, p. 93
E026	IC LM75	– call service
E028	Signal output open	– check wiring on signal outputs 1 and 2

Error	Description	Corrective action
E030	EEprom Frontend	– call service
E031	Calibration Recout	– call service
E032	Wrong Frontend	– call service
E033	Power-on	– none, normal status
E034	Power-down	– none, normal status
E065	DPD / Buffer	– Operating display, upper status line. The number next to the triangle, indicates the remaining reagents in %. Refill reagents on time. See Refill or Replace Reagents, p. 46
E067	Cleaning Solution	– Operating display, upper status line. The number next to the triangle indicates the remaining cleaning solution in %. Refill cleaning solution on time.

7.4. Opening the peristaltic pump housing

For some electrical connections (e.g. when replacing suction lances), it is necessary to open the housing of the peristaltic pump. To do this, proceed as follows:

1 Switch off the analyzer according to Stop of Operation for Maintenance, p. 45.

2 Remove the protection cap and all pump tubes as described in Dismount pump tubes, p. 60.

3 Unscrew the 4 screws of the peristaltic pump housing and remove the cover.

4 Disconnect the motor connector [A].

A *Motor connector*

5 Feed the cable into the housing through one of the PG7 cable glands.

6 Connect the cable to the terminal block of the peristaltic pump according to Connection Diagram, p. 28.

7 Reassemble in reverse order.

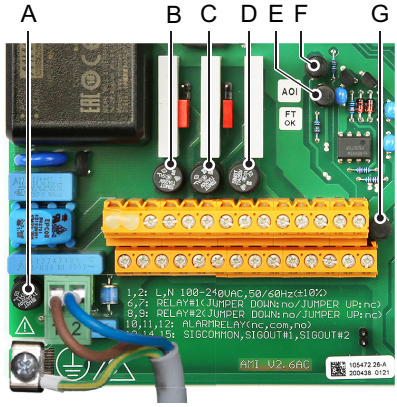
7.5. Replacing Fuses

WARNING

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

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

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



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

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, p. 77.

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

8.1. Messages (Main Menu 1)

Pending Errors 1.1*	*Pending Errors*	1.1.5*	* Menu numbers
Maintenance List 1.2*	*Maintenance List*	1.2.5*	
Message List 1.3*	*Number*	1.3.1*	
	Date, Time		

8.2. Diagnostics (Main Menu 2)

Identification 2.1*	*Designation*	*AMI Codes-II*	
	Version	*V6.20 - 08/16*	
	Peripherals 2.1.3*	*PeriClip 1 / 1.03*	2.1.3.1*
		PeriClip 2	only with cleaning module

	Factory Test 2.1.4*	*Instrument* *Motherboard* *Front End*	2.1.4.1*	* Menu numbers
	Operating Time 2.1.5*	*Years / Days / Hours / Minutes / Seconds*		2.1.5.1*
Sensors 2.2*	**Photometer** 2.2.1*	*Current Value* *(Raw value)* *Absorbance*		
		Cal. History 2.2.1.4*	*Number* *Date, Time* *Slope*	2.2.1.4.1*
		Ver. History 2.2.1.5*	*Number* *Date, Time* *Absorbance* *Reference value*	2.2.1.5.1*
	pH Electrode 2.2.2*	*Current Value* *(Raw value)*		
		Cal. History 2.2.2.5*	*Number* *Date, Time* *Offset* *Slope*	2.2.2.5.1*
	Miscellaneous 2.2.3*	*Case Temp.*	2.2.3.1*	
Sample 2.3*	*Sample ID* *Sample Flow / (Raw value)* *Temperature / (Nt5k)*	2.3.1*		
I/O State 2.4*	*Alarm Relay* *Relay 1/2* *Input* *Signal Output 1/2*	2.4.1* 2.4.2*		
Interface 2.5*	*Protocol* *Baud rate*	2.5.1*		(only with RS485 interface)

8.3. Maintenance (Main Menu 3)

Calibration	**Process DIS**	*Current Value*		* Menu numbers
3.1*	3.1.1*	*Slope*		
		Process Value	3.1.1.4*	
	Process pH	*Current Value*		
	3.1.2*	*Offset*		
		Process Value	3.1.2.4*	
	Standard pH	*(Progress)*	3.1.3.5*	
	3.1.3*			
Service	**Verification**	*(Progress)*	3.2.1.1*	
3.2*	3.2.1*			
	Fill System	*(Progress)*	3.2.2.5*	
	3.2.2*			
Simulation	*Alarm Relay*	3.3.1*		
3.3*	*Relay 1*	3.3.2*		
	Relay 2	3.3.3*		
	Signal Output 1	3.3.4*		
	Signal Output 2	3.3.5*		
Set Time	*(Date), (Time)*			
3.4*				
Cleaning	**Parameters**	**Mode**	3.5.1.1*	
3.5*	3.5.1*	**Interval**	*Interval*	3.5.1.20*
		3.5.1.1*	*Delay*	3.5.1.3*
			Signal Outputs	3.5.1.4*
			Output/Control	3.5.1.5*
		Daily	*Start time*	3.5.1.21
		3.5.1.1*	*Delay*	3.5.1.3*
			Signal Outputs	3.5.1.4*
			Output/Control	3.5.1.5*
		Weekly	**Calendar**	*Start time*
		3.5.1.1*	*Delay*	*Mo. to Su*
			Signal Outputs	3.5.1.4*
			Output/Control	3.5.1.5
		Off	3.5.1.1*	

	Fill Channel 11 3.5.2*	*(Progress)*	3.5.2.5*	* Menu numbers
	Fill Channel 12 3.5.3*	*(Progress)*	3.5.3.5*	

8.4. Operation (Main Menu 4)

Sensors 4.1*	*Filter Time Const.*	4.1.1*		
	Hold after Cal.	4.1.2*		
	Meas. Interval	4.1.3*		
	Default pH	4.1.4*		
Relay Contacts 4.2*	**Alarm Relay** 4.2.1*	**Alarm DIS** 4.2.1.1*	*Alarm High*	4.2.1.1.1*
			Alarm Low	4.2.1.1.26*
			Hysteresis	4.2.1.1.36*
			Delay	4.2.1.1.46*
		Alarm pH 4.2.1.2*	*Alarm High*	4.2.1.2.1*
			Alarm Low	4.2.1.2.x*
			Hysteresis	4.2.1.2.x*
			Delay	4.2.1.2.x*
	Relay 1 & 2 4.2.2* & 4.2.3*	*Setpoint*	4.2.x.x*	
		Hysteresis	4.2.x.x*	
		Delay	4.2.x.x*	
	Input 4.2.4*	*Active*	4.2.4.1*	
		Signal Outputs	4.2.4.2*	
		Output / Control	4.2.4.3*	
		Fault	4.2.4.4*	
		Delay	4.2.4.5*	
Logger 4.3*	*Log Interval*	4.3.1*		
	Clear Logger	4.3.2*		

8.5. Installation (Main Menu 5)

Sensors 5.1*	*Disinf.*	5.1.1*
	Dimension	5.1.2*
	Interpolation	5.1.3*
	Ref. Verification	5.1.4*

	Standards	*Standard 1*	5.1.50.1*	* Menu numbers
	5.1.50*	*Standard 2*	5.1.50.2*	
	Cleaning	1 solution	5.1.6.1*	
	5.1.6*	2 solutions	5.1.6.2*	
Signal Outputs	**Signal Output 1&2**	*Parameter*	5.2.1.1 & 5.2.2.1*	
5.2*	5.2.1* & 5.2.2*	*Current Loop*	5.2.1.2 & 5.2.2.2*	
		Function	5.2.1.3 & 5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.x*
		5.2.x.40	*Range High*	5.2.x.40.x*
Relay Contacts	**Alarm Relay**	**Alarm DIS**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.x*
			Hysteresis	5.3.1.1.x*
			Delay	5.3.1.1.x*
		Alarm pH	*Alarm High*	5.3.1.2.1*
		5.3.1.2*	*Alarm Low*	5.3.1.2.x*
			Hysteresis	5.3.1.2.x*
			Delay	5.3.1.2.x*
		Sample Flow	*Flow Alarm*	5.3.1.3.1*
		5.3.1.3*	*Alarm High*	5.3.1.3.x*
			Alarm Low	5.3.1.3.x*
		Sample Temp.	*Alarm High*	5.3.1.4.1*
		5.3.1.4*	*Alarm Low*	5.3.1.4.x*
		Case Temp. high	5.3.1.5*	
		Case Temp. low	5.3.1.6*	
	Relay 1&2	*Function*	5.3.2.1 & 5.3.3.1*	
	5.3.2* & 5.3.3*	*Parameter*	5.3.2.x & 5.3.3.x*	
		Setpoint	5.3.2.x & 5.3.3.x*	
		Hysteresis	5.3.2.x & 5.3.3.x*	
		Delay	5.3.2.x & 5.3.3.x*	
	Input	*Active*	5.3.4.1*	
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	

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

9. Program List and Explanations

1 Messages

1.1 Pending Errors

1.1.5 Provides the list of active errors with their status (active, acknowledged). If an active error is acknowledged, the alarm relay is active again. Cleared errors are moved to the Message list.

1.2 Maintenance List

1.2.5 Demands necessary maintenance, e.g. preparing new reagents.

1.3 Message List

1.3.1 Shows the error history: Error code, date and time of issue and status (active, acknowledged, cleared). 65 errors are memorized. Then the oldest error is cleared to save the newest error (circular buffer).

2 Diagnostics

In diagnostics mode, the values can only be viewed, not modified.

2.1 Identification

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

2.1.3 **Peripherals**: PeriClip 1: Firmware of peristaltic pump (e.g. 1.03)

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

2.1.5 **Operating Time**: years/days/hours/minutes/seconds

2.2 Sensors

2.2.1 **Photometer:**

Current value: Shows the actual photometer signal [ppm].
Raw value: Shows the actual photometer signal [Hz].
Absorbance: Process value, depends on sample.

2.2.1.4 **Cal. History:** Shows the diagnostic values of the last calibrations.
Number: Calibration counter.
Date, Time: Date and time of the calibration.
Slope: Slope is a correction factor calculated on the basis of a process calibration.
Range: 0.8–1.2

2.2.1.5 **Ver. History:** Shows the verification values of the last verifications:
Number: Verification counter.
Date, Time: Date and time of the verification.
Absorbance: Measured absorbance of the reference kit.
Reference value: True value of the reference kit according to label.

2.2.2 **pH Electrode:** Only available if pH option is installed.
Current Value: Shows the actually measured pH value.
Raw value: Shows the actual electrode voltage in mV.

2.2.2.5 **Cal. History:** Shows the calibration values of the last pH sensor calibrations. Offset in mV and slope in mV/pH.
Number: Calibration counter.
Date, Time: Date and time of the calibration.
Offset: Vertical shift above or below the zero point.
Slope: Characteristic of the pH sensor expressed in mV/pH.The calculated slope is used for the entire measuring range of the electrode.

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

2.2.3 **Miscellaneous**:

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

2.3 Sample

2.3.1 **Sample ID:** Shows the identification assigned to a sample. This identification is defined by the user to identify the location of the sample.
Sample Flow: Shows the actual sample flow in B/s (bubbles per second)]. The Sample flow must be above 5 B/s.
Temperature: Actual temperature in °C and in Ohm *(NT5K)*

2.4 I/O State

Shows current status of all in- and outputs.

2.4.1/2.4.2

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

2.5 Interface

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

3 Maintenance

3.1 Calibration

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

3.1.1 **Process DIS**: Possibility to correct the disinfectant value. See Process Calibration of DIS, p. 51, for more details.

3.1.2 **Process pH**: Only available if pH option has been installed. Correction of pH electrode. See Process Calibration of DIS, p. 51, for details.

3.1.3 **Standard pH:** Only available if pH option has been installed. Calibration of pH electrode with the two standard solutions programmed in Installation 5.1.3. See Standard pH, p. 53, for details.

3.2 Service

3.2.1 Verification: Performs a verification using the reference kit. Follow dialog. See Verification, p. 50

3.2.2 Fill System: Activates the reagent pump.

3.3 Simulation

To simulate a value or a relay state, select
- alarm relay,
- relay 1or 2
- signal output 1 or 2

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

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

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

3.4 Set Time

Adjust date and time.

3.5 Cleaning

Automatic cleaning process using the optional Cleaning Module-II. Cleaning is not possible if one of the following errors is active:

- E009/E010 Sample flow high/low
- E023 Cleaning solution

3.5.1 Parameters

3.5.1.1 *Mode:* The following modes can be chosen: interval, daily, weekly or off.

If Mode = Interval

3.5.1.20 *Interval:* Select one of the following cleaning intervals:
1 h, 2 h, 3 h, 4 h, 6 h, 8 h, 12 h.

3.5.1.3 *Delay:* During cleaning plus the delay time, the status of the signal and control outputs is as set in 3.5.1.4 and 3.5.1.5.
Range: 0–6000 s

3.5.1.4 *Signal Outputs:* Select the operation mode of the signal outputs during cleaning:

Cont.: Signal outputs continue to issue the measured value.

Hold: Signal outputs hold the last valid measured value. Measurement is interrupted. Errors, except fatal errors, are not issued.

Off: Signal outputs are switched off (set to 0 or 4 mA). Errors, except fatal errors, are not issued.

3.5.1.5 *Output/Control:* Relay or signal output:

Cont.: Controller continues normally.

Hold: Controller continues based on the last valid value.

Off: Controller is switched off.

If Mode = daily

The start of the daily cleaning cycle can be set to any time of day.

3.5.1.21 *Start time:* Time of the automatic start of the cleaning process.
Range: 00:00:00–23:59:59

3.5.1.3 *Delay:* see mode interval.
3.5.1.4 *Signal Outputs:* see mode interval.
3.5.1.5 *Output/Control:* see mode interval.

If Mode = weekly

The start of the automatic cleaning cycle can be set to one or more weekdays and any time of day. The programmed time of day is valid for all selected weekdays.

3.5.1.22 Calendar:

3.5.1.22.1 Start time: Time of the automatic start of the cleaning process (valid for all selected weekdays).
3.5.1.22.2 Monday: Possible settings: on or off
to
3.5.1.22.8 Sunday: Possible settings: on or off

3.5.1.3 *Delay:* see mode interval.
3.5.1.4 *Signal Outputs:* see mode interval.
3.5.1.5 *Output/Control:* see mode interval.

all modes

3.7.2 *Fill Channel 11:* Activates the cleaning pump and switches the valve to cleaning solution 1 (right canister).

3.7.3 *Fill Channel 12:* Activates the cleaning pump and switches the valve to cleaning solution 2 (left canister).

4 Operation

4.1 Sensors

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

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

4.1.3 *Meas. Interval:* Measurement interval for disinfectants.
Range: 1 to 12 min

4.1.4 *Default pH*: If the pH value of the sample is known it can be entered in this menu.This menu only appears if the pH option is not installed.
Range: 0–14 pH

4.2 Relay Contacts

See 5.3 Relay Contacts, p. 87

4.3 Logger

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

4.3.1 *Log Interval:* Select a convenient log interval. Consult the table below to estimate the max logging time. The logging buffer is designed as circular buffer. If the buffer is full, the oldest data record is erased to make room for the newest one.
If the logger interval is set to event driven, a data record of every valid measurement is saved. The interval corresponds with the measuring interval.

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

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

5 Installation

5.1 Sensors

5.1.1 *Disinf:* Select the disinfectant in use. Available disinfectants are:
- Free chlorine
- Hypochl. acid
- Ozone
- Chlorine dioxide
- Bromine
- Iodine
- Monochloramine

5.1.2 *Dimension*: The measuring value can be displayed as ppm or mg/l

5.1.3 *Interpolation:*
Yes: Display and output of free chlorine value changes linearly between two measuring points. Select this mode if you encounter problems with the controller of free chlorine.
no: Step response of display and output between two measuring points.

5.1.4 *Ref. Verification:* Set absorbance value of verification kit according to label.
Range: 0.200–0.600

5.1.5 **Standards:** Program the two standard solutions for the calibration of the pH electrode. If pH electrode is not connected the programmed standards are not active.
Range: 1.00 pH–13.00 pH

5.1.6 **Cleaning:** Program whether the cleaning module uses one or two solutions.
Range: 1 solution, 2 solutions

5.2 Signal Outputs

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

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

5.2.1.1 *Parameter:* Assign one of the process values to the signal output.
Available values:
- DIS
- pH
- Temperature
- Sample flow

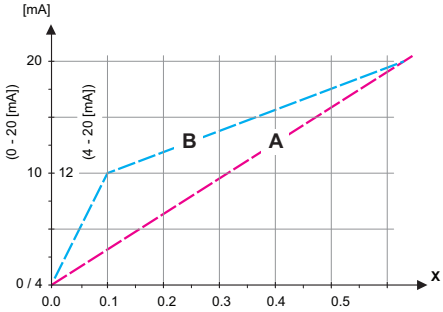
5.2.1.2 *Current Loop:* Select the current range of the signal output.
Make sure the connected device works with the same current range.
Available ranges: 0–20 mA or 4–20 mA

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

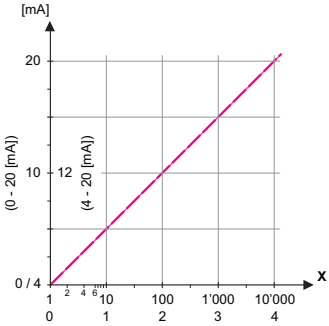
- Linear, bilinear or logarithmic for process values.
  See As process values, p. 84
- Control upwards or control downwards for controllers.
  See As control output, p. 85

As process values

The process value can be represented in 3 ways: linear, bilinear or logarithmic. See graphs below.



A *linear*
B *bilinear*
X *Measured value*



X *Measured value (logarithmic)*

5.2.1.40 **Scaling:** Enter beginning and end point (Range low & high) of the linear or logarithmic scale. In addition, the midpoint for the bilinear scale.

Parameter DIS:

5.2.1.40.10 *Range low*: 0–10 ppm or 0–10 mg/l

5.2.1.40.20 *Range high:* 0–10 ppm or 0–10 mg/l

Parameter pH

5.2.1.40.11 *Range low*: 0 –14 pH

5.2.1.40.21 *Range high*: 0 –14 pH

Parameter Temperature

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

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

Parameter Sample flow

5.2.1.40.13 *Range low*: 0 –600 B/s

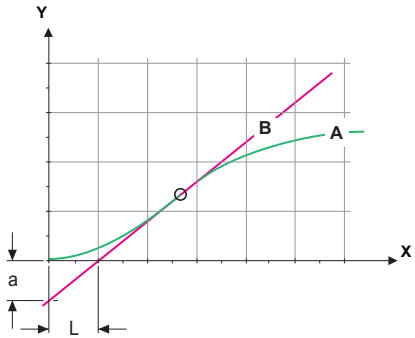
5.2.1.40.23 *Range high*: 0 –600 B/s

As control output

Signal outputs can be used for driving control units. We distinguish different kinds of controls:

- *P-controller:* The controller action is proportional to the deviation from the setpoint. The controller is characterized by the P-Band. In the steady-state, the setpoint will never be reached. The deviation is called steady-state error.
  Parameters: setpoint, P-Band
- *PI-controller:* The combination of a P-controller with an I-controller will minimize the steady-state error. If the reset time is set to zero, the I-controller is switched off.
  Parameters: setpoint, P-Band, reset time.
- *PD-controller:* The combination of a P-controller with a D-controller will minimize the response time to a fast change of the process value. If the derivative time is set to zero, the D-controller is switched off.
  Parameters: setpoint, P-Band, derivative time.
- *PID-controller:* The combination of a P-, an I - and a D-controller allows a proper control of the process.
  Parameters: setpoint, P-Band, reset time, derivative time.

Ziegler-Nichols method for the optimization of a PID controller:
Parameters: Setpoint, P-Band, Reset time, Derivative time



A *Response to maximum control output* ***Xp*** *= 1.2/a*
B *Tangent on the inflection point* ***Tn*** *= 2L*
X *Time* ***Tv*** *= L/2*

The point of intersection of the tangent with the respective axis will result in the parameters a and L.
Consult the manual of the control unit for connecting and programming details. Choose control upwards or downwards.

Control upwards/downwards

Setpoint: User-defined process value (Measured value or flow)
P-Band: Range below (upwards control) or above (downwards control) the set-point, within the dosing intensity is reduced from 100% to 0% to reach the set-point without overshooting.

5.2.1.43 Control Parameters: if Parameters = DIS
5.2.1.43.10 *Setpoint*: 0–5 ppm or 0–5 mg/l
5.2.1.43.20 *P-Band*: 0–5 ppm 0–5 mg/l

5.2.1.43 Control Parameters: if Parameters = pH
5.2.1.43.11 *Setpoint*: 0 –14 pH
5.2.1.43.21 *P-Band*: 0 –14 pH

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

5.2.1.43 Control Parameters: if Parameters = Sample Flow
5.2.1.43.13 *Setpoint*: 0–600 B/s
5.2.1.43.23 *P-Band*: 0 –200 B/s

Reset time: The reset time is the time till the step response of a single I-controller will reach the same value as it will be suddenly reached by a P-controller.
Range: 0–9'000 sec
Derivative time: The derivative time is the time till the ramp response of a single P-controller will reach the same value as it will be suddenly reached by a D-controller.
Range: 0–9'000 sec
Control timeout: If a controller action (dosing intensity) is constantly over 90% during a defined period of time and the process value does not come closer to the setpoint, the dosing process will be stopped for safety reasons.
Range: 0–720 min

5.3 Relay Contacts

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

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

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

- DIS
- pH
- Temperature
- Sample flow

The alarm values of Sample Flow and Temperature can be programmed in menu as well (5.3.1.3, p. 88 or 5.3.1.4, p. 88)

5.3.1.1 **Alarm DIS.**

5.3.1.1.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E001 is displayed in the message list. Range: 0.00–10.00 ppm

5.3.1.1.25 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E002 is displayed in the message list.
Range: 0.00–10.00 ppm

5.3.1.1.35 *Hysteresis:* Within the hyst. range, the relay does not switch. This prevents damage of relays contacts when the measured value fluctuates around the alarm value.
Range. 0.00–10.00 ppm

5.3.1.1.45 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range: 0.00–28‘800 sec

5.3.1.2 **Alarm pH:** Only available if pH option is installed. Define the measuring value, which should issue an alarm high respectively low.

5.3.1.2.1 *Alarm High:* If the measured value rises above the alarm high value, the alarm relay is activated and E003 is displayed in the message list.
Range: 0–14.00 pH

5.3.1.2.21 *Alarm Low:* If the measured value falls below the alarm low value, the alarm relay is activated and E004 is displayed in the message list
Range: 0–14.00 pH

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

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

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

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

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

5.3.1.3.x *Alarm High:* If the measuring values rises above the programmed value E009 will be issued.
Range: 100–600 B/s

5.3.1.3.x *Alarm Low:* If the measuring values falls below the programmed value E010 will be issued.
Range: 5–80 B/s

5.3.1.4 **Sample Temperature:** Only available if pH option is installed. Define the measuring value, which should issue an alarm high respectively low.

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

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

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

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

5.3.2 and 5.3.3 **Relay 1 and 2:** The contacts can be set as normally open or normally closed with a jumper. See Relay 1 and 2, p. 31.
The function of the relay contacts 1 and 2 is defined by the user.

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

1 First select the functions as:
- Limit upper/lower,
- Control upwards/downwards,
- Timer
- Fieldbus
- End of Batch (relay 2 only)

2 Then enter the necessary data depending on the selected function.

5.3.2.1 Function = Limit upper/lower:

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

5.3.2.20 *Parameter:* select a process value

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

Parameter	Range
DIS	0–5 ppm
pH	0–14.00 pH
Temperature	-30 to +120 °C
Sample flow	0–600 B/s

5.3.2.400 *Hysteresis:* within the hysteresis range, the relay does not switch. This prevents damage of relay contacts when the measured value fluctuates around the alarm value.

Parameter	Range
DIS	0–5 ppm
pH	0–14.00 pH
Temperature	0 to +100 °C
Sample flow	0–200 B/s

5.3.2.50 *Delay:* Duration, the activation of the alarm relay is retarded after the measuring value has risen above/fallen below the programmed alarm.
Range. 0–600 sec

5.3.2.1 Function = Control upwards/downwards:

The relays may be used to drive control units such as solenoid valves, membrane dosing pumps or motor valves. When driving a motor valve both relays are needed, relay 1 to open and relay 2 to close the valve.

5.3.2.22 *Parameter:* Choose on of the following process values.

- DIS
- pH
- Temperature
- Sample Flow

5.3.2.32 **Settings***:* Choose the respective actuator:

- Time proportional
- Frequency
- Motor valve

5.3.2.32.1	Actuator = Time proportional
	Examples of metering devices that are driven time proportional are solenoid valves, peristaltic pumps. Dosing is controlled by the operating time.
5.3.2.32.20	*Cycle time:* duration of one control cycle (on/off change). Range: 0–600 sec.
5.3.2.32.30	*Response time:* Minimal time the metering device needs to react. Range: 0–240 sec.
5.3.2.32.4	**Control Parameters** Range for each Parameter same as 5.2.1.43, p. 86
5.3.2.32.1	Actuator = Frequency
	Examples of metering devices that are pulse frequency driven are the classic membrane pumps with a potential free triggering input. Dosing is controlled by the repetition speed of dosing shots.
5.3.2.32.21	*Pulse frequency:* Max. pulses per minute the device is able to respond to. Range: 20–300/min.
5.3.2.32.31	**Control Parameters** Range for each Parameter same as 5.2.1.43, p. 86
5.3.2.32.1	Actuator = Motor valve
	Dosing is controlled by the position of a motor driven mixing valve.
5.3.2.32.22	*Run time:* Time needed to open a completely closed valve Range: 5–300 sec.
5.3.2.32.32	*Neutral zone:* Minimal response time in % of the runtime. If the requested dosing output is smaller than the response time, no change will take place. Range: 1–20 %
5.3.2.32.4	**Control Parameters** Range for each Parameter same as 5.2.1.43, p. 86
5.3.2.1	Function = Timer:
	The relay will be active repetitively depending on the programmed time scheme.
5.3.2.24	*Mode:* Operating mode (interval, daily, weekly)

5.3.2.24 *Interval*

5.3.2.340 *Interval:* The interval can be programmed within a range of 1–1'440 min.

5.3.2.44 *Run Time*: Enter the time the relay stays active.
Range: 5–32'400 sec.

5.3.2.54 *Delay*: during run time plus the delay time the signal and control outputs are held in the operating mode programmed below.
Range: 0–6'000 sec.

5.3.2.6 *Signal Outputs*: Select operating mode of the signal output:

Cont.: Signal outputs continue to issue the measured value.

Hold: Signal outputs hold the last valid measured value. Measurement is interrupted. Errors, except fatal errors, are not issued.

Off: Signal outputs are switched off (set to 0 or 4 mA). Errors, except fatal errors, are not issued.

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

Cont.: Controller continues normally.

Hold: Controller continues based on the last valid value.

Off: Controller is switched off.

5.3.2.24 *daily*

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

5.3.2.341 *Start time*: to set the start time proceed as follows:

1 Press [Enter], to set the hours.

2 Set the hour with the [▲] or [▼] keys.

3 Press [Enter], to set the minutes.

4 Set the minutes with the [▲] or [▼] keys.

5 Press [Enter], to set the seconds.

6 Set the seconds with the [▲] or [▼] keys.

Range: 00:00:00–23:59:59

5.3.2.44 *Run Time*: see Interval

5.3.2.54 *Delay*: see Interval

5.3.2.6 *Signal Outputs*: see Interval

5.3.2.7 *Output/Control*: see Interval

5.3.2.24 *weekly*

The relay contact can be activated at one or several days, of a week. The daily starting time is valid for all days.

5.3.2.342 **Calendar**:

5.3.2.342.1 *Start time*: The programmed start time is valid for each of the programmed days. To set the start time see 5.3.2.341, p. 92.
Range: 00:00:00–23:59:59

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

5.3.2.342.8 *Sunday*: Possible settings, on or off

5.3.2.44 *Run Time*: see Interval

5.3.2.54 *Delay*: see Interval

5.3.2.6 *Signal Outputs*: see Interval

5.3.2.7 *Output/Control*: see Interval

5.3.2.1 Function = Fieldbus:

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

5.3.3.1 Function = End of Batch

This function is only available on relay 2. It is used to communicate with canal switching instruments from third-party suppliers. The relay closes for 1 sec. after each valid measurement. If End of Batch is selected, no further selection is possible.

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

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

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

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

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

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

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

5.3.4.4 *Fault:*

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

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

5.4 Miscellaneous

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

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

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

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

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

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

5.4.6 *Line Break Detection:* If activated, error message E028 is shown in case of line break on signal outputs 1 and 2.

5.5 Interface

Select one of the following communication protocols. Depending on your selection, different parameters must be defined.

5.5.1 *Protocol:* **Profibus**

5.5.20	Device address:	Range: 0–126
5.5.30	ID-Nr.:	Range: Analyzer; Manufacturer; Multivariable
5.5.40	Local operation:	Range: Enabled, Disabled

5.5.1 *Protocol:* **Modbus RTU**

5.5.21	Device address:	Range: 0–126
5.5.31	Baud Rate:	Range: 1200–115200 Baud
5.5.41	Parity:	Range: none, even, odd

5.5.1 *Protocol:* **USB stick**

Only visible if an USB interface is installed. No further settings are possible.

5.5.1 *Protocol:* **HART**

5.5.24	Device address:	Range: 0–63

10. Material Safety Data sheets

10.1. Reagents

Catalogue No.:	A-85.410.120
Product name:	OXYCON ON-LINE DPD
Catalogue No.:	A-85.410.120
Product name:	OXYCON ON-LINE Buffer
Catalogue No:	A-85.419.200
Product name:	OXYCON ON-LINE KI
Catalogue No.:	A-85.112.300
Product name:	Calibration Solution pH 4
Catalogue No.:	A-85.113.300
Product name:	Calibration Solution pH 7
Catalogue No:	A-85.114.300
Product name:	Calibration Solution pH 9

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

11. Default Values

Note: *The parameter Cleaning is only visible if the optional Cleaning Module is connected to the AMI Codes II.*
The parameters pH and Temperature are only visible if the pH option is installed.

Operation:

Sensors:	Filter Time Const.: 30 s
	Hold after Cal.: 120 s
	Meas. Interval: 5 min
	Default pH *(If pH option is not installed)* 7.00 pH
Alarm Relay	same as in Installation
Relay 1 and 2	same as in Installation
Input	same as in Installation
Logger:	Logger Interval: Event driven
	Clear Logger: no

Installation:

Sensor:	Disinf: Free chlorine
	Dimension ppm
	Interpolation: yes
	Ref. Verification: 0.255
	Standard: Standard 1: 7.00 pH
	Standard: Standard 2: 9.00 pH
	Cleaning 2 Solutions
Signal Output 1&2	Parameter: DIS.
	Current loop: 4–20 mA
	Function: linear
	Scaling: Range low: 0.00 ppm
	Scaling: Range high: 5.00 ppm
	Scaling: pH: Range low: 0.00 pH
	Scaling: pH: Range high: 14.00 pH
	Scaling: Temperature: Range low: 0.0 °C
	Scaling: Temperature: Range high: 50.0 °C
	Scaling: Sample Flow: Range low: 0 B/s
	Scaling: Sample Flow: Range high: 200 B/s
Alarm Relay	Alarm DIS.:
	Alarm high: 5.00 ppm
	Alarm low: 0.00 ppm
	Hysteresis: 0.10 ppm
	Delay: 5 s

pH: Alarm high: ..... 14.00 pH
pH: Alarm low: ..... 0.00 pH
pH: Hysteresis: ..... 0.10 pH
pH: Delay: ..... 5 s

Sample Flow: Flow Alarm: ..... yes
Sample Flow: Alarm High: ..... 500 B/s
Sample Flow: Alarm Low: ..... 5 B/s

Sample Temp.: Alarm High: ..... 55 °C
Sample Temp.: Alarm Low: ..... 5 °C

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

Relay 1and 2

Function: ..... Limit upper
Parameter: ..... DIS.
Setpoint: ..... 5.00 ppm
Hysteresis: ..... 0.10 ppm
Delay: ..... 30 s

If Function = Control upw. or dnw:

Parameter: ..... **DIS**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 5.00 ppm
Settings: Control Parameters: P-band: ..... 0.10 ppm

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

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

Parameter: ..... **Sample Flow**
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 200 B/s
Settings: Control Parameters: P-band: ..... 20 B/s

Common settings

Settings: Control Parameters: Reset time: ..... 0 s
Settings: Control Parameters: Derivative Time: ..... 0 s
Settings: Control Parameters: Control Timeout: ..... 0 min

	Settings: Actuator: ..... Time proportional
	Cycle time: ..... 60 s
	Response time: ..... 10 s
	Settings: Actuator ..... Motor valve
	Run time: ..... 60 s
	Neutral zone: 5%
	If Function = Timer:
	Mode: ..... Interval
	Interval: ..... 1 min
	Mode: ..... daily
	Start time: 00.00.00
	Mode: ..... weekly
	Calendar; Start time: 00.00.00
	Calendar; Monday to Sunday: ..... Off
	Run time: ..... 10 s
	Delay: ..... 5 s
	Signal output: ..... cont
	Output/Control: ..... cont
Input:	Active ..... when closed
	Signal Outputs ..... hold
	Output/Control ..... off
	Fault ..... no
	Delay ..... 10 s
Miscellaneous	Language: ..... English
	Set default: ..... no
	Load firmware: ..... no
	Password: ..... for all modes 0000
	Sample ID: ..... - - - - - - - -
	Line break detection ..... no

12. Index

13. Notes

ANALYTICAL INSTRUMENTS

A-96.250.571 / 070622

Swan Products - Analytical Instruments for:

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

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SWISS MADE

AMI Codes-II