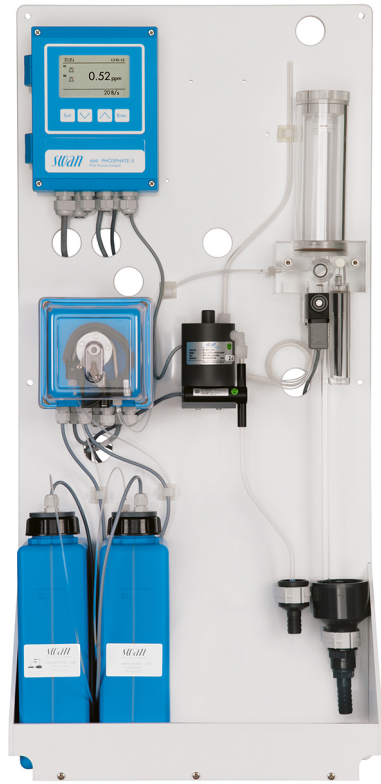
ANALYTICAL INSTRUMENTS

A-96.250.641 / 070622

Operator’s Manual

Firmware V6.20 and higher



SWISS MADE

AMI Phosphate-II

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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-II is a complete monitoring system for the automatic continuous measurement of ortho-Phosphate. ortho-Phosphate can be found in many applications like corrosion protection in sanitary systems and boilers or as additive to detergents.

The AMI Phosphate-II is used in quality control of drinking water and waste water plants.

Measuring principle

The measurement is based on the molybdenum blue colorimetric method according to APHA 4500-P E. and on EN ISO 6878. When the reaction product of o-phosphate with ammonium-molybdate is reduced with ascorbic acid, the intensely colored molybdenum blue is formed. The color intensity is proportional to the o-phosphate concentration of the sample and is measured photometrically at 815 nm.

Programmable Measuring Intervals

The duration of a measuring interval can be set to:

- 10 min
- 15 min
- 20 min
- 30 min

Independent of the programmed measuring interval, the measurement time of a sample takes 7 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

Cleaning Module

An optional cleaning module is available that can be connected to the AMI Phosphate-II.

On-line operation

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

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

If a measuring cycle starts:

1. A zero measurement with the sample is performed before the reagents are added.
2. The peristaltic pump [O] pumps the reagents [J] and [K] into the mixing chamber [E] where they are mixed together with the sample and then flowing through the photometer [M].
3. The solenoid valve [N] will be activated to close the inlet of the photometer.
4. The sample remains in the photometer for 7 minutes. During this time a reaction with the reagents takes place.

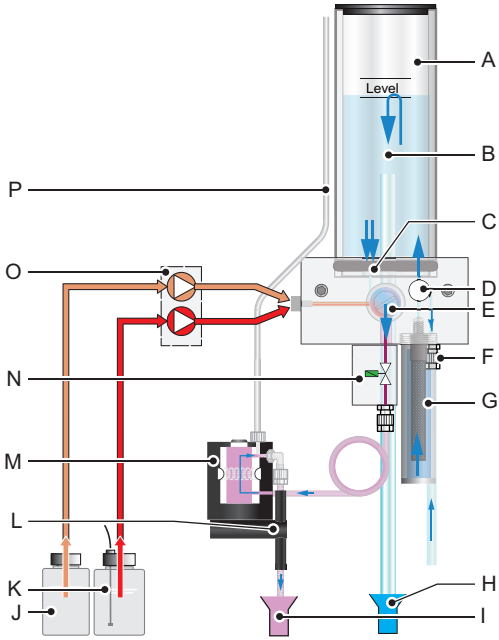
5 After the 7 min have elapsed a second measurement is carried out and the o-phosphate concentration is calculated.

6 If the measurement has been finished, the solenoid valve will be deactivated to open the inlet of the photometer.

7 The sample flows through the outlet of the photometer where it will be aerated to generate bubbles.

8 The sample flows through the bubble detector [L] and into the photometer drain [I].

Fluidics



A *Constant head*
B *Overflow tube*
C *Sample flow to mixing chamber*
D *Flow regulating valve*
E *Mixing chamber*
F *Sample inlet*
G *Filter vessel*
H *Constant head drain*
I *Photometer drain*
J *Oxycon on-line Phosphate 1*
K *Oxycon on-line Phosphate 2*
L *Bubble detector*
M *Photometer*
N *Solenoid valve*
O *Peristaltic pump*
P *Air inlet*

2.1. Instrument Specification

Power Supply	AC variant:	100–240 VAC (± 10%) 50/60 Hz (± 5%)
	DC variant	10–36 VDC
	Power consumption:	max. 35 VA
Transmitter specifications	Housing:	aluminum, with a protection degree of IP 66 / NEMA 4X
	Ambient temperature:	−10 to +50 °C
	Storage and transport:	−30 to +85 °C
	Humidity:	10–90% rel., non condensing
	Display:	backlit LCD, 75 x 45 mm
Sample requirements	Flow rate:	min. 10 l/h
	Sample pressure inlet:	0.15–2 bar (2–28 PSI)
	Temperature:	up to 50 °C (122 °F)

CAUTION

Impairment of measurement accuracy

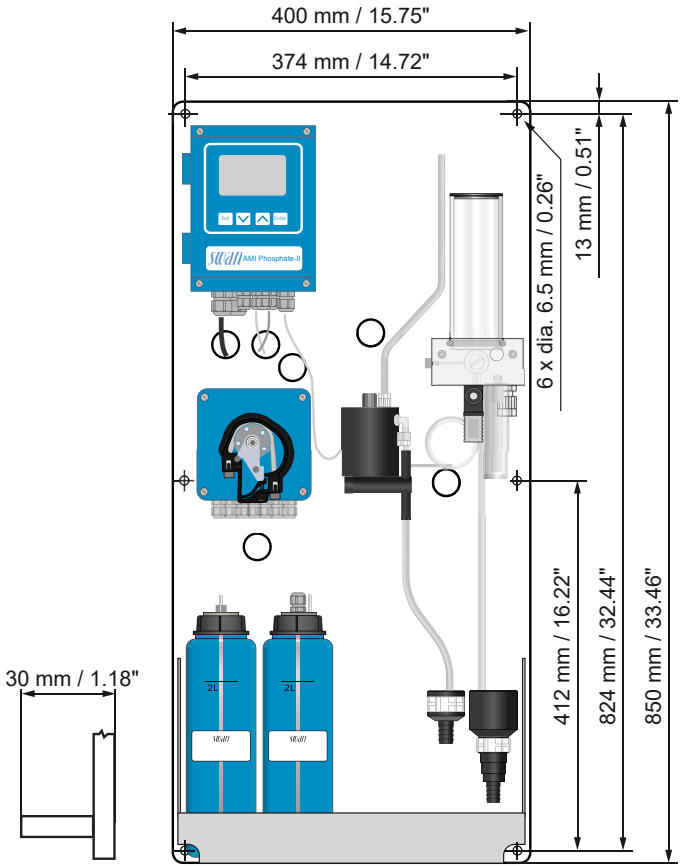
The accuracy of the instrument may be impaired by contamination of the sample.

- make sure that the sample does not contain any oil, grease or sand.

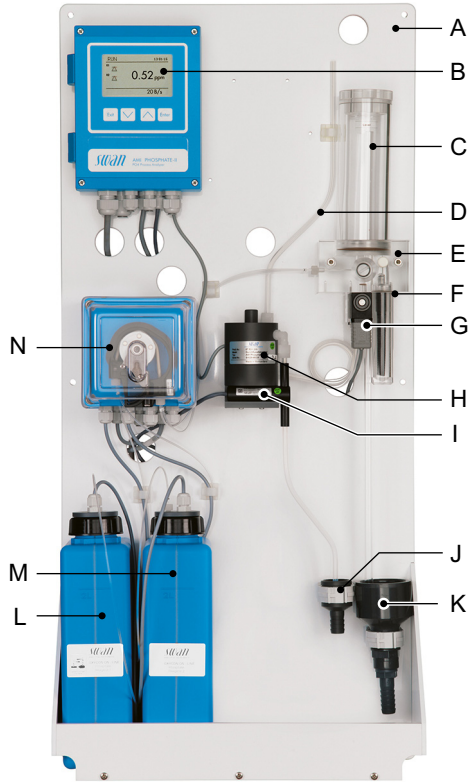
On-site requirements	The analyzer site must permit connections to:	
	Sample inlet:	Tube 6 x 8 mm
	Sample outlet:	2 Drains, 1/2” hose nozzle for flexible tube diam. 20x15 mm which must end in convenient atmospheric waste of sufficient capacity.

Dimensions

Panel:	PVC
Dimensions:	400x850x200 mm
Screws:	5 mm or 6 mm diam.
Weight:	9.5 kg /20.9 lbs



2.2. Instrument Overview



A *Panel PVC*
B *Transmitter*
C *Constant head*
D *Air inlet pipe*
E *Flow cell block*
F *Sample inlet with filter vessel*
G *Solenoid valve*
H *Photometer*
I *Bubble detector*
J *Waste funnel for sample*
K *Drain*
L *Oxycon on-line Phosphate 1*
M *Oxycon on-line Phosphate 2*
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. 13).
Installation	Mount the instrument in vertical position. Display should be at eye-level. Mount the filter, filter vessel, and constant head. Connect the sample and waste line. See Connecting Sample and Waste, p. 18
Electrical Wiring	Connect all external devices like limit switches, current loops and pumps. Connect power cord; do NOT switch on power yet! See Electrical Connections, p. 19
Reagents	Prepare reagents. See Refill or replace Reagents, p. 38
Power-up	– Lock the occlusion frames of the peristaltic pump. ⇒ *The peristaltic pump is ready* – Turn on the sample flow and wait until the flow cell is completely filled. – Switch on power. – Start “Fill System”. See Fill or Flush Reagent System, p. 31
Instrument Setup	– Program all parameters for external devices (interface, recorders, etc.). – Program all parameters for instrument operation – limits – alarms – measuring interval
Run-in period	Let the instrument run continuously for 1 h.

3.2. Mounting of Instrument Panel

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

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

For dimensions see picture 14.

Mounting requirements

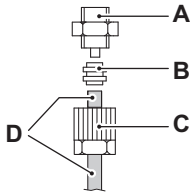
The instrument is only intended for indoor installation.

3.3. Connecting Sample and Waste

Sample inlet

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

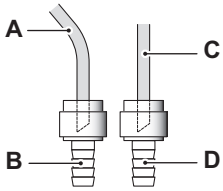
Mounting of SERTO fitting



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 an atmospheric drain of sufficient capacity.



A *Tube from photometer*
B *Waste (photometer)*
C *Tube from constant head*
D *Drain (constant head)*

WARNING

Health hazard

The sample in the photometer contains sulfuric acid.

- At no means recirculate it into the water system.

3.4. Electrical Connections

WARNING

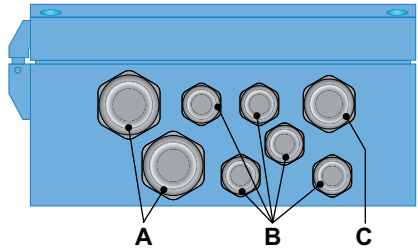
Risk of electrical shock.

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

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

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

WARNING

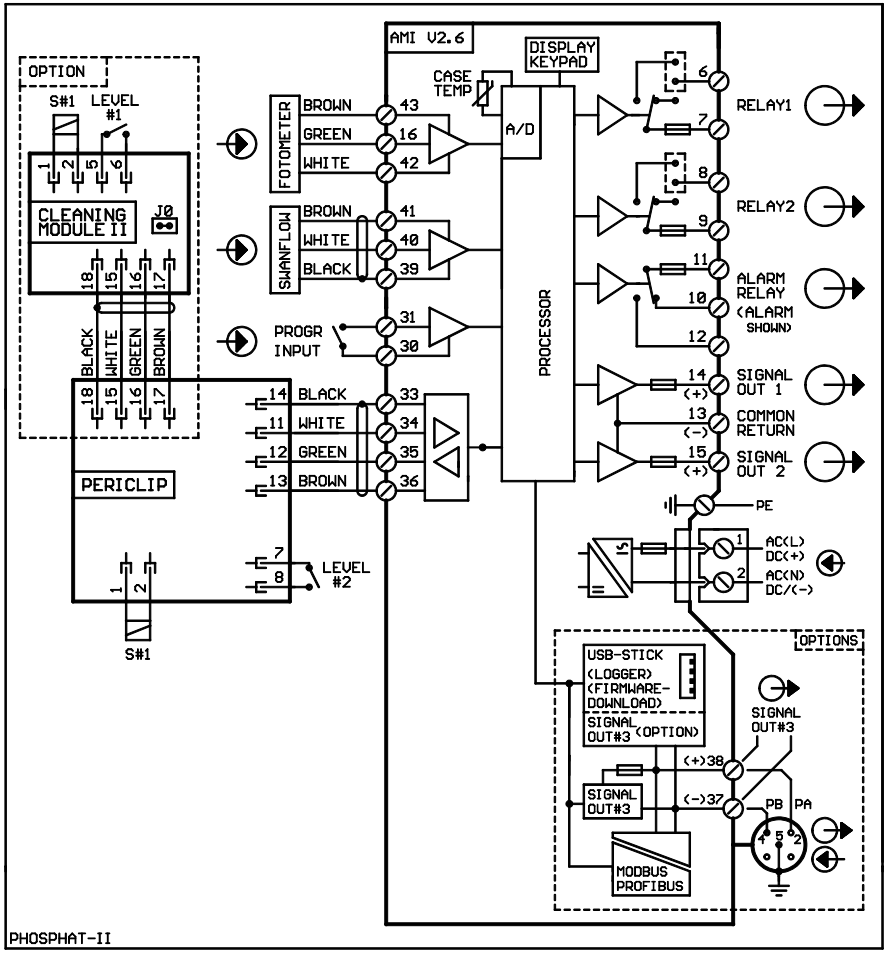
To prevent from electrical shock, do not connect the instrument to the power unless the ground wire (PE) is connected.

- Do not connect unless specifically instructed to do so.

WARNING

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

3.4.1 Connection Diagram



CAUTION

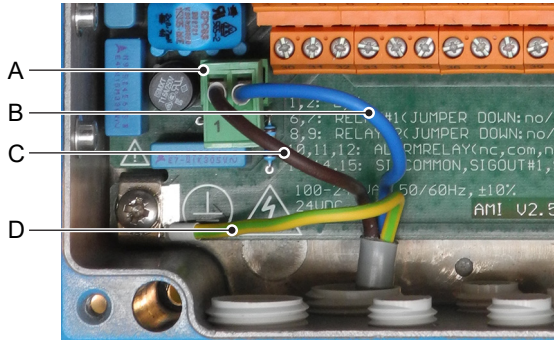
Use only the terminals shown in this diagram, and only for the mentioned purpose. Use of any other terminals will cause short circuits with possible corresponding consequences to material and personnel.

3.4.2 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-II

3.5. 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. 79

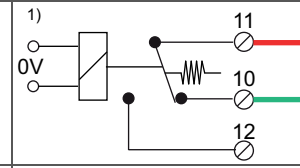
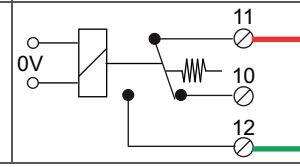
3.6. Relay Contacts

3.6.1 Alarm Relay

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

Alarm output for system errors.
Error codes see Error List, p. 55
Programming see menu 5.3.1, p. 75

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.	

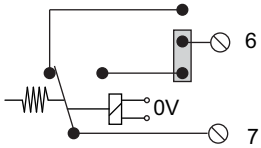
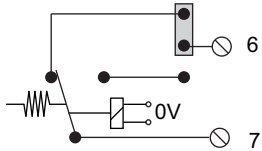
1) *usual use*

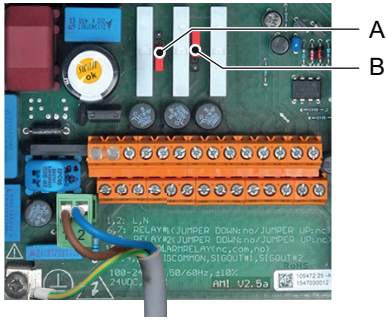
3.6.2 Relay Contacts 1 and 2

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. 77

CAUTION

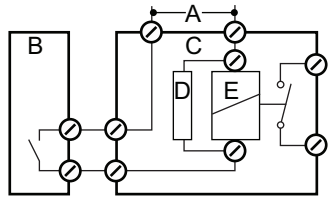
Risk of damage of the relays in the AMI Transmitter due to heavy inductive load.

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

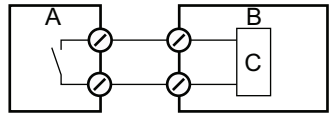
Small inductive loads (max 0.1 A) as for example the coil of a power relay can be switched directly. To avoid noise voltage in the AMI Transmitter it is mandatory to connect a snubber circuit in parallel to the load. A snubber is not necessary if an AMI relaybox is used.



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

Resistive load

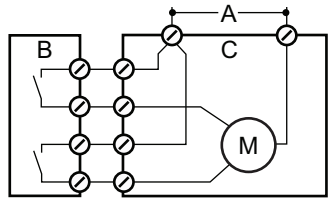
Resistive loads (max. 1 A) and control signals for PLC, impulse pumps and so on can be connected without further measures



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*

3.7. Signal Outputs

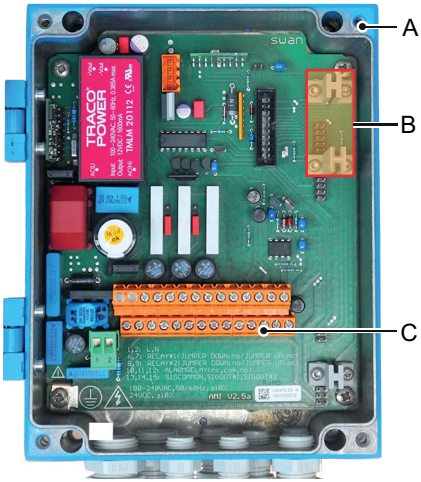
3.7.1 Signal Output 1 and 2 (current outputs)

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. 66, Menu Installation.

3.8. 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:

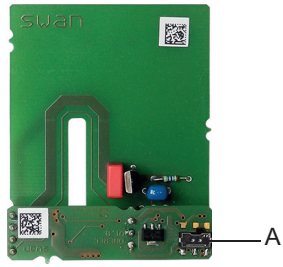
- Third signal output
- a Profibus or Modbus connection
- a HART connection
- a USB Interface

3.8.1 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

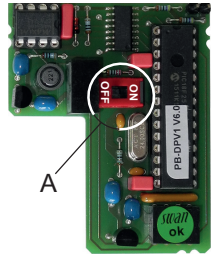
A *Operating mode selector switch*

3.8.2 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.*



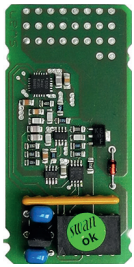
Profibus, Modbus Interface PCB (RS 485)

A *On - OFF switch*

3.8.3 HART Interface

Terminals 38 (+) and 37 (-).

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

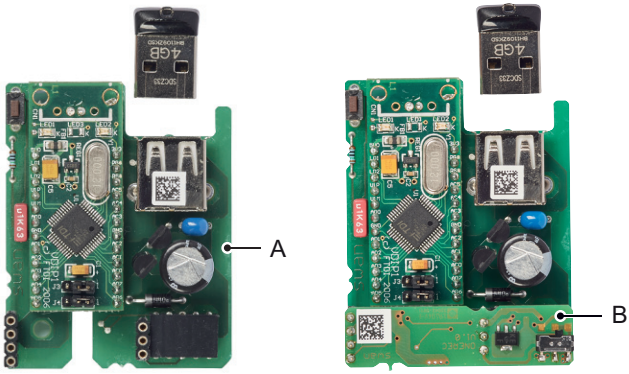


HART Interface PCB

3.8.4 USB Interface

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

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



USB Interface

A *USB interface PCB*

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

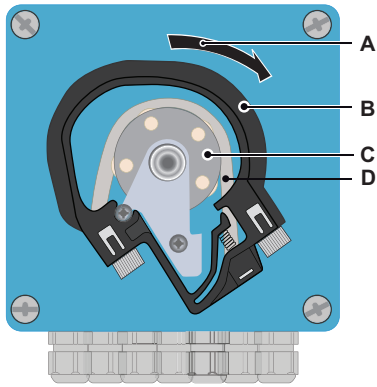
4. Instrument Setup

After installation according to the checklist proceed as following:

1 Prepare reagents. See Refill or replace Reagents, p. 38

2 Insert suction lances

3 Lock the occlusion frames of the peristaltic pump.
⇒ *The peristaltic pump is ready.*



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

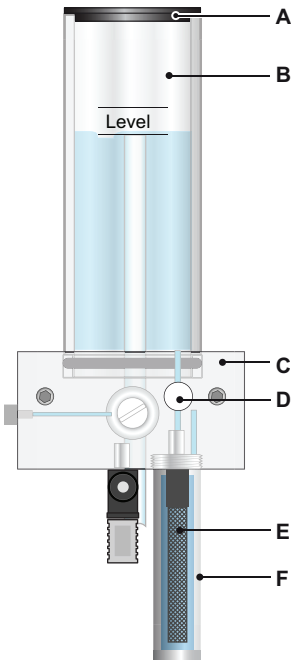
4 Turn on sample flow and wait until the flow cell is completely filled.See Establish Sample Flow, p. 30

5 Switch on power.

6 Fill system. See Fill or Flush Reagent System, p. 31

7 Let the instrument run continuously for 1 hour.

4.1. Establish Sample Flow



A *Cover*
B *Outer tube*
C *Flow cell block*
D *Flow regulating valve*
E *Filter*
F *Filter vessel*

1. Turn on the sample flow.
2. Open the flow regulating valve (D).
3. Adjust the sample flow to about 10 l/h.
4. Check tubing and flow cell for leaks and repair if necessary.

WARNING

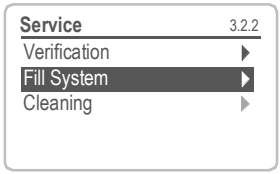
Health hazard
the sample which in the photometer contains Hexammonium heptamolybdate 4-hydrate.

- At no means recirculate it into the water system.

4.2. Fill or Flush Reagent System

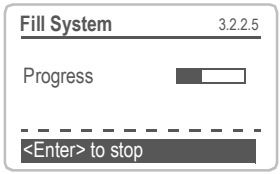
Fill or flush the reagent tubing:

- 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.

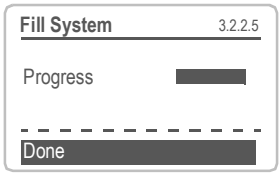


Navigate to menu <Maintenance>/<Service>/<Fill system>.

Press [Enter].



The peristaltic pump is activated for 1.5 minutes.



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

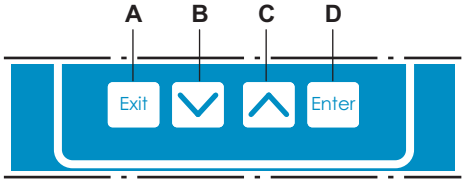
4.3. Programming

Programming

Program all parameters for external devices (interface, recorders, etc.) Program all parameters for instrument operation (Phosphate, limits, alarms). See Program List and Explanations, p. 66.

5. Operation

5.1. Function of the Keys



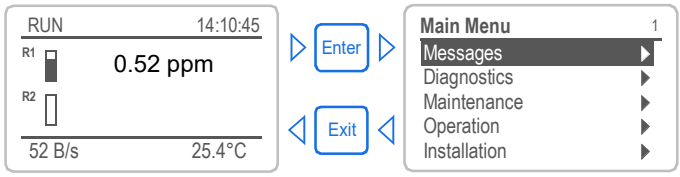
A to exit a menu or command (rejecting any changes) to move back to the previous menu level

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

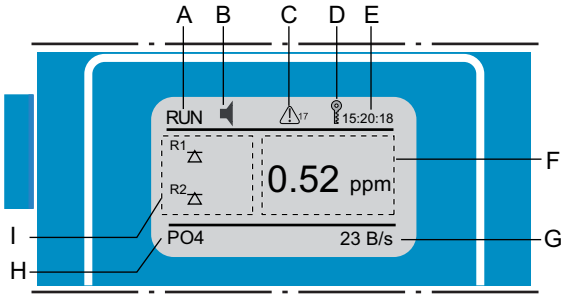
C to move UP in a menu list and to increase digits

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

Program Access, Exit



5.2. Measured Values and Symbols on the Display



A RUN — normal operation

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

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

B ERROR — Error — Fatal Error

C Reagent low. See Refill or replace Reagents, p. 38

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. 71

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

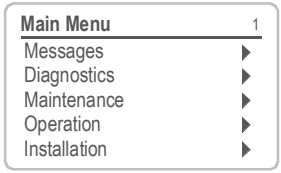
motor valve closed

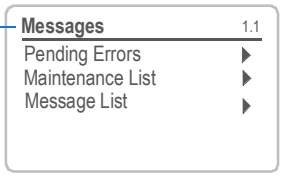
motor valve: open, dark bar indicates approx. position

timer

timer: timing active (hand rotating)

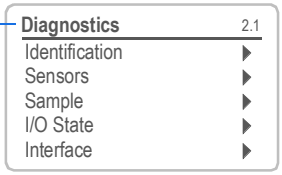
5.3. Software Structure





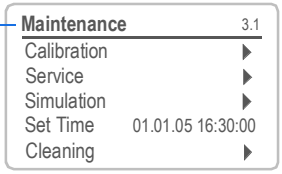
Menu 1: **Messages**

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



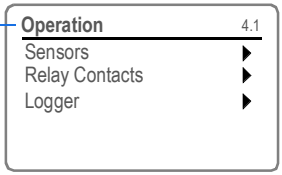
Menu 2: **Diagnostics**

Provides user relevant instrument and sample data.



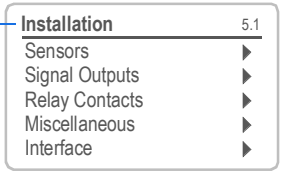
Menu 3: **Maintenance**

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



Menu 4: **Operation**

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



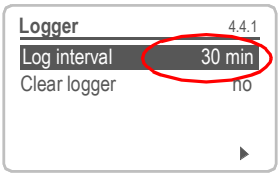
Menu 5: **Installation**

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

5.4. Changing Parameters and Values

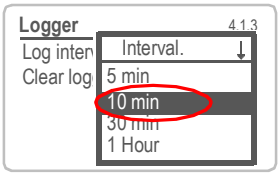
Changing parameters

The following example shows how to change the logger interval:



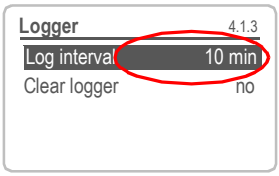
1 Select the parameter you want to change.

2 Press [Enter]



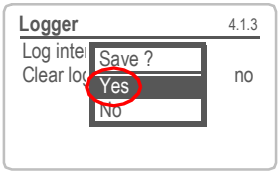
3 Press [▲] or [▼] key to highlight the required parameter.

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



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

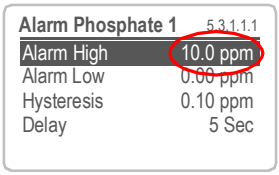
5 Press [Exit].



⇒ *Yes is highlighted.*

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

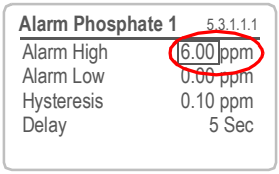
Changing values



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.*

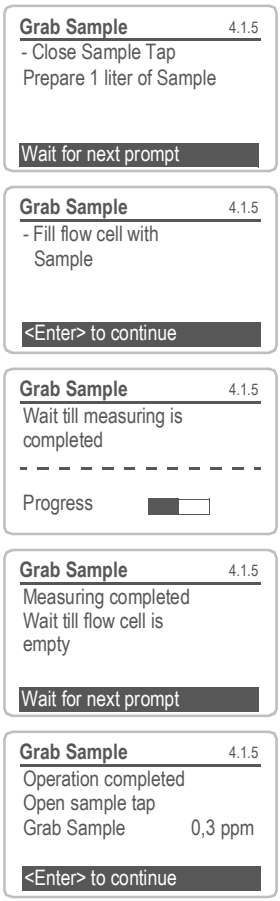
6 Press [Enter] to save the new value.

5.5 Grab Sample

Navigate to menu 4.1 <Operation/Grab Sample> and follow the dialog on the Display.

Relay status during <Grab Sample>:

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



1 Navigate to menu <Operation>.

2 Press [Enter].

3 Follow the dialog on the Display.

4 Press [Enter], to terminate the grab sample measurement.

Note: *The measuring value of the grab sample will not be stored!*

6. Maintenance

6.1. Maintenance Schedule

Daily (dirty water) up to every 2 weeks (clean water)	Check sample supply for dirt. Clean all filters and strainers, if necessary. Check sample flow
Monthly	Recommendation: Check photometer with verification kit Verification, p. 40
Yearly	Exchange reagent pump tubes.
By occurrence	E015, Valve defective, Cleaning the solenoid valve, p. 49 E020, FOME dirty: Cleaning the Photometer, p. 45 E022, Reagent empty: Refill or replace Reagents, p. 38 E065, Reagent low: Refill or replace Reagents, p. 38

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 reagents. To rinse the system proceed as follows:

1. Put suction lances into a bucket with clean water.
2. Start fill system.
3. Wait until the filling process has been finished.
4. Remove suction lances from water and leave them 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 Reagents

The liquid level in container 2 is monitored. The following message is displayed:

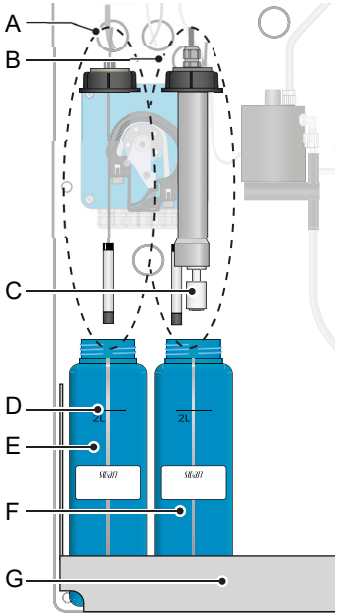
Container almost empty	Maintenance E065 - Reagents low and the remaining reagent volume in% (starting at 17% = 340ml). See Operation, p. 32
Container empty	Error E022 - Reagent empty

CAUTION

Chemical exposure hazard

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

Canister setup



A *Suction lance without level detector (container 1)*
B *Suction lance with level detector (container 2)*
C *Level detector*
D *2 L mark*
E *Reagent container 1*
F *Reagent container 2*
G *Holder*

Reagent consumption

Depending on the measuring interval, a 2-liter reagent container is sufficient for an operating period of between 1 and 3 months.

Depending on the measuring interval the content of a reagent kit lasts for 6–18 Months

Contents of the reagent kit

A-85.420.660 Reagent set for the measurement of phosphate:

- 1 graduated bucket 100 ml
- Reagent 1: 6 bottles with 20 g ammonium heptamolybdate
- Reagent 2: 6 bottles with 6 g potassium antimonyl(III) oxide tartrate and 20 g ascorbic acid

Not contained in this kit:

- Demineralized water
- Sulfuric acid 96% (e.g. Merck no. 100732)

Reagent 1:
Not classified.

Reagent 2:
H332: Harmful if inhaled.
H412: Harmful to aquatic life with long lasting effects.

Reagent 1

1. Fill the container with two liters of demineralized water.
2. Dissolve the content of one bottle of reagent 1.
3. Measure 100 ml sulfuric acid and add carefully while gently mixing.

Reagent 2

1. Fill the container with two liters of demineralized water.
2. Dissolve content of one bottle of reagent 2.
   ⇒ *Some foam forms on the surface, this is normal and does not disturb the measurement.*

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 reference value, e.g. 0.255, 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, if a measuring cycle is in progress wait for next prompt.*

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>

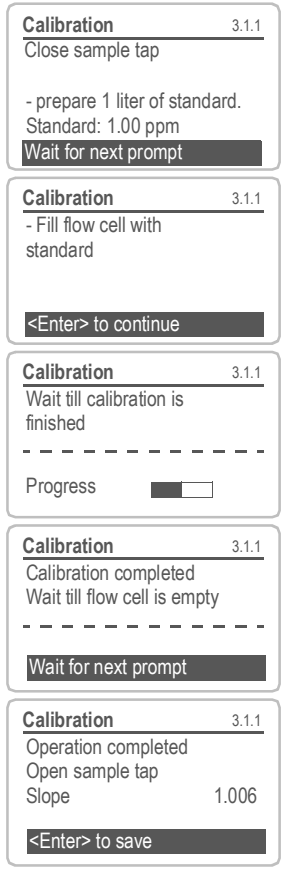
6.5. Calibration

6.5.1 Prepare the Standard Solution

To prepare the standard solution proceed as follows:

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

6.5.2 Start the calibration



1. Navigate to menu Maintenance / Calibration.
2. Press [Enter].
3. Follow the dialog on the Display.

Press [Enter], to save the calibration or [Exit] to discard.

6.6. Process Calibration

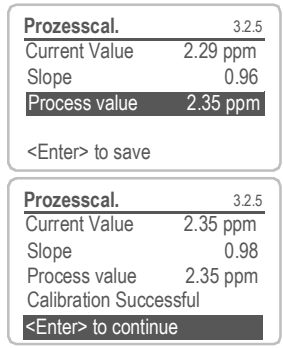
The process calibration is based on a comparison measurement of the Instrument with an external high precision instrument. A process calibration can only be performed if the instrument has finished at least one valid measurement.

Consider that the accuracy of the process calibration depends on the following factors:

- The time between taking a sample and its measurement should be as short as possible to avoid contamination of the sample with unknown substances.
- Sampling should be done as close as possible on the location of the measurement.
- The sample container must be cleaned well.
- The accuracy of the measuring instrument.

Under certain circumstances a calibration is more precise than a process calibration.

6.6.1 Start the Process Calibration



1. Navigate to menu 3.2 <Maintenance/Process cal.
2. Press [Enter]
3. Enter the measured comparison process value.
4. Press [Enter] to save the value.
   ⇒ *The slope is recalculated and displayed.*

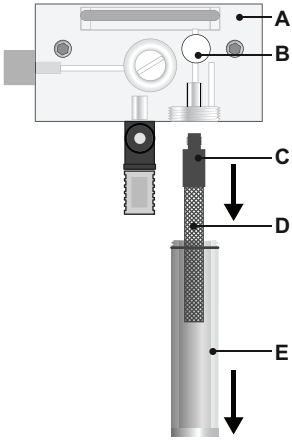
Possible error messages:

- Slope error
- Current value invalid

If a slope error occurs, the slope value is not saved. If one of these errors occurs proceed as follows: Repeat the process calibration and avoid possible sources of error.

6.7. Cleaning the protective Filter

Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 37.



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:

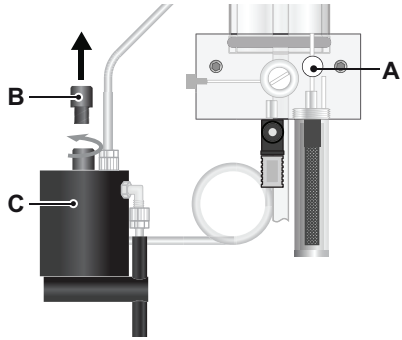
1 Close the main tap of the sample inlet.
2 Close flow regulating valve [B].
3 Unscrew and remove the filter vessel [E] from the flow cell block [A].
4 Hold the filter [D] on the shaft [C] and unscrew and remove it.
5 Backwash the filter under pressure of tap water.
6 Clean the outside of the filter.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

6.8. 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. 37.

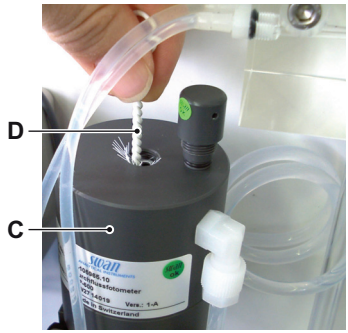
Material Small brush.

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.

6.9. Cleaning the Flow Cell

Because of using molybdenum, the flow cell block and the tubes will change color. Use 10% ammonia to remove the blue color.

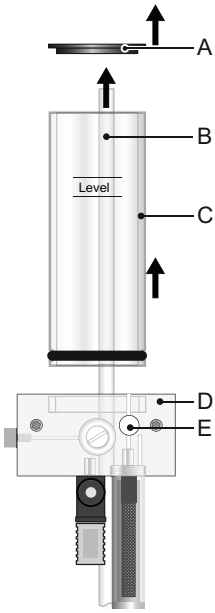
CAUTION

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.

6.9.1 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. 37



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

CAUTION

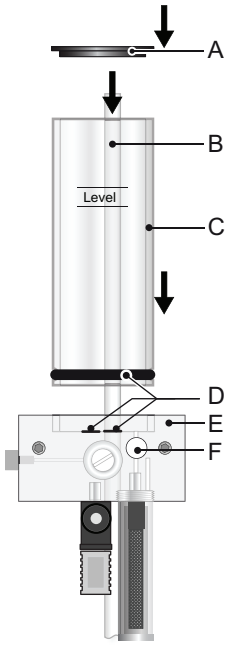
Acrylic glass parts are fragile

- Handle with care.

Cleaning

1. Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 37
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.

6.9.2 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.

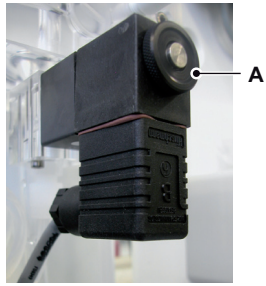
5 Align the overflow tube with the upper level mark

6.10. Cleaning the solenoid valve

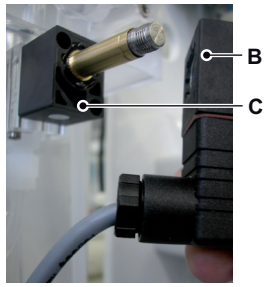
Disassemble the solenoid valve

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.

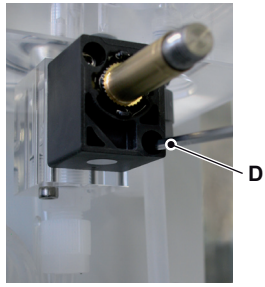
1 Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 37



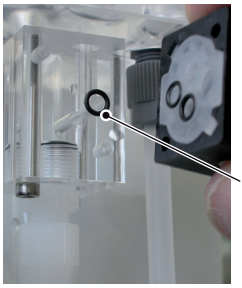
2 Loosen the nut (A).



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

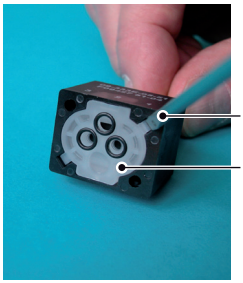


4 Loosen the fixing screws of the valve body with a 2.5 mm Allen key (D).

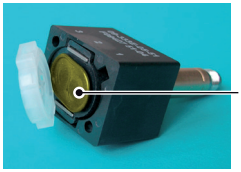


Note: *The O-rings inside the valve body may stick on the flow cell and fall down if the valve body is removed.*

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.

6.11. Tube Replacement

6.11.1 Changing Pump Tubes

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

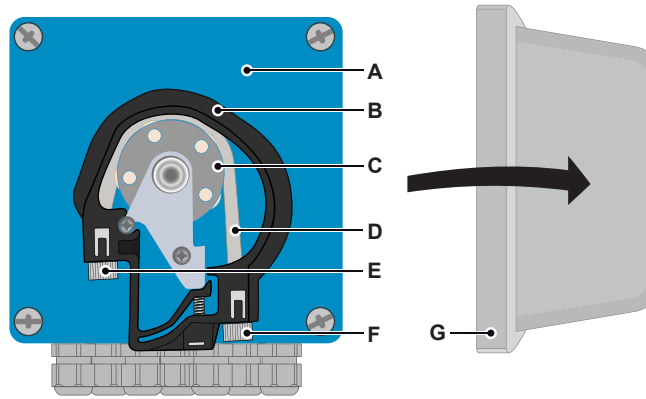
CAUTION

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. 37 before opening the occlusion frames.

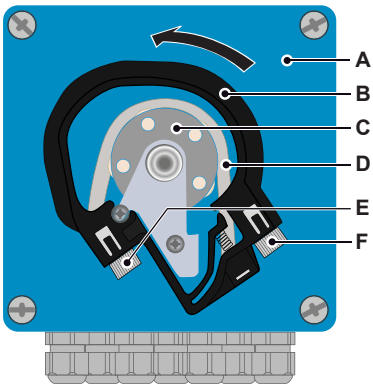
Overview



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

Dismount pump tubes

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



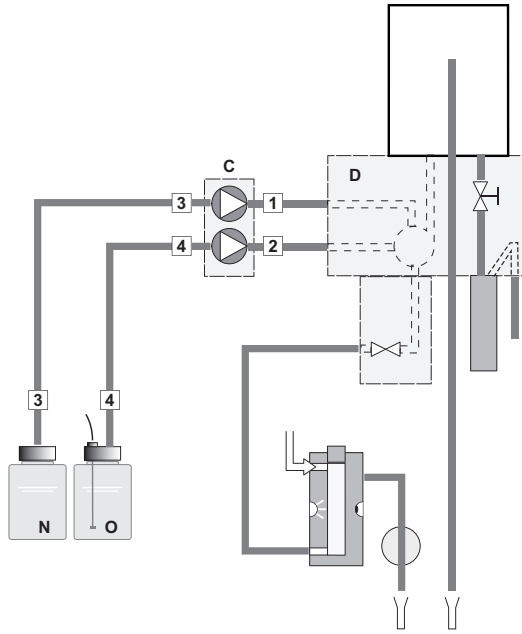
A *Pump housing*
B *Occlusion frames relaxed*
C *Rotor*
D *Pump tubes*
E *Pump inlet*
F *Pump outlet*

1. Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 37
2. Remove the protection cap.
3. Open the occlusion frames [B] by turning them counter-clockwise.
4. Remove the pump tubes [D] from the rotor [C] by pulling the complete occlusion frames [B] out of the holder.

Install new pump tubes

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

6.11.2 Tube Numbering



Tube Nr.	from	to
1	Pump (C): rear frame, delivery side	Flow cell (D), input 1
2	Pump (C): front frame, delivery side	Flow cell (D), input 2
3	Reagent container (N) Oxycon on-line Phosphate Reagent 1	Pump (C): rear frame, suction side
4	Reagent container (O) Oxycon on-line Phosphate Reagent 2	Pump (C): front frame, suction side

6.12. Longer Stop of Operation

1. Switch off the instrument according to instructions in Stop of Operation for Maintenance, p. 37
2. Open pump tube assembly of Peristaltic pumps. See Changing Pump Tubes, p. 51
3. Empty the filter vessel.

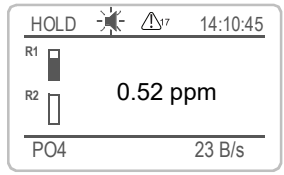
7. Troubleshooting

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).

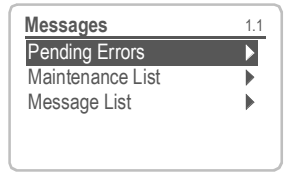
Fatal Error (blinking symbol)
Control of dosing devices is interrupted.
The indicated measured values are possibly incorrect.
Fatal Errors are divided in the following two categories:

- 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)

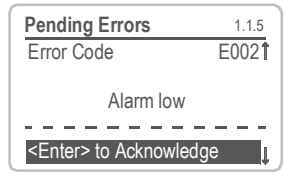


Error or fatal Error
Error not yet acknowledged.
Check **Pending Errors 1.1.5** and take corrective action.

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. 76
E002	Phos. 1 Alarm low	– check process – check programmed value 5.3.1.1.25, p. 76
E003	Phos. 2 Alarm high	– check process – check programmed value 5.3.1.1.1, p. 76
E004	Phos. 2 Alarm low	– check process – check programmed value 5.3.1.1.25, p. 76
E005	Absorbance too high	– check process
E009	Sample Flow high	– check sample flow – check programmed value 5.3.1.3.2, p. 76 – adjust sample flow with the flow regulating valve
E010	Sample Flow low	– establish sample flow – clean instrument – check programmed value 5.3.1.3.35, p. 76
E013	Case Temp. high	– check environment temperature – check programmed value 5.3.1.4, p. 76
E014	Case Temp. low	– check environment temperature – check programmed value 5.3.1.4, p. 76
E015	Valve defective	– check valve, see 49
E017	Control Timeout	– check control device or programming in Installation, Relay contact, Relay 1/2 5.3.2 and 5.3.3, p. 77
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. 45
E022	Reagent empty	– refill reagents, see Refill or replace Reagents, p. 38
E023	Cleaning Solution	– refill Cleaning Solution
E024	Input active	– See If Fault Yes is programmed in Menu 5.3.4, p. 79
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
E049	Power-on	– none, normal status
E050	Power-down	– none, normal status
E065	Reagents 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 Reagents, p. 38
E067	Cleaning Solution	Only AMI Phosphate II with Cleaning Module. A triangle without number ⚠ indicates that the cleaning solution containers are empty. – Refill cleaning solution

7.2. Opening the peristaltic pump housing

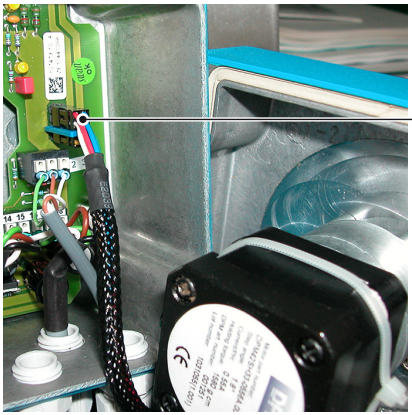
For some electrical connections (e.g. when replacing suction lances), it is necessary to open the housing of the peristaltic pump. To do this, proceed as follows:

1 Switch off the analyzer according to Stop of Operation for Maintenance, p. 37.

2 Remove the protection cap and all pump tubes as described in Dismount pump tubes, p. 52.

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

4 Disconnect the motor connector [A].



A *Motor connector*

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

6 Connect the cable to the terminal block of the peristaltic pump according to Connection Diagram, p. 21.

7 Reassemble in reverse order.

7.3. Replacing Fuses

WARNING

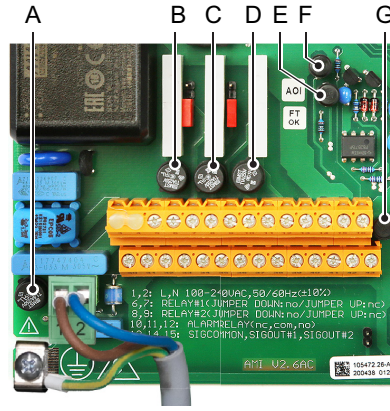
External Voltage.

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

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

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

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



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

8. Program Overview

For explanations about each parameter of the menus see Program List and Explanations, p. 66

- 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*
Maintenance List 1.2*	*Maintenance List*	1.2.5*
Message List 1.3*	*Number*	1.3.1*
	Date, Time	

* Menu numbers

8.2. Diagnostics (Main Menu 2)

Identification	*Desig.*	AMI Phosphate-II		* Menu numbers
2.1*	*Version*	V6.20 - 05/18		
	Peripherals	*PeriClip 1 1.06*	2.1.3.1*	
	2.1.3*	*PeriClip 2 1.06*	If 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	Calibration	3.1.5*		* Menu numbers
3.1*				
Processcal.	Processcal.	3.2.5*		
3.2				
Service	**Verification**	(Progress)	3.3.1.5*	
3.3*	3.3.1*			
	Fill System	(Progress)	3.3.2.5*	
	3.3.2*			
Simulation	*Alarm Relay*	3.4.1*		
3.4*	*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*		
Set Time	*(Date), (Time)*			
3.5*				
Cleaning	**Parameter**	**Mode**	3.6.1.1*	
3.6*	3.6.1*	**Interval**	*Interval*	3.6.1.20*
		3.6.1.1*	*Delay*	3.6.1.3*
			Signal Outputs	3.6.1.4*
			Output/Control	3.6.1.5*
		Daily	*Start time*	3.6.1.21*
		3.6.1.1*	*Delay*	3.6.1.3*
			Signal Outputs	3.6.1.4*
			Output/Control	3.6.1.5*
		Weekly	**Calender**	*Start time*
		3.6.1.1*	3.6.1.22*	*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*	* Menu numbers
	Fill Channel 12 3.6.3*	*(Progress)*	3.6.3.5*	

8.4. Operation (Main Menu 4)

Grab Sample 4.1*	*Grab Sample*	4.1.5		
Sensors 4.2*	*Filter Time Const.*	4.2.1*		
	Hold after Cal.	4.2.2*		
Relay Contacts 4.3*	**Alarm Relay** 4.3.1*	**Alarm Phosphate 1** 4.3.1.1*	*Alarm High*	4.3.1.1.1*
			Alarm Low	4.3.1.1.25*
			Hysteresis	4.3.1.1.35*
			Delay	4.3.1.1.45*
	Relay 1/2 4.3.2*/4.3.3*	*Parameter*	4.3.x.100*	
		Setpoint	4.3.x.200*	
		Hysteresis	4.3.x.300*	
		Delay	4.3.x.40*	
	Input 4.3.4*	*Active*	4.3.4.1*	
		Signal Outputs	4.3.4.2*	
		Output / Control	4.3.4.3*	
		Fault	4.3.4.4*	
		Delay	4.3.4.5*	
Logger 4.4*	*Log Interval*	4.4.1*		
	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*		
Signal Outputs	**Signal Output 1/2**	*Parameter*	5.2.1.1/5.2.2.1*	
5.2*	5.2.1*/5.2.2*	*Current Loop*	5.2.1.2/5.2.2.2*	
		Function	5.2.1.3/5.2.2.3*	
		Scaling	*Range Low*	5.2.x.40.10/12*
		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*	5.3.1.1.26*
			Hysteresis	5.3.1.1.36*
			Delay	5.3.1.1.46*
		Alarm Phosphate 2	*Alarm High*	5.3.1.2.1*
		5.3.1.2*	*Alarm Low*	5.3.1.2.26*
			Hysteresis	5.3.1.2.36*
			Delay	5.3.1.2.46*
		Sample Flow	*Flow Alarm*	5.3.1.3.1*
		5.3.1.3*	*Alarm High*	5.3.1.3.2*
			Alarm Low	5.3.1.3.36*
		Case Temp. high	5.3.1.4*	
		Case Temp. low	5.3.1.5*	
	Relay 1/2	*Function*	5.3.2.1/5.3.3.1*	
	5.3.2*/5.3.3*	*Parameter*	5.3.2.20/5.3.3.20*	
		Setpoint	5.3.2.300/5.3.3.300*	
		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*		
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 Indicates 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 – 05/18)

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

2.1.4 **Factory Test**: Test date of the Instrument, motherboard and frontend.

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: Process value, depends on sample.

2.2.1.4 **Cal. History:** Review 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 *Number*: Verification counter

Date, Time: Date and time of verification
Absorbance: Measured absorbance of the reference kit.
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 *Sample ID*: Shows the assigned sample identification. The identification is defined by the user to identify the sample point in the plant.

Sample Flow: Shows the actual sample flow in [B/s] (bubbles per second). 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

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

2.5 Interface

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

3 Maintenance

3.1 Calibration

3.1.5 Calibration: Performs a calibration using the standard solution. Follow dialog on the screen.See Calibration, p. 42.

3.2 Process cal.

3.2.5 **Process calibration**:
The Process calibration is based on a comparison measurement of the Instrument wit an external high precision instrument, see Process Calibration, p. 43.

3.3 Service

3.2.1 **Verification:** Performs a verification using the reference kit. Follow dialog. See Verification, p. 40.

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

3.4 Simulation

To simulate a value or a relay state, select the

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

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

Alarm Relay:	Active or inactive
Relay 1 and 2:	Active or inactive
Input:	Open or closed
Signal Output 1 and 2:	Actual current in [mA].
Signal Output 3	If option is installed actual current in mA.
Magnetic valve 1:	Active or inactive
Magnetic valve 2:	Active or inactive

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

3.5 Set Time

Adjust date and time.

3.6 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

3.6.1 Parameters

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

If Mode = Interval

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

3.6.1.3 *Delay:* During cleaning plus the delay time, the status of the signal and control outputs is as set in 3.6.1.4 and 3.6.1.5.
Range: 0–6000 s

3.6.1.4 *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.

3.6.1.5 *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.

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

3.6.1.3 *Delay:* see mode interval.

3.6.1.4 *Signal Outputs:* see mode interval.

3.6.1.5 *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.

3.6.1.22 Calendar:

- 3.6.1.22.1 Start time: Time of the automatic start of the cleaning process (valid for all selected weekdays).
- 3.6.1.22.2 Monday: Possible settings: on or off
  to
- 3.6.1.22.8 Sunday: Possible settings: on or off

3.6.1.3 *Delay:* see mode interval.

3.6.1.4 *Signal Outputs:* see mode interval.

3.6.1.5 *Output/Control:* see mode interval.

all modes

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

3.6.3 *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. 36.

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. 75

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 logging buffer is full, the oldest data record is erased to make room for the newest one. (circular buffer)

Interval	1 s	5 s	1 min	5 min	10 min	30 min	1 h	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 absorbance value of verification kit according to 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: 0.10 ppm to 8.00 ppm

5.1.4 *Meas. Interval:* Set the measuring interval:
Range: 10 min to 30 min

5.1.5 *Channels:* Function not used.

5.1.6 *Channel Selection:* Function not used.

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 equal. 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.

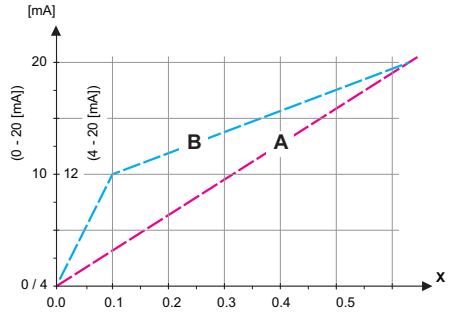
5.2.1.1 *Parameter:* Assign one of the process values to the signal output. Available values: Phosphate, Sample Flow.

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

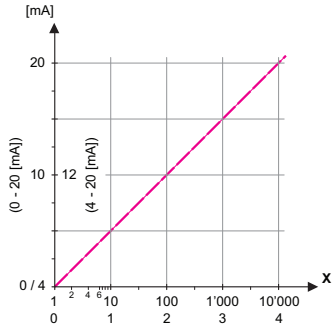
5.2.1.3 *Function:* Define if the signal output is used to transmit a process value or to drive a control unit. Available functions are:

- Linear, bilinear or logarithmic for process values.
  See As process values, p. 72
- Control upwards or control downwards for controllers.
  See As control output, p. 74

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.
Range: 0 – 10 ppm

Parameter phosphate 1

5.2.1.40.10 Range low: 0.00 – 10.00 ppm

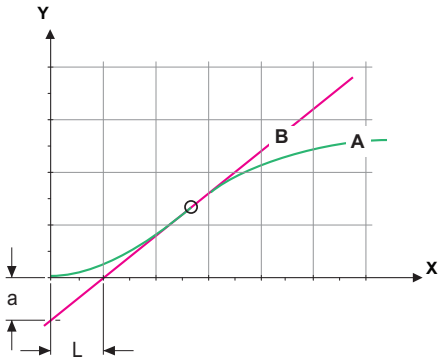
5.2.1.40.20 Range high: 0.00 – 10.00 ppm

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: 0.00 – 10.00 ppm

5.2.1.43.20 P-Band:

Range: 0.00 – 10.00 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

5.2.1.43.3 *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

5.2.1.43.3 *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 at:

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

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

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. 76).

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

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

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

5.3.1.1.45 *Delay:* Duration, the activation of the alarm relay is retarded after the 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. 24. 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 equal. For reason of simplicity only the menu numbers of Relay 1 are used in the following.*

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

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

5.3.2.1 Function = Limit upper/lower:

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

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

5.3.2.300 *Setpoint*: If the measured value rises above respectively falls below the set-point, the relay is activated.
Range: 0.00–10.00 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.
Range: 0.00–10.00 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. 75

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. 75

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. 75

5.3.2.1 Function = Timer

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

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

5.3.2.340 Interval/Start time/Calendar: Dependent on options operating mode.

5.3.2.44 *Run time:* time the relay stays active.
Range: 5–32400 Sec

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

5.3.2.6 *Signal Outputs:* select the behavior of the signal outputs when the relay closes. Available values: cont., hold, off

5.3.2.7 *Output/Control:* select the behavior of the control outputs when the relay closes. Available values: cont., hold, off

5.3.2.1 Function = Fieldbus

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

5.3.3.1 Function = End of Batch

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

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

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

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

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

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.
Available settings: German / English / French / Spanish / Italian

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

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

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

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

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

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

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

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

Choose between <Yes> or <No>.

5.5 Interface

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

5.5.1 *Protocol:* **Profibus**

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

5.5.1 *Protocol:* **Modbus RTU**

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

5.5.1 *Protocol:* **USB stick**

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

5.5.1 *Protocol:* **HART**

Device address: Range: 0–63

10. Material Safety Data Sheets

10.1. Reagents

Catalogue No.:	Included in A-85.420.660
Product name:	OXYCON ON-LINE phosphate reagent 1
Catalogue No.:	Included in A-85.420.660
Product name:	OXYCON ON-LINE phosphate reagent 2
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:	0.235
	Phosphate as:	PO4
	Standard PO4:	1.0 ppm
	Meas. Interval:	10 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:	0.00 ppm
	Scaling: Range high:	10.00 ppm
Alarm Relay:	Alarm Phosphate1:	
	Alarm high:	10.00 ppm
	Alarm low:	0.00 ppm
	Hysteresis:	0.10 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
Relay1/2	Function:	limit upper
	Parameter:	Phosphate 1
	Setpoint:	10.0 ppm
	Hysteresis:	0.10 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: ..... 5.00 ppm
Settings: Control Parameters: P-band: ..... 0.10 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

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13. Notes

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A-96.250.641 / 070622

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SWISS MADE

AMI Phosphate-II