ANALYTICAL INSTRUMENTS

A-96.250.821 / 070222

Operator's Manual

Firmware V6.23 and higher

SWISS MADE

AMI Phosphate HL

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.

2. Product Description

Application

The AMI Phosphate HL is a complete monitoring system for the automatic continuous measurement of orthophosphate in water. Orthophosphate (PO_4^{3-}) can be found in many applications like corrosion protection in sanitary systems and boilers or as additives and detergents.

The AMI Phosphate HL is used as a quality control for waters containing elevated orthophosphate level. Examples of such applications are water in thermal power plants, district heating systems or cooling water systems.

The measuring value can be displayed in ppm as PO4 or as P.

Measuring principle

The measurement is based on the vanadomolybdophosphoric acid colorimetric method according to APHA 4500-P C. In diluted orthophosphate solution, ammonium molybdate reacts under acid conditions to form a heteropoly acid. In the presence of vanadium, yellow vanadomolybdophosphoric acid is formed which is measured photometrically with a wavelength of 460 nm. The intensity of the yellow color is proportional to the orthophosphate concentration in the water.

Interferences and detection limit

The method does not interfere with silica. The instrument is designed to measure orthophosphate in presence or in excess of silica without interferences. High ammonia or salt concentrations do not interfere.

Detection limit of the method: 0.1 ppm PO4.

Programmable measuring intervals

The duration of a measuring interval can be set to:

- 5, 6, 7, 8 or 9 min (available if “1 channel” is selected)
- 10 min (shortest interval if “2 channels” is selected or if an
- 15 min AMI Sample Sequencer is connected)
- 20 min
- 25 min
- 30 min

Regardless of the programmed measuring interval, the reaction time of a measurement is 2.5 minutes.

Signal outputs

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

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

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

Relay

Two potential-free contact programmable as limit switches for measuring values, controllers or timer for system cleaning with automatic hold function. Both contacts can be used as normally open or normally closed.

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

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

Safety features

No data loss after power failure. All data is saved in non-volatile memory. 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

2nd sample stream

As an option an inlet for two sample streams with a sample switching valve can be installed onto the panel of the AMI Phosphate HL.

AMI Sample Sequencer

If measurement of more than two sample streams is required, the AMI Phosphate HL can be connected to an AMI Sample Sequencer (available as an accessory), which allows to measure up to six sample streams.

Cleaning module

A cleaning module is available as an accessory, which can be connected to the AMI Phosphate HL.

On-line operation

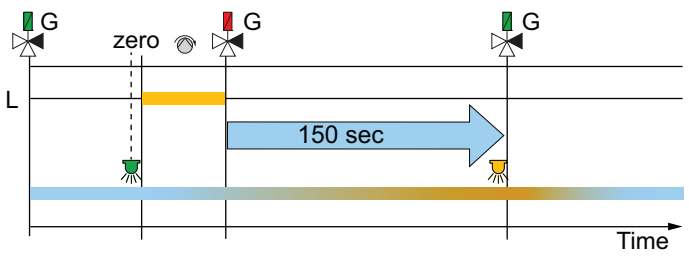
The sample flows through the sample inlet [F] and the filter vessel [H] into the constant head [A]. Adjust the flow regulating valve [D] so that a small part of the sample always flows through the overflow tube [B] into the constant head drain [J]. This adjustment ensures a sufficient sample flow through the measuring chamber of the photometer [N].

If no measurement takes place, the sample flows through the outlet of the photometer where it will be aerated through the air inlet tube [P] to generate bubbles. Then the sample flows through the bubble counter [I] into the photometer drain [K].

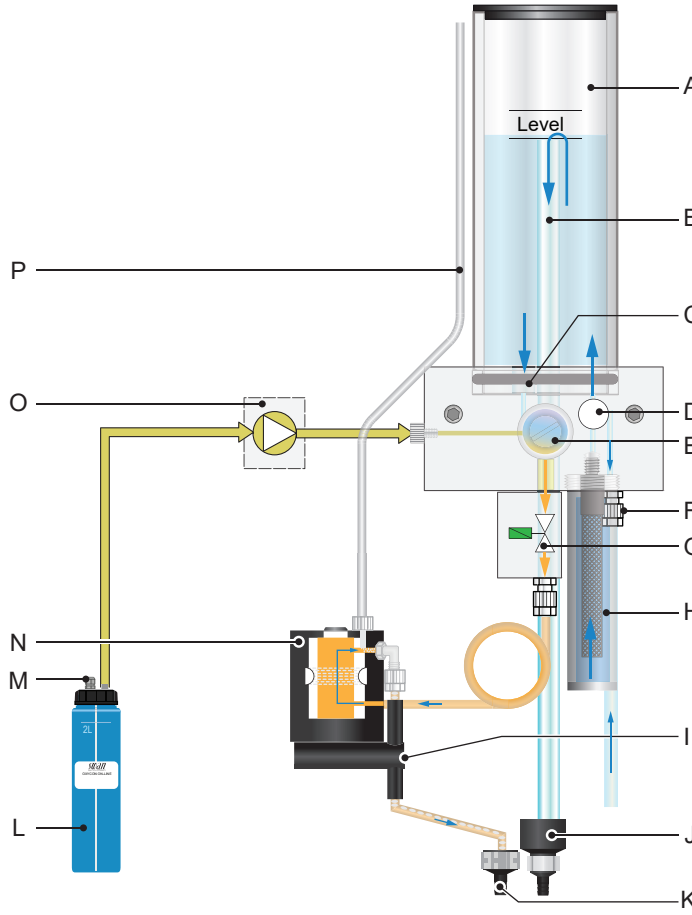
When a measuring cycle starts,

1. a zero measurement of the sample is performed before the reagents are added.
2. The peristaltic pump [O] pumps the reagent [L] into the mixing chamber [E] where it is mixed with the sample and then flowing through the photometer [N].
3. The solenoid valve [G] will be activated to close the inlet of the photometer.
4. The sample remains in the photometer for 2.5 minutes.
5. After the reaction time (2.5 min) the o-phosphate concentration in the sample is measured.
6. After the measurement, the solenoid valve will be deactivated to open the inlet of the photometer. The photometer is flushed.
7. The sample flows through the outlet of the photometer where it will be aerated by the air inlet tube [P] to generate bubbles.
8. The sample flows through the bubble detector [I] and into the photometer drain [K].

Measuring cycle



Fluidics



A *Constant head*
B *Overflow tube*
C *Sample flow to mixing chamber*
D *Flow regulating valve*
E *Mixing chamber*
F *Sample inlet*
G *Solenoid valve*
H *Filter vessel*
I *Bubble detector*
J *Constant head drain*
K *Photometer drain*
L *Reagent canister*
M *Level detector*
N *Photometer*
O *Peristaltic pump*
P *Air inlet tube*

Standard calibration

Note: *The instrument is factory-calibrated and ready for use. Therefore there is no need for a further standard calibration.*

The standard calibration is carried out with a defined standard solution. The concentration of the calibration solution should be within the measuring range. At the end of the calibration the calculated slope correction is displayed, which can be saved by pressing [Enter]. For details see Calibration, p. 53.

Verification

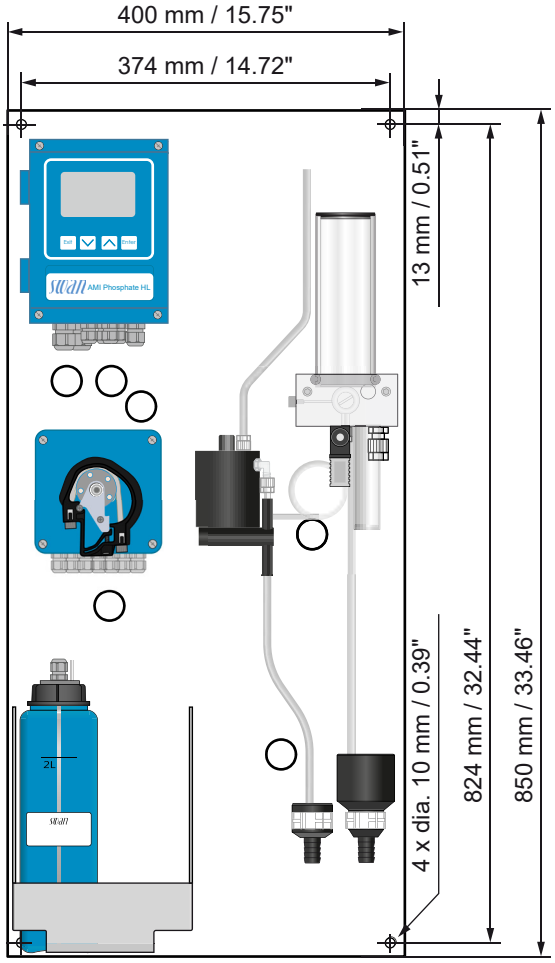
The verification is carried out with a verification kit, which is available as an accessory. The verification kit has an optical window with a precisely defined absorbance value. This value is printed on the Label of the Verification kit and has to be entered in Menu 5.1.1. Ref. verification. The verification does not change any parameters in the AMI transmitter. For details see Verification, p. 52.

2.1. Instrument Specification

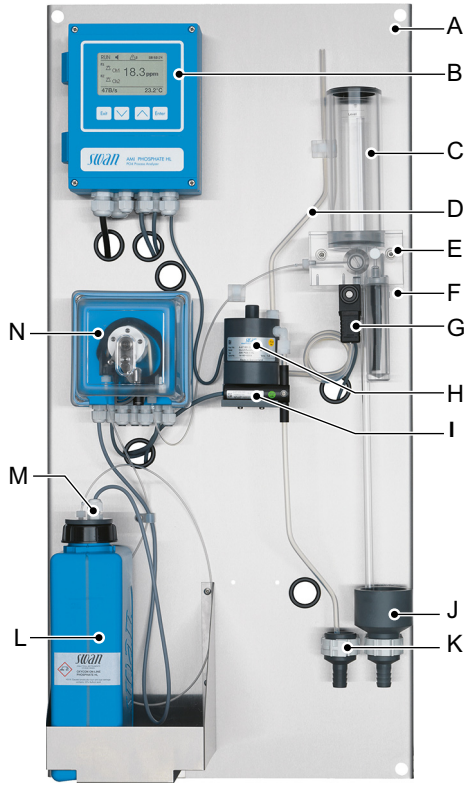
Power supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant:	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Standard measuring range	0.1–25 ppm as PO_4	Resolution 0.1 ppm
	0.1–8 ppm as P	Resolution 0.1 ppm
Extended measuring range	0.1–50 ppm as PO_4	Resolution 0.1 ppm
	0.1–16 ppm as P	Resolution 0.1 ppm
Reproducibility	0.1–10 ppm	± 0.1 ppm or ± 2.5%, whichever is the greater
	10–50 ppm	± 0.3 ppm or ± 5%, whichever is the greater
Sample requirements	Flow rate:	min. 10 l/h
	Sample pressure inlet:	0.15–2 bar (2–28 PSI)
	Temperature:	up to 50 °C (122 °F)
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Serto PVDF 6 mm (1/4” thread) for tubing 6x4 mm
	Sample outlet:	2 drains, 1/2” hose nozzle for flexible tube diam. 20x15 mm which must end in a pressure free waste of sufficient capacity.

Dimensions

Panel:	stainless steel
Dimensions:	400x850x200 mm
Screws:	8 mm diameter
Weight:	14.5 kg / 31.95 lbs



2.2. Instrument Overview



A *Panel*
B *Transmitter*
C *Constant head*
D *Air inlet tube*
E *Flow cell block*
F *Sample inlet with filter vessel*
G *Solenoid valve*
H *Photometer*
I *Bubble detector*
J *Constant head drain*
K *Photometer drain*
L *Reagent canister*
M *Cover with reagent level detector and suction lance*
N *Peristaltic pump*

3. Installation

3.1. Installation Checklist

On-site requirements	AC variant: 100–240 VAC (± 10%), 50/60 Hz (± 5%) DC variant: 10–36 VDC Power consumption: 35 VA maximum. Protective earth connection required. Sample line with sufficient sample flow and pressure (see Instrument Specification, p. 15).
Installation	◆ Mounting of Instrument Panel, p. 19 ◆ Connecting Sample and Waste, p. 20 ◆ Mounting the Constant Head Tube, p. 21
Electrical wiring	◆ Connect all external devices like limit switches, current loops and pumps. ◆ Install 2nd Sample Stream, p. 22 (if available) or ◆ Install the AMI Sample Sequencer, p. 24 (if available) ◆ Connect power cord, see Power Supply, p. 28 and Electrical Connections, p. 25
Reagent	◆ Refill or replace Reagent, p. 49. – Prepare the reagent. – Insert suction lance with level detector.
Power-up	◆ Activate the Peristaltic Pump, p. 36 ◆ Establish Sample Flow, p. 37 – Switch on power. ◆ Fill or Flush Reagent System, p. 40
Instrument setup	◆ Programming, p. 41 – Program all parameters for external devices (interface, recorders, etc.). – Program all parameters for instrument operation – Limits – Alarms – Measuring interval – Number of channels (if 2nd sample stream option or AMI Sample Sequencer is connected)

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:
  - 4 Screws 8x60 mm
  - 4 Dowels
  - 4 Washers 8.4/24 mm

For dimensions see 16.

Mounting requirements

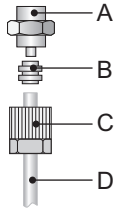
The instrument is only intended for indoor installation.

3.3. Connecting Sample and Waste

Sample inlet

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

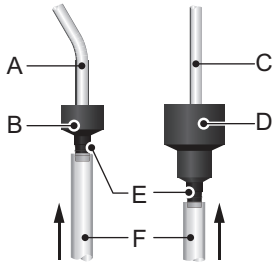
Mounting of SERTO fitting



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

Waste

Connect the 1/2” tubes to the nozzle of the waste funnels and place them into a pressure free drain of sufficient capacity.



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

WARNING

Risk of water pollution

The sample outlet of the photometer contains hexammonium heptamolybdate 4-hydrate.

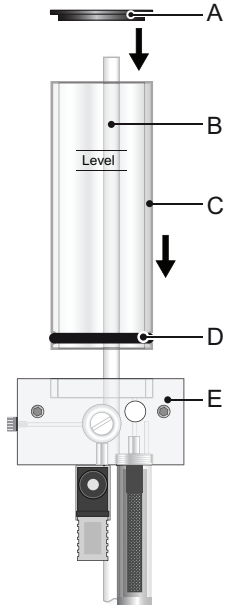
- At no means recirculate it into the water system.

3.4. Mounting the Constant Head Tube

CAUTION

Fragile part
Handle the constant head tube with care.

To avoid damage during the transport, the constant head tube [C] of the AMI Phosphate HL is not installed.

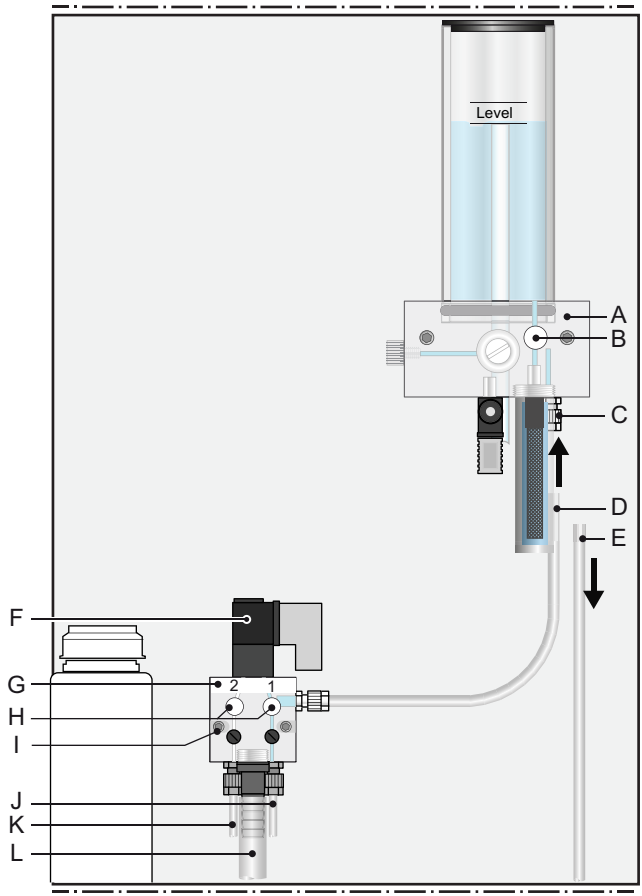


A *Constant head cover*
B *Overflow tube*
C *Constant head tube*
D *Gasket*
E *Flow cell block*

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 2nd Sample Stream



A *Flow cell block*
B *Flow regulating valve*
C *Sample inlet*
D *Sample inlet tube from 2nd sample stream option*
E *Sample inlet tube*
F *Solenoid valve*
G *2nd sample stream option*
H *Flow regulating valves*
I *Fixing screws*
J *Sample inlet 1*
K *Sample inlet 2*
L *Overflow tube*

Sample connection

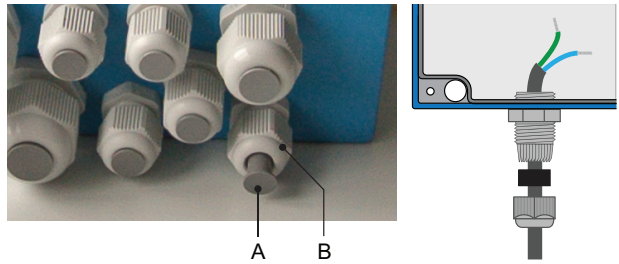
1. Close the main tap to stop the sample flow.
2. Switch off the instrument.
3. Empty the flow cell.
4. Remove the sample inlet tube [E] from the flow cell block [A].
5. Screw the 2nd sample stream option [G] with the two fixing screws [I] to the panel.
6. Install the tube [D] between the 2nd sample stream option outlet and the flow cell block inlet.
7. Connect sample inlet 1 [J] and sample inlet 2 [K] to the corresponding inlets at the 2nd sample stream option.
8. Connect the overflow tube [L] to the drain.

Connect the solenoid valve

WARNING

Electrical shock hazard!
Before opening the AMI Transmitter switch power off.

Use one of the PG7 cable glands to feed the cable of the solenoid valve into the AMI transmitter housing.



1. Remove the plug [A] from the cable gland [B].
2. Open the transmitter housing.
3. Feed the cable of the solenoid valve through the cable gland [B] into the AMI transmitter housing.
4. Connect the wires to the terminals in the AMI transmitter according to the Connection Diagram, p. 27.

3.6. Install the AMI Sample Sequencer

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

3.7. Electrical Connections

WARNING

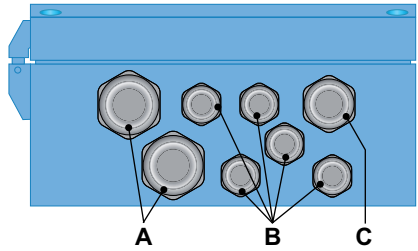
Risk of electrical shock

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

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

Cable thicknesses

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



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

Note: *Protect unused cable glands.*

Wire

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

WARNING

External voltage

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

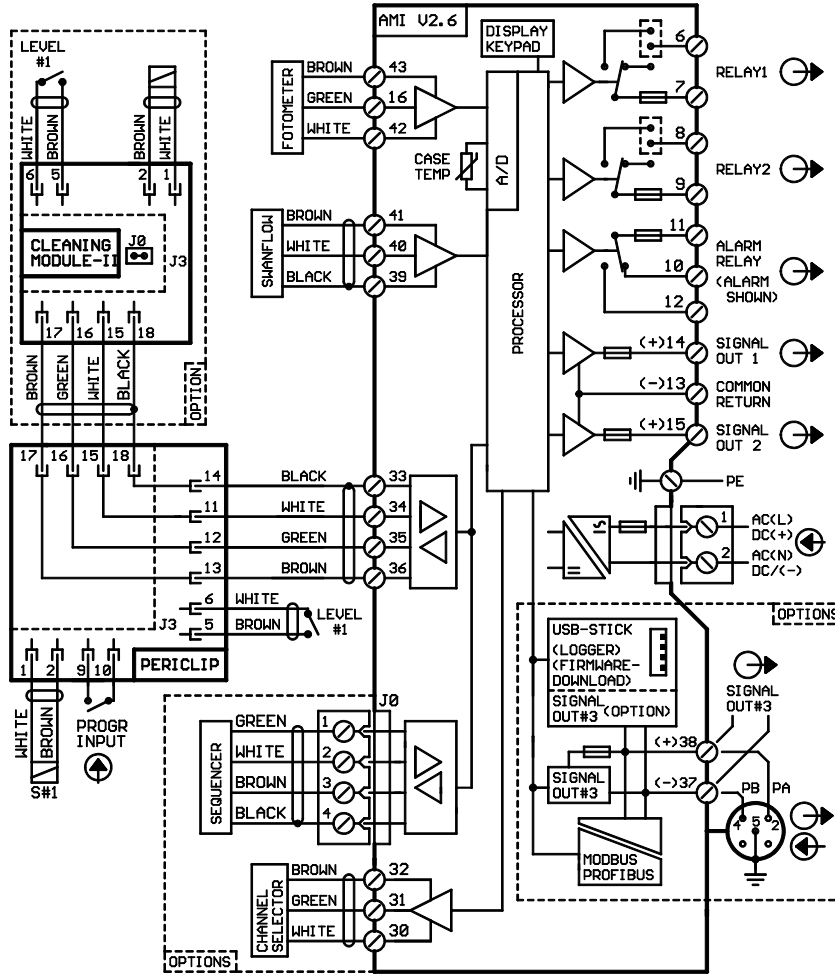
WARNING

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.

3.7.1 Connection Diagram



CAUTION

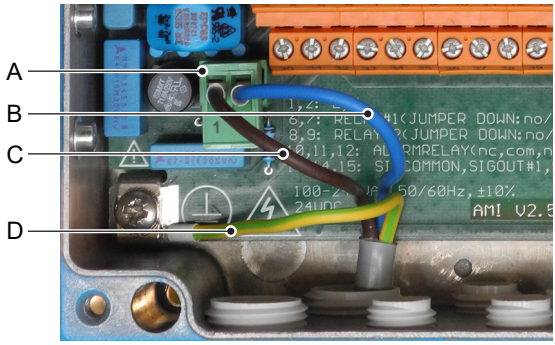
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.7.2 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

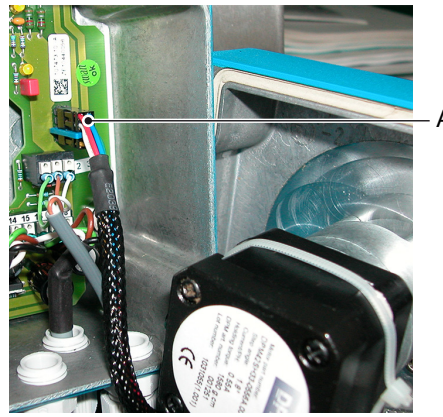
The installation must meet the following requirements.

- 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 Phosphate HL

3.7.3 Opening the Peristaltic Pump Housing

For some electrical connections (see Connection Diagram, p. 27), 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. 48.
2. Remove the protection cap and all pump tubes as described in Dismount pump tube, p. 61.
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 (permissible cable thicknesses are specified in Cable thicknesses, p. 25).
6. Connect the cable to the terminal block of the peristaltic pump according to Connection Diagram, p. 27.
7. Reassemble in reverse order.

3.8. Relay Contacts

3.8.1 Input

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

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

For programming see menu 5.3.4, p. 92

3.8.2 Alarm Relay

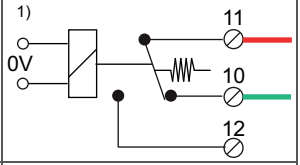
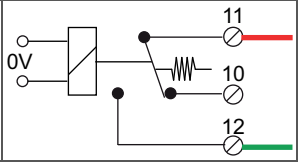
Note: *Max. load 1 AT / 250 VAC*

Alarm output for system errors.

Error codes see Error List, p. 64

Programming see menu 5.3.1, p. 87

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.	

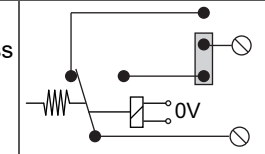
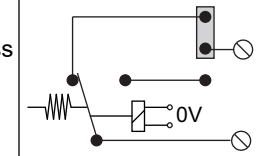
1) *usual use*

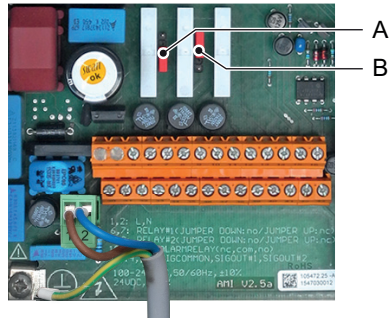
3.8.3 Relay Contacts 1 and 2

Note: *Rated load 1 AT / 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. 88

CAUTION

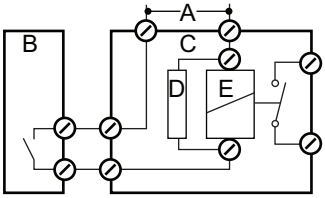
Risk of damage of the relays in the AMI transmitter due to heavy inductive load.

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

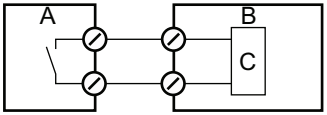
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI transmitter it is mandatory to connect a snubber circuit in parallel to the load. A snubber is not necessary if an AMI relaybox is used.



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

Resistive load

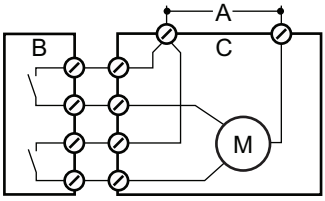
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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

Actuators

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



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

3.9. Signal Outputs

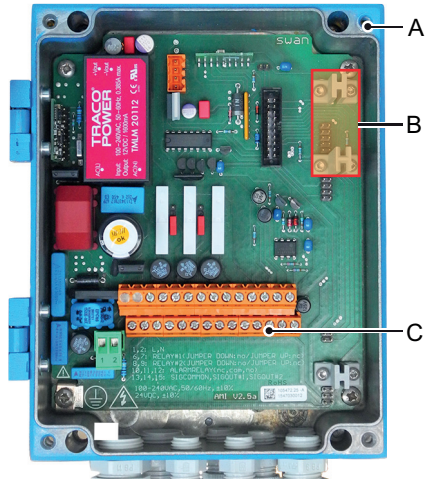
3.9.1 Signal Output 1 and 2 (current outputs)

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. 75, menu Installation.

3.10. Interface Options



A *AMI transmitter*
B *Slot for interfaces*
C *Screw terminals*

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

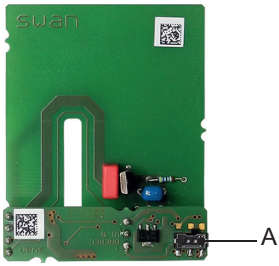
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- a USB Interface

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

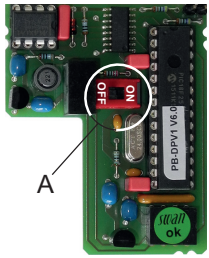
A *Operating mode selector switch*

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.*



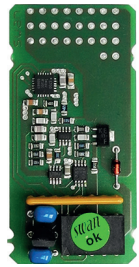
Profibus, Modbus Interface PCB (RS 485)

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.

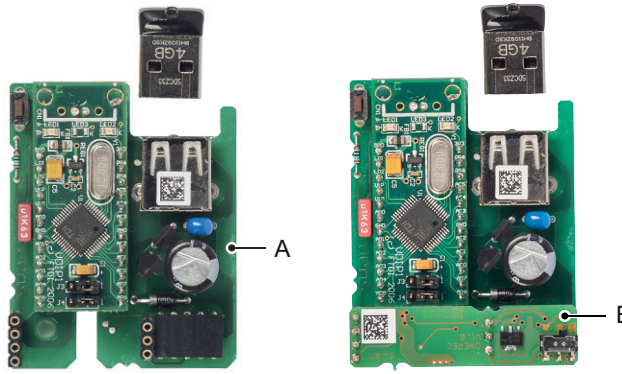


HART Interface PCB

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*

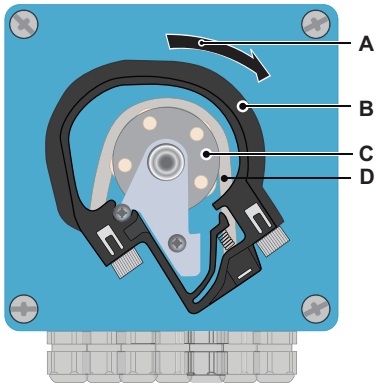
4. Instrument Setup

4.1. Activate the Peristaltic Pump

The occlusion frames of the peristaltic pump are opened during transport and storage. This prevents the pump tubs from sticking together at the pressure points.

1 Turn the occlusion frame [B] clockwise to activate the peristaltic pump.

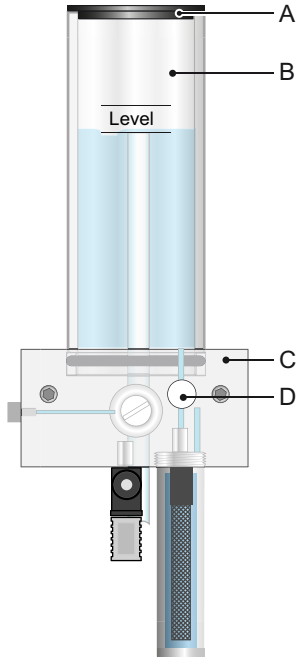
⇒ *The peristaltic pump is ready.*



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

4.2. Establish Sample Flow

Single-channel instrument



A *Cover*
B *Outer tube*
C *Flow cell block of the constant head*
D *Flow regulating valve*

With a single-channel instrument, proceed as follows:

1 Switch on power.

2 Adjust the sample flow to about 10 l/h using the flow regulating valve [D] on the flow cell block of the constant head.

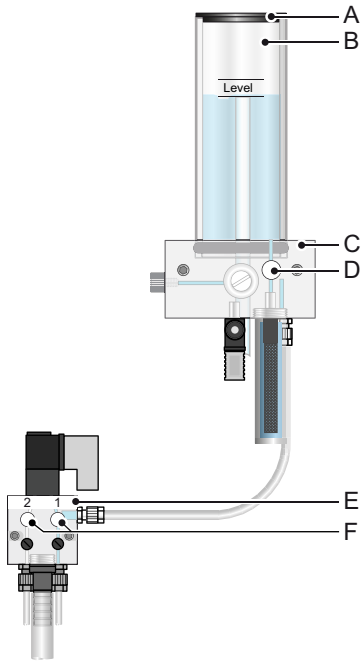
WARNING

Risk of water pollution

The sample outlet of the photometer contains hexammonium heptamolybdate 4-hydrate.

- At no means recirculate it into the water system.

Two-channel instrument



A *Cover*
B *Outer tube*
C *Flow cell block of the constant head*
D *Flow regulating valve*
E *Second sample stream option*
F *Flow regulating valves of sample streams 1 and 2*

If the second sample stream option is installed, proceed as follows:

1 Switch on power.

2 Open the flow regulating valve [D] on the flow cell block of the constant head.

3 Adjust the sample flow to about 10 l/h using the flow regulating valves [F] of the second sample stream option.

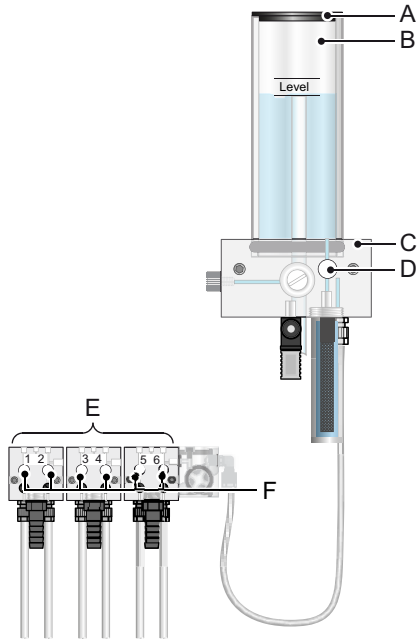
WARNING

Risk of water pollution

The sample outlet of the photometer contains hexammonium heptamolybdate 4-hydrate.

- At no means recirculate it into the water system.

Instrument with AMI Sample Sequencer



A *Cover*
B *Outer tube*
C *Flow cell block of the constant head*
D *Flow regulating valve*
E *Flow cell blocks of sample streams 1 to 6*
F *Flow regulating valves*

If an AMI Sample Sequencer is installed, proceed as follows:

1 Switch on power.

2 Open the flow regulating valve [D] on the flow cell block of the constant head.

3 Adjust the sample flow to about 10 l/h using the flow regulating valves [F] of the AMI Sample Sequencer.

WARNING

Risk of water pollution

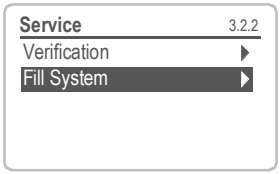
The sample outlet of the photometer contains hexammonium heptamolybdate 4-hydrate.

- At no means recirculate it into the water system.

4.3. Fill or Flush Reagent System

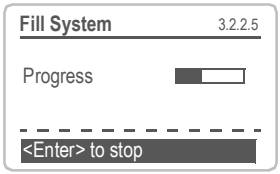
Fill or flush the reagent tubing:

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

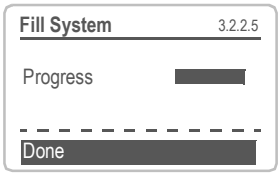


Navigate to menu <Maintenance>/<Service>/<Fill system>.

Press [Enter].



The peristaltic pump is activated for 1.5 minutes.



Press [Exit] 4 times to return to the operating display mode.

4.4. Programming

External devices

Program all parameters for external devices (interface, recorders, etc.). See 5.2 Signal Outputs, p. 84 and 5.3 Relay Contacts, p. 87.

Limits, alarms

Program all parameters for instrument operation (limits, alarms). See 5.3 Relay Contacts, p. 87.

Multi-channel instruments

If the 2nd sample stream option is installed, make the following settings:

- Set the number of channels to “2”. See 5.1.5, p. 81.
- Select the channel switching mode. See 5.1.6, p. 81.

If an AMI Sample Sequencer is installed, make the following settings:

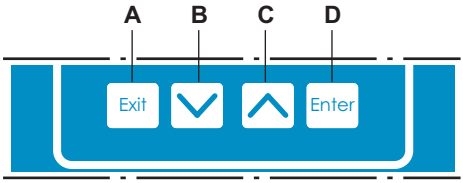
- On the AMI Sample Sequencer, navigate to <Installation>/ <Sequence> and select “AMI”.
- On the AMI Phosphate HL, select the number of available channels and the channel selection mode. See 5.1.5, p. 81 and 5.1.6, p. 81.

For detailed descriptions of the channel selection modes, see the following sections:

Mode Internal, p. 81
Mode Fieldbus, p. 82
Mode External, p. 82

5. Operation

5.1. Function of the Keys



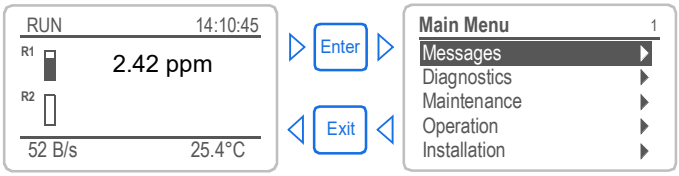
A *to exit a menu or command (rejecting any changes) to move back to the previous menu level*

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

C *to move UP in a menu list and to increase digits*
to scroll the measuring values if a Sample Sequencer is connected

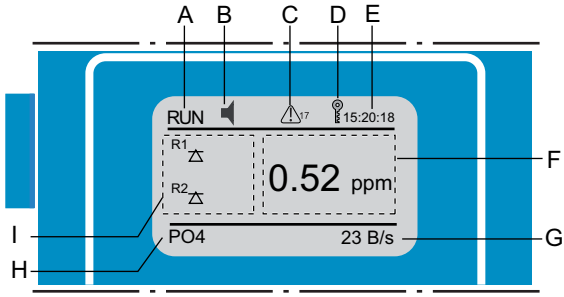
D *to open a selected sub-menu*
to accept an entry

Program access, exit



5.2. Measured Values and Symbols on the Display

Display when operating with one sample stream



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. See Refill or replace Reagent, p. 49

D Transmitter control via Profibus

E Time

F Process values

G Sample flow in bubbles/s

H Display of measuring mode, PO4 or P, see 5.1.3, p. 80

I 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

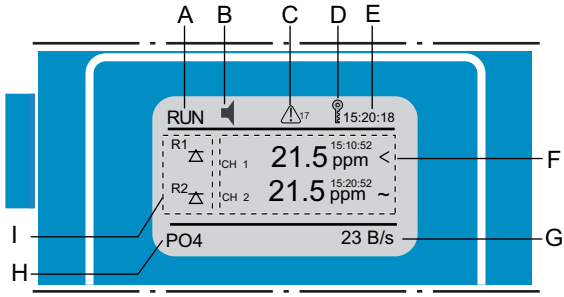
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

Display when operating with two sample streams

Only applicable with AMI Phosphate HL and installed 2nd sample stream option or if an AMI Sample Sequencer is connected.



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

D Transmitter control via Profibus

E Time

F Process values with time stamp

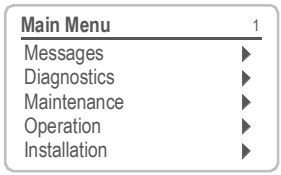
CH 1 measuring value of sample stream 1
CH 2 measuring value of sample stream 2
< Channel active
~ No sample flow
n Measurement not valid (not visible in this example)
x Channel switched off (not visible in this example)

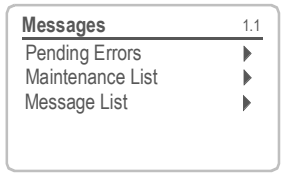
G Sample flow in bubbles per second B/s

H Display of measuring mode, PO4 or P, see 5.1.3, p. 80

I Relay status

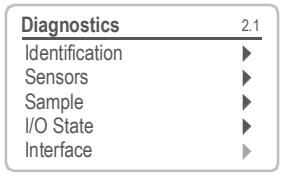
5.3. Software Structure





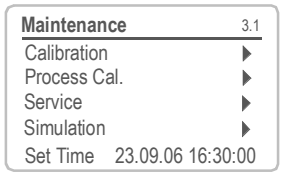
Menu **Messages 1**

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



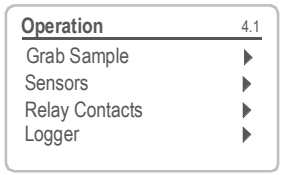
Menu **Diagnostics 2**

Provides user relevant instrument and sample data.



Menu **Maintenance 3**

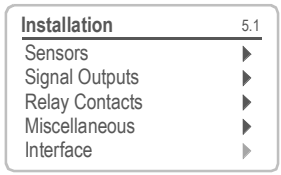
For instrument calibration, relay and signal output simulation, and to set the instrument time.
It is used by the service personnel.



Menu **Operation 4**

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

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



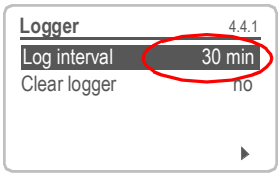
Menu **Installation 5**

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

5.4. Changing Parameters and Values

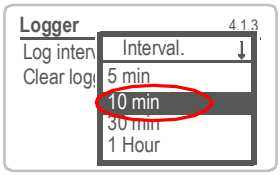
Changing parameters

The following example shows how to change the logger interval:



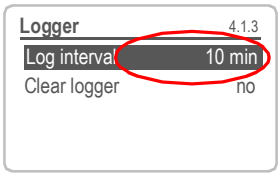
1 Select the parameter you want to change.

2 Press [Enter]



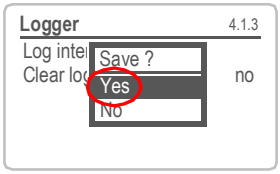
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

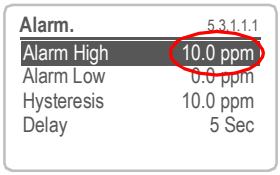
5 Press [Exit].



⇒ *Yes is highlighted.*

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

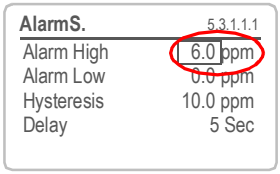
Changing values



1 Select the value you want to change.

2 Press [Enter].

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



4 Press [Enter] to confirm the new value.

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

6 Press [Enter] to save the new value.

5.5 Grab Sample

Status of relays and signal outputs during the procedure:

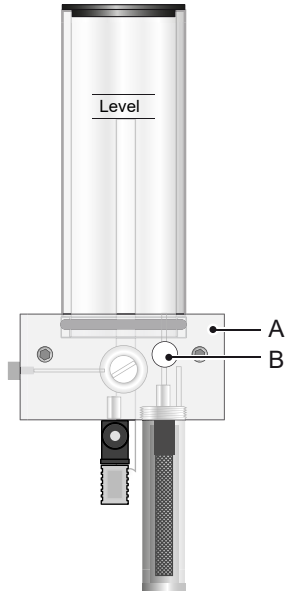
- Signal outputs are on hold
- All limits are switched off

1 Navigate to <Operation>/<Grab Sample>.

2 Follow the instructions on the screen.

Note:

- *The measured value of the grab sample is not stored.*
- *If the second sample stream option or an AMI Sample Sequencer is installed, the flow regulating valve [B] on the flow cell block of the constant head must be closed during the grab sample measurement. Otherwise, the grab sample may flow back into the sample feed line.*



A *Flow cell block of the constant head*
B *Flow regulating valve*

6. Maintenance

6.1. Maintenance Schedule

Daily (dirty water) up to every 2 weeks (clean water)	Check sample supply for dirt. Clean inlet filter if necessary. Check sample flow.
Monthly	Recommendation: Check photometer with verification kit.
Yearly	Exchange reagent pump tubes.
By occurrence	E065, Reagent low: Refill or replace Reagent, p. 49.

6.2. Stop of Operation for Maintenance

Before starting any maintenance work, all pipes as well as the photometer and the constant head must be rinsed with clean water to remove the reagent. To rinse the system proceed as follows:

1. Put suction lance into a bucket with clean water.
2. Start fill system.
3. Wait until the filling process has been finished.
4. Remove suction lance from water and leave it at the air.
5. Close the tap of the sample inlet.
6. Let the flow regulating valve open.
7. Start fill system again.
8. Wait until the flow cell is empty.
9. Shut off power of the instrument.

6.3. Refill or replace Reagent

The liquid level in the container is monitored. The following message is displayed:

Container almost empty	Maintenance E065 - Reagents low and the remaining reagent volume in% (starting at 17% = 340ml). See Operation, p. 42
Container empty	Error E022 - Reagent empty

CAUTION

Pollution of reagent

Refilling reagent without flushing the containers may lead to pollution of the reagent.

- Before refilling the reagent, rinse the container with pure water.

Reagent consumption

The 2 liter reagent canister will last for 1 month of operation with default measurement interval of 15 minutes and standard measuring range of 0–25 ppm.
As the reagent consumption is not linear find further examples below:

Measuring interval	**Duration per canister**	**Duration per reagent set**	
		0–25 ppm	0–50 ppm
5 minutes	~ 9 days	~ 54 days	~ 27 days
10 minutes	~ 17 days	~ 100 days	~ 51 days
15 minutes	**~ 26 days**	**~ 150 days**	~ 78 days
20 minutes	~ 34 days	~ 200 days	~ 102 days
30 minutes	~ 51 days	~ 300 days	~ 153 days

The reagent kit contains:

Reagent 1a	6 bottles containing 100 ml each of sulfuric acid solution 25% with dissolved vanadate salt. Sufficient for 3 or 6 fillings, depending on the measuring range.
Reagent 1b	6 bottles containing 50 g each of ammonium molybdate tetrahydrate (white powder). Sufficient for 3 or 6 fillings, depending on the measuring range.

Not contained in this kit: 1.8 l of sulfuric acid solution 25% for one canister filling

SWAN recommends the following products:

- Merck Millipore: 1007161000
- Sigma-Aldrich: 84736

WARNING

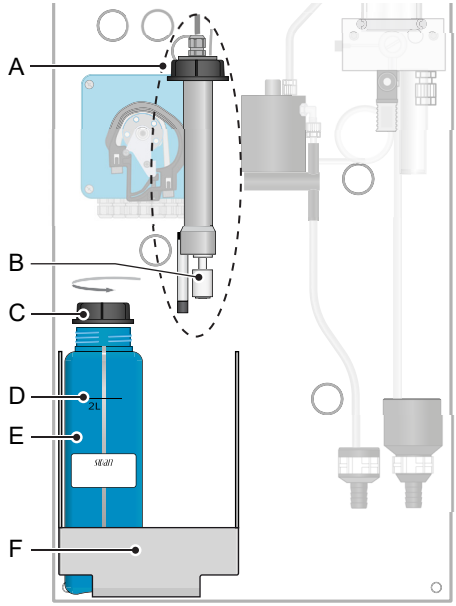
Health hazard

Sulfuric acid 25%.

- Causes severe skin burns and eye damage. (H314)
- Do not breathe dust / fume / gas / mist / vapours / spray (P260).
- Wear protective gloves/protective clothing/eye protection/face protection (P280).
- IF ON SKIN (or hair) Remove/Take off immediately all contaminated clothing. Rinse skin with water/shover. (P303+P361+P353).
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. (P305+P351+P338).
- Read the material safety data sheets.

Personal protective equipment

Canister set up



A *Suction lance*
B *Level detector*
C *Screw cover*
D *2 L mark*
E *Reagent canister*
F *Holder*

Note: *The number in brackets applies for the measuring range 0–50 ppm. The procedure for preparation remains the same.*

Preparation

1. Wash the container with pure water.
2. Fill one (two) bottle(s) of reagent 1a into the container.
3. Fill the container up to the 2 l mark with the sulfuric acid solution 25%.
4. Add one (two) bottle(s) reagent 1b.
5. Close the container with screw cover, tighten it well.
6. Shake the container vigorously.
   ⇒ *Some foam forms on the surface, this is normal and does not disturb the measurement.*
7. Remove the screw cover [C], insert the suction lance [A] and tighten the screw cover.

6.4. Verification

The “Verification kit for the 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 a verification the phosphate reference value, e.g. 0.242, needs to be set in menu 5.1.1. <Installation>/<Sensors>/<Ref. Verification>.

Verification procedure

Navigate to the menu 3.2.1 <Maintenance>/<Service>/<Verification> and follow the dialog on the screen.

Note: *Start any time, an ongoing measurement will be interrupted.*

1. Stop sample flow by closing the flow regulating valve. Wait for next prompt: Constant head will be drained and an automatic zero will be defined.
2. Unscrew the cover from the photometer.
3. Insert the verification filter.
4. Press [Enter] to continue.
5. Align the triangle shape either to the front– or backside and adjust it so, that the display of the AMI transmitter shows minimal absorbance.
6. Press [Enter] to save the verification measurement. The verification is successful if the difference is within the limits. [Enter] to continue.
7. Remove filter, close the photometer and open regulating valve. [Enter] to finish and [Exit] to the main display.

Verification history

The history of the verification can be viewed in menu 2.2.1.5 <Diagnostics>/<Sensors>/<FOME Sensor>/<Ver. History>

6.5. Calibration

Prepare the standard solution

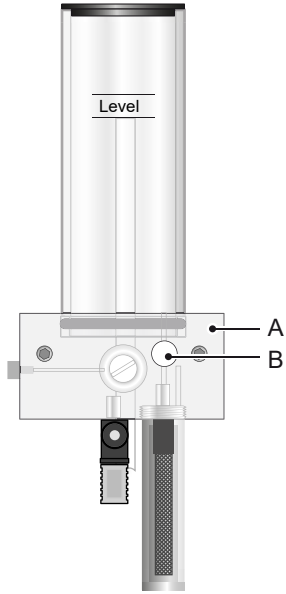
To prepare the standard solution proceed as follows:

1. Fill a pipette with 1 ml of standard solution 1000 ppm.
2. Put the pipette into a volumetric flask and empty it.
3. Fill the volumetric flask with one liter demineralized water.

Calibration

1. Navigate to <Maintenance>/<Calibration>.
2. Follow the instructions on the screen.

Note: *If the second sample stream option or an AMI Sample Sequencer is installed, the flow regulating valve [B] on the flow cell block of the constant head must be closed during the calibration. Otherwise, the standard solution may flow back into the sample feed line.*

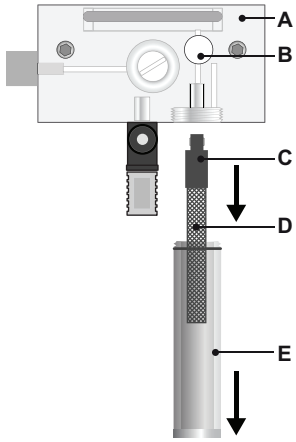


A *Flow cell block of the constant head*
B *Flow regulating valve*

6.6. Cleaning the Instrument

6.6.1 Cleaning the Protective Filter

Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 48



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:

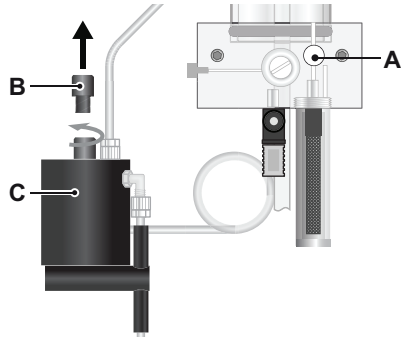
1. Close the main tap of the sample inlet.
2. Close flow regulating valve [B].
3. Unscrew and remove the filter vessel [E] from the flow cell block [A].
4. Hold the filter [D] on the shaft [C] and unscrew and remove it.
5. Backwash the filter under pressure of tap water.
6. Clean the outside of the filter.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

6.6.2 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. 48.

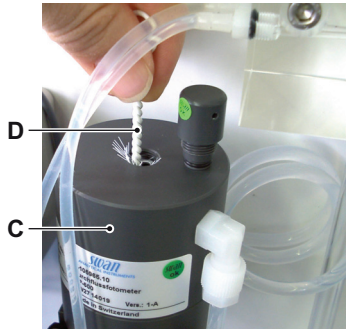
Material Small brush.

Procedure



A Flow regulating valve
B Photometer cover
C Photometer
D Brush

1 Close the flow regulating valve [A].
2 Unscrew the cover [B] from the photometer [C].



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

6.6.3 Cleaning the Flow Cell

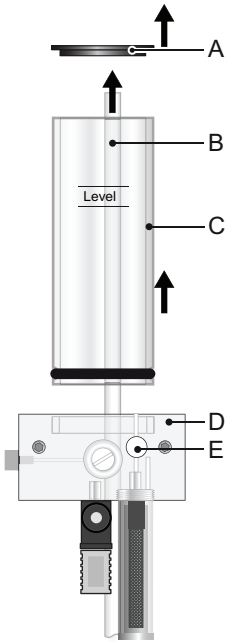
CAUTION

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.

Disassemble the flow cell

The flow cell can be disassembled easily. Before disassemble the flow cell, switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 48



A *Constant head cover*
B *Overflow tube*
C *Outer 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. 48
2. Remove the constant head cover [A].

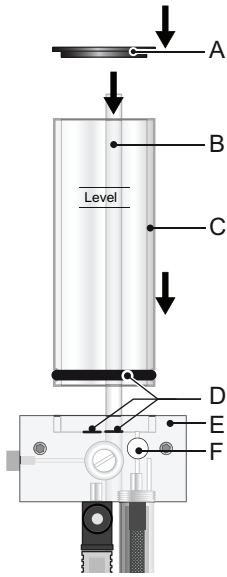
3 Pull the overflow tube [B] out of the flow cell block [D]

4 Remove the outer tube [C] from the flow cell block.

5 Clean all acrylic parts with a soft brush (bottle cleaner) and soapy water.

6 Remove lime deposits with a common household deliming agent with standard concentrations.

Assemble the flow cell



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

1 Replace all gaskets [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 outer tube [C] onto the flow cell block.

4 Put the cover onto the constant head.

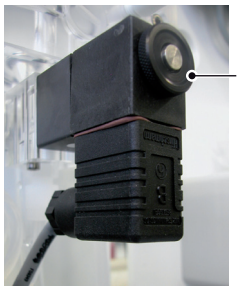
5 Align the overflow tube with the upper level mark

6.6.4 Cleaning the Solenoid Valve

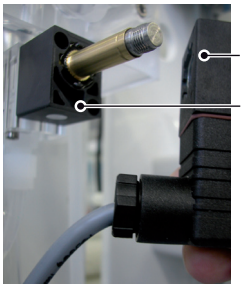
Disassemble the solenoid valve

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

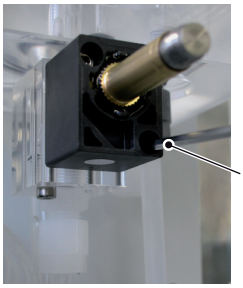
1 Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 48



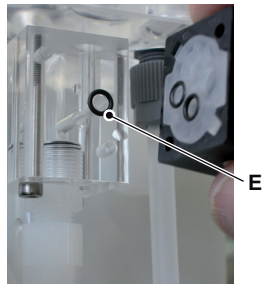
2 Loosen the nut (A).



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

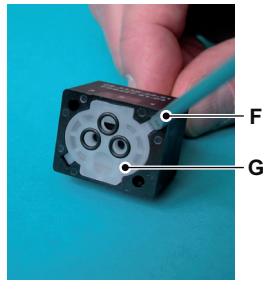


4 Loosen the fixing screws of the valve body with a 2.5 mm Allen key (D).

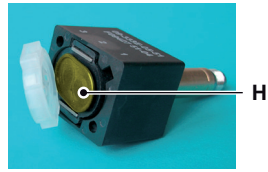


Note: *The O-rings inside the valve body may stick on the flow cell and fall down if the valve body is removed.*

5 Remove the valve body from the flow cell.



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



⇒The membrane (H) is now visible.

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

Assemble Assemble the solenoid valve in reverse order.

6.7. Tube Replacement

6.7.1 Replace the Pump Tube

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

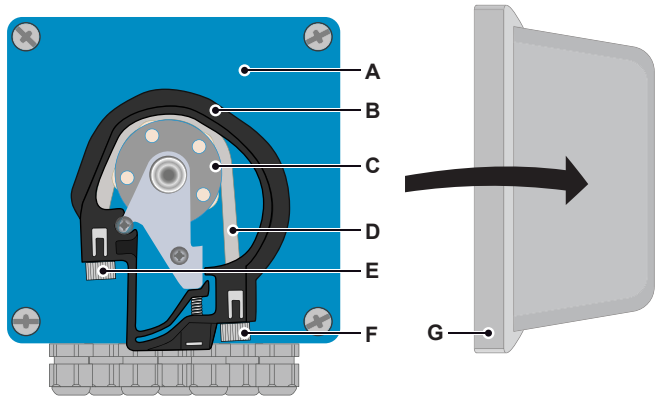
CAUTION

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. 48 before opening the occlusion frames.

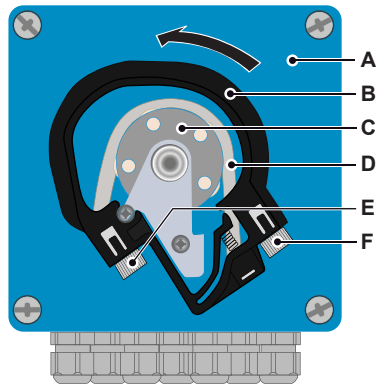
Overview



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

Dismount pump tube

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



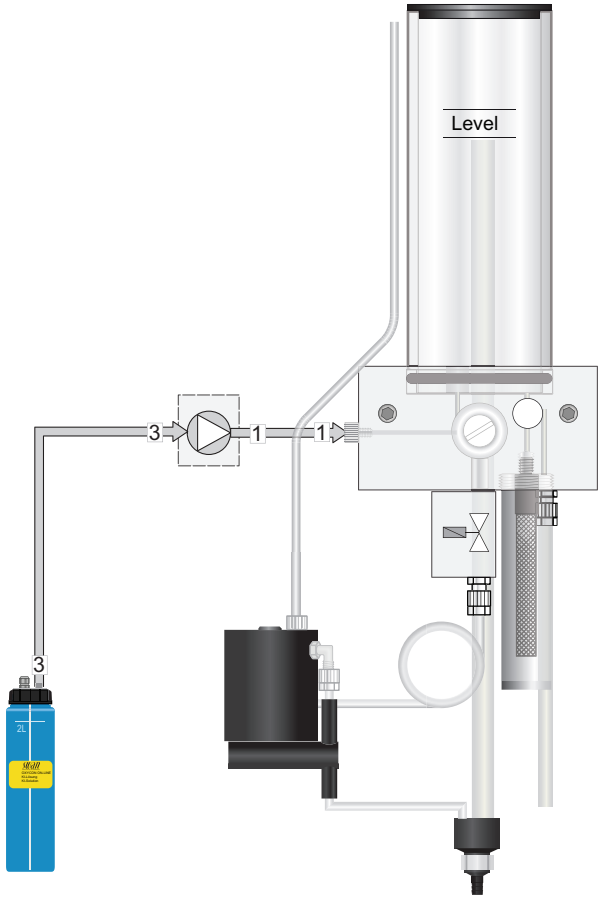
A *Pump housing*
B *Occlusion frame relaxed*
C *Rotor*
D *Pump tube*
E *Pump inlet*
F *Pump outlet*

1. Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 48.
2. Remove the protection cap.
3. Open the occlusion frame [B] by turning it counter-clockwise.
4. Remove the pump tube [D] from the rotor [C] by pulling the complete occlusion frame [B] out of the holder.

Install new pump tubes

1. Disconnect the reagent tubes from the old pump tube and connect them to the new pump tube.
2. Install the new pump tube by pushing the occlusion frame onto the holder.
3. Lock the occlusion frame. Check that the occlusion frame and the tube are aligned perpendicular to the axis of the rotor.
4. Insert the suction lance into the container.
5. Start the <Fill system> function.

6.7.2 Tube Numbering



Tube No.	from	to
3	Reagent canister	Pump inlet
1	Pump outlet	Flow cell block

6.8. Longer Stop of Operation

1 Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 48

2 Open pump tube assembly of peristaltic pump. See Replace the Pump Tube, p. 60

3 Empty the filter vessel.

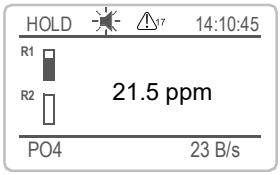
7. Troubleshooting

7.1. Error List

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

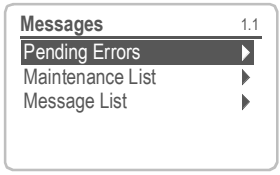
Fatal Error (blinking symbol)
Control of dosing devices is interrupted.
The indicated measured values are possibly incorrect.
Fatal Errors are divided in the following two categories:

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

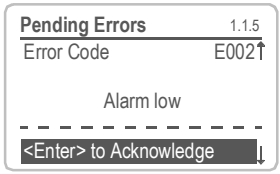


Error or fatal error
Error not yet acknowledged.
Check **Pending Errors 1.1.5** and take corrective action.

Reagent level low
Indicates the remaining reagent in percent.



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



Press [ENTER] to acknowledge the pending errors.
⇒ *The error is reset and saved in the message list.*

Error	Description	Corrective action
E001	Phos. 1 Alarm high	– check process – check programmed value 5.3.1.1.1, p. 87
E002	Phos. 1 Alarm low	– check process – check programmed value 5.3.1.1.25, p. 87
E003	Phos. 2 Alarm high	– check process – check programmed value 5.3.1.1.1, p. 87
E004	Phos. 2 Alarm low	– check process – check programmed value 5.3.1.1.25, p. 87
E005	Absorbance too high	– check process
E009	Sample Flow high	– check Inlet pressure – readjust sample flow – check programmed value 5.3.1.3.2, p. 88
E010	Sample Flow low	– check Inlet pressure – readjust sample flow – clean instrument, see Cleaning the Protective Filter, p. 54 – check programmed value 5.3.1.3.35, p. 88
E013	Case Temp. high	– check environment temperature – check programmed value 5.3.1.4, p. 88
E014	Case Temp. low	– check environment temperature – check programmed value 5.3.1.4, p. 88
E015	Valve defective	– check valve, see Cleaning the Solenoid Valve, p. 58
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 5.3.2 and 5.3.3, p. 88
E018	Reagent Pump	– shut off power – check wiring

Error	Description	Corrective action
E019	FOME not connected	– shut off power – check wiring
E020	FOME dirty	– clean photometer, see Cleaning the Photometer, p. 55
E021	Sequencer	– Check wiring between Sequencer and AMI Phosphate HL
E022	Reagent empty	– refill reagents, see Refill or replace Reagent, p. 49
E023	Cleaning Solution	– refill Cleaning Solution
E024	Input active	– See If Fault Yes is programmed in Menu 5.3.4, p. 92
E026	IC LM75	– Hardware failure, call service
E028	Signal output open	– Check wiring on signal outputs 1 and 2
E030	EEprom Frontend	– Hardware failure, call service
E031	Calibration Recout	– Hardware failure, call service
E032	Wrong Frontend	– Hardware failure, call service
	If the 2nd sample stream option is connected to the AMI Phosphate HL, E033 and E034 will be displayed if the sample flow is too low. If an AMI Sample Sequencer is connected to the AMI Phosphate HL, the error messages E033 to E038 will be displayed if the sample flow is too low.	
E033	Sample Flow 1 low	– Check 2nd sample stream option – Check AMI Sample Sequencer
E034	Sample Flow 2 low	– Check 2nd sample stream option – Check AMI Sample Sequencer
E035	Sample Flow 3 low	– Check AMI Sample Sequencer

Error	Description	Corrective action
E036	Sample Flow 4 low	– Check AMI Sample Sequencer
E037	Sample Flow 5 low	– Check AMI Sample Sequencer
E038	Sample Flow 6 low	– Check AMI Sample Sequencer
E049	Power-on	– none, normal status
E050	Power-down	– none, normal status
E065	Reagent low	⚠17 The decreasing number next to the triangle in the upper status line on the display, indicates the remaining reagent in percent. Refill reagent on time, see Refill or replace Reagent, p. 49
E067	Cleaning Solution	Only AMI Phosphate HL with Cleaning Module. A triangle without number ⚠ indicates that the cleaning solution containers are almost empty. – Refill cleaning solution

7.2. Replacing Fuses

WARNING

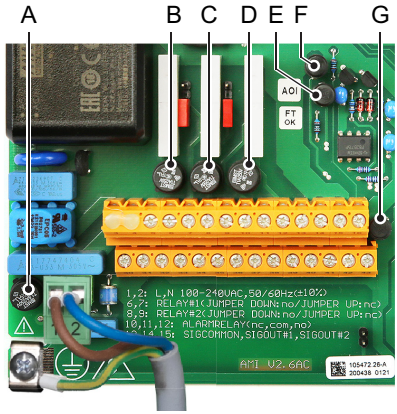
External Voltage.

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

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

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

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



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

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, p. 75

- 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	*Desig.*	AMI Phosphate HL		* Menu numbers
2.1*	*Version*	V6.20 - 10/17		
	Peripherals	*PeriClip 1 1.06*	2.1.3.1*	
	2.1.3*	*PeriClip 2 1.06*	If a cleaning module is installed	
	Factory Test	*Instrument*	2.1.4.1*	
	2.1.4*	*Motherboard*		
	Operating Time	*Years / Days / Hours / Minutes / Seconds*		2.1.5.1*
	2.1.5*			
Sensors	**FOME Sensor**	*Current Value*		
2.2*	2.2.1*	*Raw value*		
		Absorbance		
		Cal. History	*Number*	2.2.1.4.1*
		2.2.1.4*	*Date, Time*	
			Slope	
		Ver. History	*Number*	2.2.1.5.1*
		2.2.1.5*	*Date, Time*	
			Absorbance	
			Reference value	
	Miscellaneous	*Case Temp.*	2.2.2.1*	
	2.2.2*	*State Machine*		
Sample	*Sample ID*	2.3.1*		
2.3*	*Sample Flow*			
	(Raw value)			
I/O State	*Alarm Relay*	2.4.1*		
2.4*	*Relay 1/2*			
	Input			
	Signal Output 1/2/3	2.4.2*		
Interface	*Protocol*	2.5.1*		(only with RS485
2.5*	*Baud rate*			interface)

8.3. Maintenance (Main Menu 3)

Calibration 3.1*	Calibration	3.1.5*		* Menu numbers
Service 3.3*	**Verification** 3.3.1*	(Progress)	3.3.1.5*	
	Fill System 3.3.2*	(Progress)	3.3.2.5*	
Simulation 3.4*	*Alarm Relay*	3.4.1*		
	Relay 1	3.4.2*		
	Relay 2	3.4.3*		
	Signal Output 1	3.4.4*		
	Signal Output 2	3.4.5*		
	Magnetic valve 1	3.4.6*		
	Magnetic valve 2	3.4.7*	(only with 2nd sample stream option)	
Set Time 3.5*	*(Date), (Time)*			
Cleaning 3.6*	**Parameter** 3.6.1*	**Mode** 3.6.1.1*		
		Interval 3.6.1.1*	*Interval*	3.6.1.20*
			Delay	3.6.1.3*
			Signal Outputs	3.6.1.4*
			Output/Control	3.6.1.5*
		Daily 3.6.1.1*	*Start time*	3.6.1.21*
			Delay	3.6.1.3*
			Signal Outputs	3.6.1.4*
			Output/Control	3.6.1.5*
		Weekly 3.6.1.1*	**Calender** 3.6.1.22*	*Start time* *Mo. to Su*
			Delay	3.6.1.3*
			Signal outputs	3.6.1.4*
			Output/Control	3.6.1.5*
		Off	3.6.1.1*	
	Fill Channel 11 3.6.2*	*(Progress)*	3.6.2.5*	
	Fill Channel 12 3.6.3*	*(Progress)*	3.6.3.5*	

8.4. Operation (Main Menu 4)

Grab Sample	*Grab Sample*	4.1.5		* Menu numbers
4.1*				
Sensors	*Filter Time Const.*	4.2.1*		
4.2*	*Hold after Cal.*	4.2.2*		
Relay Contacts	**Alarm Relay**	**Alarm Phosphate 1**	*Alarm High*	4.3.1.1.1*
4.3*	4.3.1*	4.3.1.1*	*Alarm Low*	4.3.1.1.25*
			Hysteresis	4.3.1.1.35*
			Delay	4.3.1.1.45*
	Relay 1 and 2	*Parameter*	4.3.x.100*	
	4.3.2* and 4.3.3*	*Setpoint*	4.3.x.200*	
		Hysteresis	4.3.x.300*	
		Delay	4.3.x.40*	
	Input	*Active*	4.3.4.1*	
	4.3.4*	*Signal Outputs*	4.3.4.2*	
		Output / Control	4.3.4.3*	
		Fault	4.3.4.4*	
		Delay	4.3.4.5*	
Logger	*Log Interval*	4.4.1*		
4.4*	*Clear Logger*	4.4.2*		

8.5. Installation (Main Menu 5)

Sensors	*Ref. Verification*	5.1.1*		* Menu numbers
5.1*	*Phosphate as*	5.1.2*		
	Standard PO4	5.1.3*		
	Meas. Interval	5.1.4*		
	Channels	5.1.5*		
	Channel Selection	5.1.6*		
	Cleaning	5.1.7*		
Signal Outputs	**Signal Output 1 and 2**	*Parameter*	5.2.1.1/5.2.2.1*	
5.2*	5.2.1* and 5.2.2*	*Current Loop*	5.2.1.2/5.2.2.2*	
		Function	5.2.1.3/5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.10/12*
		5.2.x.40	*Range High*	5.2.x.40.20/22*
Relay Contacts	**Alarm Relay**	**Alarm Phosphate 1**	*Alarm High*	5.3.1.1.1*
5.3*	5.3.1*	5.3.1.1*	*Alarm Low*	5.3.1.1.25*
			Hysteresis	5.3.1.1.35*
			Delay	5.3.1.1.45*
Only with 2nd sample stream option		**Alarm Phosphate 2**	*Alarm High*	5.3.1.2.1*
		5.3.1.2*	*Alarm Low*	5.3.1.2.25*
			Hysteresis	5.3.1.2.35*
			Delay	5.3.1.2.45*
		Sample Flow	*Flow Alarm*	5.3.1.3.1*
		5.3.1.3*	*Alarm High*	5.3.1.3.2*
			Alarm Low	5.3.1.3.35*
		Case Temp. high	5.3.1.4*	
		Case Temp. low	5.3.1.5*	
	Relay 1 and 2	*Function*	5.3.2.1/5.3.3.1*	
	5.3.2* and 5.3.3*	*Parameter*	5.3.2.20/5.3.3.20*	
		Setpoint	5.3.2.300/5.3.3.300*	
		Hysteresis	5.3.2.400/5.3.3.400*	
		Delay	5.3.2.50/5.3.3.50*	
	Input	*Active*	5.3.4.1*	
	5.3.4*	*Signal Outputs*	5.3.4.2*	
		Output/Control	5.3.4.3*	
		Fault	5.3.4.4*	
		Delay	5.3.4.5*	

Miscellaneous	*Language*	5.4.1*		* 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 / 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 – 10/17)

2.1.3 **Peripherals**: PeriClip: Firmware of peristaltic pump (e.g. 1.06)

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 **FOME Sensor**:

- *Current value*: Shows the actual photometer signal in ppm.
  (Raw value): Shows the actual photometer signal in Hz.
- *Absorbance*: Shows the actual absorbance of the sample with respect to the last stored zero-point measurement.

2.2.1.4 **Cal. History:** Shows the diagnostic values of the last calibrations.

2.2.1.4.1
- *Number*: Calibration counter
- *Date, Time*: Date and time of calibration
- *Slope*: Slope photometer: 0.8–1.2

2.2.1.5 **Ver. History:** Review verifications values of the last verifications:

2.2.1.5.1
- o *Number*: Verification counter
- o *Date, Time*: Date and time of verification
- o *Absorbance*: Measured absorbance of the reference kit.
- o *Reference value*: True value of the reference kit according to label.

2.2.2 **Miscellaneous**:

2.2.2.1 *Case Temp:* Shows actual temperature in °C inside the transmitter.
State Machine: Each number is assigned to a step of the measuring cycle.

2.3 Sample

2.3.1
- o *Sample ID*: Shows the assigned sample identification. The identification is defined by the user to identify the sample point in the plant.
- o *Sample Flow*: Shows the actual sample flow in bubbles per second (B/s). Sample flow must be above 5 B/s.
  (Raw value): Shows the raw value of the sample flow in Hz.

2.4 I/O State

Shows actual status of all in- and outputs.

2.4.1

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

2.5 Interface

2.5.1 *Interface:*

Only available if optional interface is installed. Shows the programmed communication settings.

3 Maintenance

3.1 Calibration

3.1.5 **Calibration:** Performs a calibration using the standard solution. Follow dialog on the screen. See Calibration, p. 53.

3.2 Service

3.2.1 **Verification:** Performs a verification using the reference kit. Follow dialog. See Verification, p. 52.

3.2.2 **Fill System:** Activates the reagent pump. Can be used to fill, flush or empty the system.

3.3 Simulation

To simulate a value or a relay state, select the

- alarm relay
- relay 1 or 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.*

3.4.1	*Alarm Relay:*	Active or inactive
3.4.2	*Relay 1:*	Active or inactive
3.4.3	*Relay 2*	Active or inactive
3.4.4	*Signal Output 1:*	Actual current in mA
3.4.5	*Signal Output 2*	Actual current in mA
3.4.6	*Magnetic valve 1*	Off or On

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 and the transmitter reboots.

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

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

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

4 Operation

4.1 Grab Sample

Starts a grab sample measurement. Follow the dialog on the display, see Grab Sample, p. 47.

4.2 Sensors

4.2.1 *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

4.2.2 *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

4.3 Relay Contacts

See 5.3 Relay Contacts, p. 87.

4.4 Logger

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

The logger can save approx. 1500 data records. Records consists of: Date, time, alarms, measured value, measured value uncompensated, temperature, flow.
Range: 1 second to 1 hour

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

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

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

5 Installation

5.1 Sensors

5.1.1 *Ref. Verification:* Set the absorbance value of the verification kit according to the label.
Range: 0.150–0.600

5.1.2 *Phosphate as*: Default setting is PO4. If the setting is changed from PO4 to P (phosphor), the measured value is expressed in P.

In this case 1 mg PO4 corresponds to 0.33 mg P.
Available values: P, PO4

5.1.3 *Standard PO4:* Usual concentration range:
Range: 1.0 ppm to 30.0 ppm

5.1.4 *Meas. Interval:* Set the measuring interval:

- 5, 6, 7, 8 or 9 min (available if “1 Channel” is selected)
- 10 min (smallest interval if “2 Channels” is selected or if an
- 15 min AMI Sample Sequencer is connected)
- 20 min
- 25 min
- 30 min

5.1.5 *Channels:*
If the 2nd sample stream option is installed, you can choose 1 or 2 channels.

If an AMI Sample Sequencer is connected to the AMI Phosphate HL, you can choose 1 to 6 channels.

5.1.6 *Channel Selection:*
The following 3 operating modes can be set:

Mode
Internal
Fieldbus
External

Mode Internal

The AMI Phosphate HL works as a master.

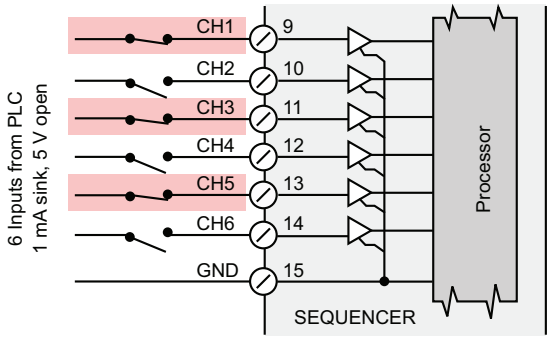
2nd sample stream option

The AMI Phosphate HL switches automatically between channel 1 and 2.

Sample Sequencer

The AMI Phosphate HL sequentially measures each single sample stream of the Sample Sequencer.
Via an external PLC it can be defined which sample streams should be measured. In the example below, only sample streams 2, 4 and 6 are measured, whereas sample streams 1, 3 and 5 are switched off. The programmed sample streams are sequentially measured. Sample streams which are switched off are marked with an “x” behind the measuring value on the AMI Phosphate HL display.

***Note:** If all contacts are closed, the AMI Phosphate HL switches to standby mode.*



Mode Fieldbus The AMI Phosphate HL is controlled via fieldbus.

Mode External The AMI Phosphate HL works as a slave.

2nd sample stream option

The 2nd Sample Stream Option is switched between sample stream 1 and 2 via input, see Input 5.3.4, p. 92.

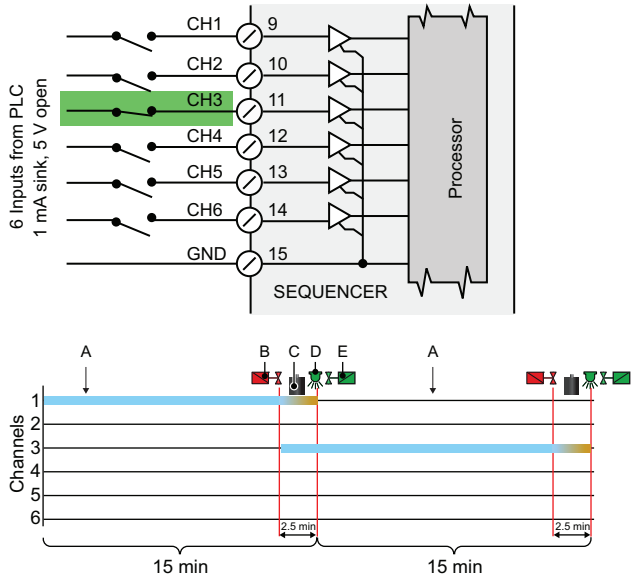
Sample Sequencer

The AMI Phosphate HL is controlled by the Sample Sequencer. The Sample Sequencer in turn is controlled via an external PLC. Each sample stream to be measured has to be activated by closing the respective contact.

Example: If sample stream x of the Sample Sequencer is active, the AMI Phosphate HL measures this sample stream until the Sample Sequencer changes to the next programmed channel. In the example below, the sample stream 3 (CH3) highlighted in green was activated at the point [A]. At the point [B] the solenoid valve closes and the channel is switched to sample stream 3.

Note:

- *Closing more than one of the inputs will cause an undefined state.*
- *If all inputs are open the AMI Phosphate HL switches to standby mode.*



A *Remote switching command at time x*
B *Solenoid valve closes the photometer inlet*
C *Reaction time in the photometer*
D *Measurement of sample*
E *Solenoid valve opens the photometer inlet*

5.1.7 **Cleaning***:* Only visible if a cleaning module is connected.
Program whether the cleaning module uses one or two solutions.
Range: 1 solution or 2 solutions

5.2 Signal Outputs

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

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.

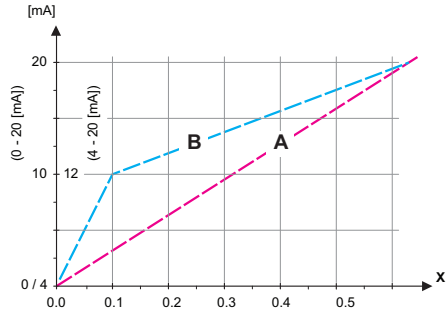
5.2.1.1 *Parameter:* Assign one of the process values to the signal output. Available values: Phosphate

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

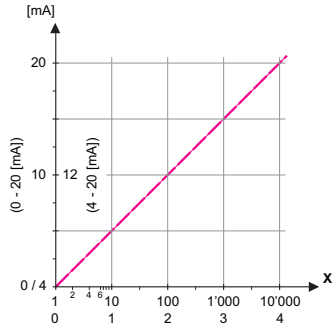
5.2.1.3 *Function:* Define if the signal output is used to transmit a process value or to drive a control unit. Available functions are:

- 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 phosphate

5.2.1.40.10 Range low: 0.0 – 50 ppm

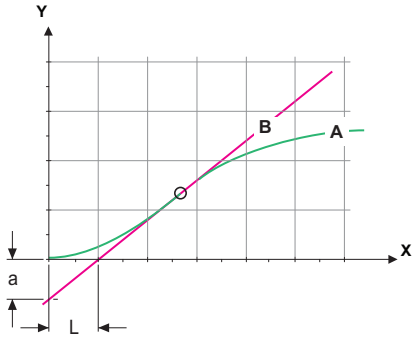
5.2.1.40.20 Range high: 0.0 – 50 ppm

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 intersection point of the tangent with the respective axis will result in the parameters a and L.

Consult the manual of the control unit for connecting and programming details. Choose control upwards or downwards.

Control upwards or downwards

Setpoint: User defined precess value for the selected parameter.

P-Band*:* Range below (upwards control) or above (downwards control) the set-point, within which the dosing intensity is reduced from 100% to 0% to reach the set-point without overshooting.

5.2.1.43 **Control Parameters:** Process value Phosphate 1

5.2.1.43.10 Setpoint:
Range: 0.0 – 50 ppm

5.2.1.43.20 P-Band:
Range: 0.0 – 50 ppm

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

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

5.2.1.43.5 *Control time out:* 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 if:

- 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:

Phosphate, Sample Flow or Case Temperature

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

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: 0.0–50 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: 0.0–50 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: 0.0–50 ppm

5.3.1.1.45 *Delay:* Duration, the activation of the alarm relay is retarded after the messuring 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.*

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

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

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

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

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

> ***Note:*** *The navigation in the menu <Relay 1> and <Relay 2> is identical. 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)
- Channel Selection (relay 2 only)

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

5.3.2.1 Function = Limit upper/lower:

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

5.3.2.20 *Parameter*: select a process value (Phosphate 1)

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

Parameter	Range
Phosphate 1	0.00–50 ppm

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
Phosphate 1	0.00–50 ppm

5.3.2.50 Delay: Duration, the activation of the alarm relay is retarded after the messuring 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*: select a process value (Phosphate 1)

Choose the respective actuator:

- Time proportional
- Frequency
- Motor valve

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

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

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

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. 91.
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

5.3.3.1 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 channel 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.

5.3.3.1 Function = Channel Selection

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

Relay 2 inactive: Channel 1 is selected

Relay 2 active: Channel 2 is selected

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

Note: *If the 2nd sample stream option is connected to the AMI Phosphate HL and <Channel Selection> is set to <External>, the Input will be set to "Active = no" and no further settings are possible.*

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:

Continuous:	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):

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

5.3.4.4 *Fault:*

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

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

5.4 Miscellaneous

5.4.1 *Language:* Set the desired language.

Language
German
English
French
Spanish

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

Set defaults
no
Calibration
In parts
Completely

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

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

Load Firmware
no
yes

5.4.4 Password: Select a password different from 0000 to prevent unauthorized access to the following menus:

5.4.4.1 Messages
5.4.4.2 Maintenance
5.4.4.3 Operation
5.4.4.4 Installation

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

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

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

5.4.6 *Line Break Detection:* Define if message E028 should be issued in case of a line break on signal output 1 or 2.

Choose between <Yes> or <No>.

5.5 Interface

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

5.5.1 *Protocol:* **Profibus**

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

5.5.1 *Protocol:* **Modbus RTU**

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

5.5.1 *Protocol:* **USB stick**

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

5.5.1 *Protocol:* **HART**

Device address: Range: 0–63

10. Material Safety Data Sheets

10.1. Reagents

Catalogue no.:	Included in A-85.420.760
Product name:	AMI Phosphate HL reagent 1a
Catalogue no.:	Included in A-85.420.760
Product name:	AMI Phosphate HL reagent 1b
Catalogue no.:	A-85.143.400
Product name:	Phosphate standard solution 1000 ppm

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

11. Default Values

Operation

Sensors	Filter Time Const.:	30 s
	Hold after Cal.:	300 s
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

Sensors	Ref. Verification:	0.242
	Phosphate as:	PO4
	Standard PO4:	10 ppm
	Meas. Interval:	15 min
	Channels:	1
	Channel selection:	internal
	Cleaning:	2 Solutions
Signal Output 1 and 2	Parameter:	Phosphate 1
	Current loop:	4–20 mA
	Function:	linear
	Scaling: Range low:	0.0 ppm
	Scaling: Range high:	50 ppm
Alarm Relay	Alarm Phosphate1:	
	Alarm high:	50 ppm
	Alarm low:	0.0 ppm
	Hysteresis:	0.1 ppm
	Delay:	5 s
	Sample Flow: Flow Alarm:	yes
	Sample Flow: Alarm High:	500 B/s
	Sample Flow: Alarm Low:	10 B/s
	Case temp. high:	65 °C
	Case temp. low:	0 °C
Relay1 and 2	Function:	limit upper
	Parameter:	Phosphate 1
	Setpoint:	50 ppm
	Hysteresis:	0.1 ppm
	Delay:	30 s

If Function = Control upw. or dnw:

Parameter: ..... Phosphate 1
Settings: Actuator: ..... Frequency
Settings: Pulse Frequency: 120/min
Settings: Control Parameters: Setpoint: ..... 50 ppm
Settings: Control Parameters: P-band: ..... 0.1 ppm
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

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ANALYTICAL INSTRUMENTS

A-96.250.821 / 070222

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SWISS MADE

AMI Phosphate HL